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Several years ago fears were entertained by some of our leading engineering industrial authorities that we should be at a serious disadvantage because of the shortage of skilled men in the electrical and other technical trades. In the early years of the war many men in these trades eagerly took up arms, as did very large numbers of experienced men employed in the mines. This rush to the Colours helped to delay the emergency's advance, but it placed us at a disadvantage, and as the need for retaining such men for essential service in munition works became recognised measures were taken for organising the man power of the country along selective lines; thus greatly reducing the outflow, thus preventing the available army of skilled workers from being depleted to a dangerous point. The early expectations of post-war engineering requirements and the loss of so many men of technical skill who fell in the fighting gave rise to the fears which we have mentioned. When the forces were demobilised, however, owing to the dilution and other processes which had been adopted, there was a shortage—possibly a certain semi-skilled classes of labour. If the trade boom that followed hostilities had continued, the early fears of leaders might have been realised, but unfortunately we have been passing through an unprecedented period of depression, with the result that large numbers of skilled engineering workers have left the United Kingdom and found work in the United States. To-day organised employers and employees alike deplore this movement and the necessity for it, and give expression to the fear that when our trade fully revives we shall not have adequate suitable labour at hand in the engineering trades. The new schemes that have been put in hand for relieving unemployment include some very large undertakings which will provide work for skilled men, and every such development is to be welcomed in the national interest, because it gives employment also to others as a consequence of increased activity in the other trades. There is a great interdependence between different classes of employment.

But what is happening on the other side of the Atlantic where our skilled men are being absorbed?

We have received a somewhat remarkable document from the National Industrial Conference Board of New York. It outlines the difficulties of the United States industries owing to the shortage of trained engineers—or shall we say the prospective shortage?—looking some years ahead. It tells us that, spurred by the fact that the need of big business for trained young men to become leaders is far surpassing the ability of the American technical schools to graduate men of this calibre, a committee of eminent industrialists and educationists has been holding a series of conferences in New York to seek a remedy for this difficulty.

The committee has been organised by the National Industrial Conference Board into a joint conference on engineering education. The first autumn session has just concluded preliminary meetings, and from the report before us it seems that American industry may need 400,000 more persons for positions of responsibility in 1930 than it now provides. In 1920 the reason for this growth in demand for experts and leaders is the change of methods by which industrial work is being performed, which change consists mainly,

Looking Ahead

Regulations for Overhead Lines

Armourable Fungi-Locating on Electric Railways, by H. Lathbury (illus.)

Assorted Metering, by S. H. Richards (illus.)

The Fyans-Weichsel Motor (illus.)

New Electrical Devices, Fittings, and Parts (illus.)

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The Institution of Electrical Engineers

The Invention of Electrical Engineers

The Invention of the Internal Combustion Engine (illus.)

The Misuse of the Internal Combustion Engine (illus.)

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Accurate Metering, by S. H. Richards (illus)

The Fynn-Weichsel Motor (illus.)

The Oldest Electrical Paper. Established 1872.

Manchester: Gordon & Gotch, 52, Peter Street; Gordon & Trevelyan, 5, Great Northern Street.

Canadian: Toronto, Ont.: Wm. Dawson and Sons, Ltd., Manning Chambers; Gordon & Gotch, 132, Bay Street.

New Zealand: Wellington, N.Z.: Cuba Street.


MEXICO: Mexico: 125, Mercaderes; 33, N. Moore Street; Gordon & Trevelyan, 31, Calle del Conde.


UNITED STATES: New York: D. Van Warren Street; Gordon & Gotch, 132, Bay Street.

Rome: Ditta P. Maglione Strini, 88, Via Due Macelli.

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in the development of corporations, in the increasing use of machinery, power, and other labour-saving de-

vices, and in the elaboration of methods of control in production and distribution. Mass production greatly

increases the amount of product per worker, but requires a relatively larger increase in the proportion of planners and administrators. It is considered that these facts and the evidence that both the normal progress in industrial methods and the approaching new competitive conditions will call for a more decided change than ever before in the quality and number of trained executives and leaders.

The situation is being used as a message of opportu-

nity to the youth of America, and industrial and educa-
tional authorities are at work elaborating plans for

marshalling the required army of trained young men. It is felt that the needs of the next generation must be con-
cidered in the educational plans of to-day. The technical

schools of the United States are now turning out about 9,000 graduates a year, and, in industry at present, less than 20 per cent. of those who now plan and administer the productive work of the nation are graduates of any college at all.

The joint committee arrived at a number of conclu-
sions as follows:-

There is a rapidly-growing need for administrative and technical ability in practically all lines of activity. This is especially true of the manufacturing and mechanical industries.

There is an increasing demand for graduates of engineering schools to enter upon work which will fit them for positions of administrative as well as technical responsibility. This, apparently, is due to the fact that courses of education in engineering and related sciences have for the past been highly successful in the early development of both kinds of talent.

The demand for young men with capacity for becoming administrative or technical leaders is already far greater than the number of such men now being graduated from the engineering schools.

It is equally as important that a greater proportion of the graduates of engineering schools be young men of high quality, inasmuch as the total number of such graduates must be increased. Therefore, admission to these schools should be based on selective tests.

The preparatory schools can perform a great service to industry, as well as to the students, by properly evaluating the advantages of an engineering course and guiding toward the engineering schools the boys who have, or in whom can be developed, an interest in producing things.

There is a growing opinion that the engineering schools should provide a thorough grounding in fundamentals of engi-

neering science, and not merely in specialized training.

There should be more and better training courses in con-
nexion with industrial establishments to supplement the educational courses of the colleges.

Close co-ordination of educational effort is therefore neces-
sary between industrialists and educators.

To most of these conclusions we can heartily sub-
scribe. Similar views were voiced by Mr. C. T. Allan in his address as Chairman of the Western Centre of the Institution of Electrical Engineers, of which we gave an abstract in our issue of October 26th. Mr. Allan laid special stress on the British engineer's lack of commer-

cial training, an essential element of which is a due appreciation of the value of publicity—not merely as a personal matter, but in respect of the status of engi-

neering as a whole in the public eye; he is out of touch not only with the lay Press, but often even with his own technical Press, which, as Mr. Allan stated, most actual to fight his cause and serve his interests, but only too frequently finds him inclined to emulate the oyster.

Mr. Allan's views were strongly supported in the dis-
cussion which followed his address. Here, as in the United States, the demand for highly trained men ca-

pable of holding responsible positions is bound to in-
crease. Unfortunately the resources of our training insti-

tutions are far short of those in the United States and Germany, and the cost of the training is far greater. These conditions are largely due to the lack of interest of our manufacturing firms, many of which are apt to look upon a technical college as a thing with which they have no concern—forgetting that it is to the collective power of such institutions that they must look for the trained intelligence which is indispensable to the successful conduct of their own business. Let them give heed to the example of the National Industrial Conference Board and take the necessary steps to ensure an adequate supply of col-
graduates of any college at all.

On Tuesday last the new regulations

for petrol-electric Mr. L. Murphy before the Institution of

Automobile Engineers, which we summarise elsewhere in this issue, are of considerable interest to electrical engineers, in that they indicate that there is a large field for economy in the propulsion of road vehicles by the adoption of the petrol-electric system combined with the battery system. The author states that the ordinary petrol-driven com-

mercial vehicle gives a result of about 40 ton-miles per gallon unladen, rising perhaps to 65 ton-miles per gallon fully laden; a battery-driven vehicle, obtaining its charge from a stationary petrol-driven dynamo, will give 68 ton-miles per gallon in spite of the low efficiency of this method, but if a generating set and battery are suitably designed and carried on the vehicle, a result of at least 85-ton-miles can be secured under the worst con-

ditions, and this may be increased to 130 ton-miles per gallon under the best conditions. At the same time, advantages are gained by eliminating variable-ratio me-


cial systems and by increasing the mileage per charge. Electric storage batteries were first used on petrol cars for ignition and lighting; then they were made bigger and used for starting; and it was found that the electric stage that they may next share in the development of electric vehicles, may be a significant indication of the general economic efficiency of the electric stage.
The application of such systems is, however, limited through size and layout of the network. If we consider, for instance, the conditions of the universally known and very simple protection by means of overload and time-limit relays, it is evident that in a large network the maximum time setting would probably exceed practical limits, or the differences in the time settings would be so small that accurate calibration and reliability might be found an impossibility.

Such difficulties can, to a certain extent, be counteracted by the application of differential relays, but here, again, certain considerations may lead to their exclusion from application.

It is claimed that the system of protection, described in the following article, overcomes all such difficulties in a perfect manner. It comprises 18 trolley-line sections, partly loop lines between the stations and partly the line-sectioning switches. The two no-volt relays are fed from the secondaries of two transformers (15,000/110 volts), which are connected to the two incoming trolley lines. At Sihlbrugg only one single-phase transformer is required. The controller is operated by a small d.c. motor. In case of a short-circuit on the line, the main feeder switch is tripped and puts the test resistance in circuit, whereby the line voltage drops to a very small percentage of its normal value. This voltage drop sets off the controller motors in all the stations simultaneously in operation. The sectionalising progresses over a special contact device in the following sequence:—

The trolley section 3 at Zürich, fig. 1, is cut out, then the two sections, 7 and 8. The controller then remains in its position. There follows the cutting-out and cutting-in again of the two lines, 1 and 2, at Enge, and cutting-out of the two incoming lines, 7 and 8, in this station. This performance is repeated all along the line, and reaches eventually the two outgoing feeders, 1 and 12, in the Sihlbrugg sub-station. Through the

Current is obtained from the 15,000-volt busbars at the Sihlbrugg sub-station and a feeder switch with instantaneous overload release, which comes into operation in the case of breakdown of insulation. The opening of this switch, however, does not cut off supply, but puts a testing resistance in circuit which absorbs nearly the whole line voltage. The current flowing over this resistance into the system is checked at the sub-station, and as soon as it has attained a certain minimum value, the attendant recloses the switch. It is at this moment that the automatic fault-localising system commences its duty of locating and immediately isolating the faulty section of the contact line.

The time at disposal for location of the fault is only dependent on the heat-absorbing capacity of the testing resistance and on the condition that the disturbance shall not in any way be noticeable in the functional adherence to scheduled time of the trains. The dangering of the line switches due to overheating falls completely out of consideration, since the test current does not exceed 7.5-amps. The fact that the faulty section is cut off between the two nearest automatic switches. This isolation is completed within a time short enough to prevent excessive heating of, and damage to, the affected parts of the installation.

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The line sections in each station are connected to a busbar by means of electrically remote-controlled oil switches, the latter being assembled in separate switch stations. This interconnection permits any section to be isolated without disturbing the continuity of the line.
method of operation described it is evident that for a certain time each section of the line becomes disconnected from the line. As soon as the faulty section, in the case of fig. 1, between Enge and Wollishofen, becomes isolated, the test current disappears and the full line voltage returns. The return of the no-volt relay at Wollishofen to its normal condition stops all further action of the controllers, thus immediately isolating the outgoing line switch 1. The line voltage is communicated over switch 2 in Wollishofen to the incoming line switch 8 at Enge, which is reclosed, due to the no-volt relay assuming normal conditions, but switch 7 of the faulty section remains open, since the line voltage has not been communicated to this switch. The line voltage continues to travel over the line until the switches 7 and 8 in Zurich are closed again. In all those stations which, up to the moment of reappearance of the voltage, have not yet been reached by the switching performance, the no-volt relays assume their normal condition without leading to an opening of the switch. This is the case, for example, at the stations Kilchberg, Thalwil, Horgen-Oberdorf, and Sihlbrugg. In the last-named station the return of the line voltage leads to the automatic closing of the main feeder switch, and thus the whole line is restored to normal service. A certain time after this restoration, all the controllers on the line cease their movement. The final result is the absolutely automatic isolation of the faulty section through the opening of the incoming and outgoing switches of this section, a fact which is signalled by optical and acoustical devices.

The system permits, without any difficulty, the connection of branch lines and continuation of a number of substations, so that all these substations feed one large network, which is, in the case of a fault, split up into a large number of open-line sections. It is evident that as soon as this splitting-up of the whole network is established, the fault has no further influence upon the healthy sections, which receive immediately their full line voltage and resume normal service. The part of the network containing the short circuit is then sectionalised as described above.

In comparison with all the well-known overload protection systems, it is noteworthy that, with the same effect of protection, the breaking capacity required of the line switches is negligible, since they do not interrupt more than the test current at a very reduced voltage. Only the main feeder switch must be built for an adequate breaking capacity. The line switches can therefore all be of a comparatively light and cheap design. This consideration is, for traction work, especially of great advantage, since it permits the extensive use of the sectionalising idea and allows of the installation of full automatic protection, which would not be the case with all switches of large capacity.

The prime condition for the isolation of a faulty section is the proper sequence of the switching operations from station to station, which is obtained by synchronism of all the controllers in the various stations. The controller drums are set so as not to overlap each other in their action. The controllers assume synchronism automatically, since each controller drum completes one revolution through the failure of the voltage without being in any way influenced by the further occurrences on the network; the time for one complete revolution of all the controllers is set for a constant value, which in turn is checked by a speed-regulating device, necessary owing to the variable voltage of the battery (mean value 72 volts).

Description of the Various Apparatus.

The controller is shown in fig. 2, the side and top coverings being removed to permit a view of the inside of the controller. The upper part is occupied by the operating mechanism with the regulator, whereas the lower part contains all the controllers in the various stations. The two controller drums are arranged in the lower part. One of these drums provides for the proper sequence of operation of the five switches in their respective stations, whereas the second drum serves for ensuring the proper moment for starting the aforesaid operation. An adjustment with scale permits of the selection of this moment for starting the aforementioned operation. The part of the network containing the faulty section is the absolutely automatic isolation which is signalled by optical and acoustical devices.

The operating apparatus for the controller are comprised of a specially strong design with strong spring action. It may be noted, as a special advantage, that these contacts do not break circuit under current, so that the nature of the contacts and segments is immaterial. Further segments are provided for special purposes. The operating apparatus for the controller are com-
tain in a relay case, fig. 3, which contains also the main switch and a signal lamp which indicates a fault on the line and also coming into operation of the automatic gear. The relays are simple voltage relays, and the contacts are arranged so that they do not break circuit under load.

The remote-control operating gear, fig. 3, consists of the control switch and red and green signal lamps. In case of a fault, the various control switches are automatically and electrically interlocked, so that it is not possible for the proper procedure of the automatic gear to be disturbed. Provision is also made so that any section which is isolated, due to repairs being carried out, is not in any way influenced by the automatic operation of the sectioning gear, so that there is no danger of any such section being inadvertently connected to the line. The various handles for operating switches are interlocked by a special bar which can only be liberated by the signal lamp. A voltmeter on the top of the case can be connected by means of a suitable change-over switch to one or the other of the interconnecting feeders. The front of this control box is hinged so as to give access to the interior. The line switches are built as outdoor switches for 24,000 volts and 600 amps., and the control magnets are contained inside the oil tank; each single-pole switch is fitted with a hand-wheel for easy manipulation.

FIG. 5.—OUTDOOR SWITCHGEAR.

Besides the oil switches, each box contains isolating switches and a transformer, the latter being protected by corona-free primary fuses. These fuses are arranged so that the fuse-holders can be handled by the same operating rod as is used for the isolating switches.

The supply and erection of the apparatus described above was carried out by the electrical apparatus manufacturers, Sprecher & Schuh Co., Aarau, Switzerland; the apparatus for automatic fault-localising is covered by patents held by this company.

Service.

In most cases the drop in voltage on the line is the result of the breakdown of an insulator or a direct earth due to a mechanical defect. If the "shorts" clear themselves within five seconds, none of the oil switches are operated. If, however, the "shorts" are dead earth, as they will be in most cases, the automatic apparatus will come into operation in the manner described above.

In each station the sectioning process can be followed on the control box, since the green lamps will indicate how the localising is proceeding. The duration of the switching action is four seconds for an open station containing five switches; for the entire line from Sihlbrugg to Zürich the process of localising of the faulty section absorbs 40 seconds. Further tests which have been carried out prove that this time can be reduced to about half in any way affecting the safety and accuracy of operation of the whole combination. The above indications prove that in the most unfavourable case, i.e., if there should be a fault in the sub-station itself, a period of 40 seconds would elapse until the voltage returned. This would not be an any way endangering the network or the line, since it may be assumed that any trains which happened to be on the line at that moment would overcome the 40 seconds due to their kinetic energy. For any trains which are on the point of starting, this delay if of no consequence. It may be interesting to exclude the restoring of normal conditions of service if a train happens to be travelling along a healthy line section when the sectionalisin sets in. The fact that the main switch on the locomotive is fitted with no-volt release does not exclude the possibility that the engine-driver may try to close the switch just at the moment when, after clearing the fault, the full-line voltage returns. Tests which have been carried out to this effect on the section Zug-Goldau have shown that the above-mentioned condition may even happen simultaneously in two locomotives, without in any way endangering the proper function of the automatic gear, since the moment taken by the locomotives across the test resistance does not bring the drop of voltage low enough to set the no-volt relays in operation.

The special arrangement of the double trolley line and the station lines in the point of the block signal seems to allow the possibility that a "short" may develop which would communicate itself to two-line sections; for instance, the line switch 7 and the station line switch 3 in fig. 1. The automatic gear deals with this case by opening first the switches 7 and 1, and then sectionalis- ing the fault from the healthy lines.

A further possible short circuit may be established through the simultaneous opening of the incoming feeder switches 7 and 8 remain open in spite of the return of the normal voltage on the line. It will be seen that in this case also the complete part of the network remains cut off, but this is not of very great consequence, since the feeding of the healthy parts could not then in any case be accomplished.

The failure of voltage is not always the result of a short circuit. It is evident that the voltage will fall if, for instance, the sub-station should be cut off from the power station. In this case the same method of separation would set in, but the line switches of the incoming lines would remain open until, with the reap- appearing of the line voltage, they were mechanically closed again. Under certain conditions it may occur that the voltage of the line does not drop to zero. This would be the case when a second contact line under full a.c. voltage ran near and parallel to the dead line, which would occur at the point of junction between a section out of service with a part of the line actually operating. In this case the two lines would be at a distance from each other corresponding to the distance centre to centre of the two traction lines. It is evident that in such a case the live line will induce a voltage in the parallel dead line, this voltage being dependent on the capacity of the two wires to the capacity of the influenced wire to earth. Calculations and actual tests in this respect have shown that if the two trolley lines are run parallel for a length of only 5 km. a static voltage of a value up to 6,000 volts may be induced.

Upon the electrification of the line Thalwil-Richterswil, owing to the necessity of the parallel arrangement of the contact lines at Thalwil and Horgen, the effect of the above-mentioned condition has been prevented by increasing the capacity of the dead line to earth as large as possible. This result, however, was only obtained by the fact that the trolley line forms one continuous unit from Sihlbrugg to Zürich.

For this purpose the above-mentioned special segments are fitted in the controller, which connect the incoming
electric light associations, insurance companies, and within certain limits. The accuracies called for in other controlling bodies have drawn up a series of rules which define the accuracy of meters to be deemed to be accurate.

After its installation a meter is the point of contact and ultimate responsibility between the supply authority and the consumer, and it is the definite indication of honesty of intention of the engineer to his consumer. It therefore holds that unless a meter is accurate (within the limits prescribed by the electrical authorities), the engineer may unintentionally be increasing profits at the expense of the consumer, or decreasing them to the benefit of the consumer.

Operating, as a meter does, under the most varied conditions, the necessity arises for a close scrutiny and systematic test of all meters. A meter must be accurate for varying voltages and wave forms and also when subjected to vibration, extremes of temperature, and moisture conditions which so often prevail on circuit. It must also operate for months or years without any supervision, under any or all of the above conditions, and is expected to register as accurately as on the day when first installed. The conditions enumerated call for a meter which is accurate not only during its initial tests, but also after ageing.

Meter accuracies can only be maintained by a frequent and intelligent inspection and test not only when a meter has been received from the manufacturer, but also at periodic intervals, such as 3/5 years, or at such times as may be considered necessary by the supply authorities.


In this article the word "accuracy" has a meaning other than absolute accuracy, and is used to denote the limits of error permissible within which a meter may be deemed to be accurate.

The proper operation of the whole combination has been proved through artificial "shorts" which have been established to correspond to any of the above-mentioned possible cases of fault which may actually develop during service; since then, on a number of occasions, the gear has been given the opportunity of demonstrating the great reliability and accuracy with which it clears the entire network within spheres of operation of any "short" which may develop.

The application of this system is not confined only to single-phase working, but is also applicable to any other system. In the case of d.c. systems the line-sectioning switches would be a simple form of contactor switch.

ACCURATE METERING.

By S. H. RICHARDS, A.M.I.E.E.

1. — Importance of Accuracy.

It is a short-sighted policy that will carefully scrutinise the cost of generation and neglect the meter, or "cash register" between the consumer and the supply. Such a policy has often been found to result in losses exceeding the gains made at the generating end, thereby increasing the apparent cost of supply, whereas a close scrutiny of the meters and the maintenance of their accuracy has invariably led to lower cost and smaller charges, producing in turn an increase in the number of connections.

After its installation a meter is the point of contact between the supply authority and the consumer, and is the definite indication of honesty of intention of the engineer to his consumer. It therefore holds that unless a meter is accurate (within the limits prescribed by the electrical authorities), the engineer may unintentionally be increasing profits at the expense of the consumer, or decreasing them to the benefit of the consumer.

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### Table: Allowable Errors of Meters

<table>
<thead>
<tr>
<th>Remarks</th>
<th>Load</th>
<th>Starting Error</th>
<th>Variation of Pressure</th>
<th>Allowable Error</th>
<th>Excess Pressure</th>
<th>Variation of Power Factor</th>
<th>Allowable Error</th>
<th>Excess Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without external shunts or transformer</td>
<td>1 to 6</td>
<td>1% full load or less than $0.05$ amp.</td>
<td>1% above or below</td>
<td>1%</td>
<td>0%</td>
<td>5% for 500 lagging</td>
<td>100 to 50</td>
<td>Excess pressure not to exceed $0.1$</td>
</tr>
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<td>Excess pressure not to exceed $0.1$</td>
</tr>
</tbody>
</table>

Variation of Pressure. — For each 1 per cent. above or below normal—additional error permissible—2.1.0.

Creep. — With normal pressure, or 10 per cent. above normal and the current coils disconnected, the meter must not register.

Variation due to Heating by Main Current. — The change in the rate of registration of a meter from the time the marked current is switched on to the time at which registration becomes constant, shall not exceed 2 per cent.

Excess Current. — 25 per cent. for one hour, without injury.

ALTERNATING-CURRENT METERS.

The limits enumerated for direct-current meters, with or without shunts, also hold good for single and poly-phase (balanced and unbalanced) meters, with or without transformers, on non-inductive load, together with the following additional limitations:

Variation of Power Factor. — From 1.0 to 0.5 lagging—additional permissible error ±2.0%, provided that the total error of the meter does not exceed $3.0%$.

Variation of Frequency. — 5 per cent. above or below the marked periodicity. Permissible additional error ±1.0%.
The limits stated include every possible operation on circuit, but do not cover accuracies on permanent overloads in the meters.

While it may be necessary, owing to unforeseen circumstances, to provide for installations in which accuracies must be guaranteed up to 25 per cent. overload, care should be taken so to gauge the possibilities of a circuit as to prevent at all times overload capacities exceeding this figure, and the tendency to conditions which call for meter accuracies used beyond their rated capacity should be strongly opposed. It is far better to connect a meter in a circuit whose rated capacity is between 25 and 50 per cent., so that a meter shall register within 3 per cent. slow at that load than to allow meter overloading of the meter.

Consumers should not be allowed to connect subsidiary apparatus to the company's mains without previous indication, as all overloading of meters inevitably results in a loss of revenue.

In the U.S.A. accuracies at overloads of 50 per cent. are insisted upon with the sacrifice, in the case of d.c. meters, of accuracy at light load to compensate for better accuracy at the overload, while the limitations placed upon an a.c. meter make it difficult to obtain the accuracies demanded from 1/20 load to 50 per cent.

Although the American rules demand a 50 per cent. overload, the tendency amongst American engineers has been to call for a 100 per cent. overload with an accuracy at that load which, if obtained, must inevitably sacrifice accuracies at light load. The curves, figs. 1 and 2, which are typical curves, show that there is a rapid falling away of meter accuracy at overloads past 50 per cent. and upwards.

When a demand has been created for house-service meters with an overload capacity of 100 per cent., the following factors have to be considered:

1. The capacity of the meter to withstand short circuits without mechanical or electrical damage.
2. The capacity of the meter to carry the current without undue heating.
3. The capacity of the meter to register within 3 per cent. on 100 per cent. overload.

While there is no great difficulty in fulfilling the demands enumerated in the three given points, and particularly in avoiding the risks of mechanical failure, it seems impossible, in the light of the full knowledge of an induction meter's capabilities, to avoid a falling curve from full load to 100 per cent. overload.

This means that where supply companies demand a 10 per cent. accuracy at 100 per cent. overload, they are asking for a meter which registers 3 per cent. slow at that load.

It has been stated in America that a 10-amp. meter is enough for ordinary lighting purposes, but that consumers install additional apparatus without advising the supply authority, so that the current consumption is liable to be as high as 20 amp., or even more; also that the percentage of consumers who do this is nearly 100, and that the meters installed are invariably 3 to 4 per cent. slow at double load.
Some authorities may look upon this error as too large, but when it is remembered that stop watches on meter test are continually being stopped and started, it will readily be seen that a smaller error is not practicable.

The above figures therefore show that the maximum permissible instrument-cum-stop-watch error for both d.c. and a.c. testing is from ± 1.00 to ± 1.25 per cent., depending upon whether ammeters and voltmeters or wattmeters are used.

This error is considered to be the "personal" error. This is a quantity which varies with the type of tester employed, but with the average tester it will be in the neighbourhood of ± 0.5 per cent., while with an expert tester it may be possible to limit it to ± 0.25 per cent.

While the law of averages will preclude the probability of the maximum error being obtained, the possibility remains, and the need is emphasized for conditions and apparatus which will give limits of error within the limits of accuracy actually called for.

Another great danger in testing lies in using instruments below the point of efficient service. It is astonishing to find how careless in this respect many testers are in their employment of instruments, and that such beliefs are not only not probable but impossible, for example:

Consider an instrument of 100 equal divisions and assume the error to be 0.5 per cent. at a maximum scale reading (i.e., at the 100 division point), and that the error per division remains constant throughout the scale. The following table shows how the error increases as the reading decreases:

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From the 30 division mark the error rapidly increases until at 1 scale division the instrument is actually 50 per cent. out. Yet cases are on record of tests having been taken at instrument scale divisions from 20 per cent. to 5 per cent. of the scale, and complaints have been received of the inaccuracy of meters whereas the meter has been correct and the tester at fault in using his testing instrument below the accuracy level.

Under no circumstances should any instrument be read below a weight attached over a pulley, which applied a sl |

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The FYNN-WEICHSEL MOTOR.

The Wagner Electric Corporation, of St. Louis, U.S.A., has announced the marketing of a new polyphase motor which bristles interesting technical features and operating characteristics. It is stated that the machine has all the desirable features of the polyphase induction motor, such as large starting torque, ample overload capacity, and simplicity of design, coupled with a power-factor control which permits the designer, and if need be the operator, to adjust the motor's power factor to suit the most exacting requirements.

The new motor is a combination of a synchronous and an induction motor with a rotary converter, and may be designated as a "synchronous induction motor." The novel features are applicable to single-phase as well as to polyphase motor circuits.

Figure 1 shows a section of the machine, with the stator and rotor coils clearly visible. The stator is made of a combination of copper wire and steel, while the rotor is made of a combination of copper wire and iron. The machine is designed to operate on a 3-phase 440-volt, 60-cycle power system.

Figure 2 illustrates the rotor of the machine. The rotor is made of a combination of copper wire and iron, and is designed to operate on a 3-phase 440-volt, 60-cycle power system.

The Fynn-Weichsel motor, we are told, can do duty as a condenser at all loads below the normal without sacrifice of full-load efficiency, and without overheating or complication of any sort. The weight efficiency of the motor is somewhat better than that of a corresponding polyphase slip-ring motor.

The motor was invented and patented by Mr. Val A. Fynn, F.I.E.T.E., M.I.E.E., an English engineer whose work in connection with a.c. motors is of world-wide reputation; he left this country some 15 years ago, and joined the Wagner company, but is now practising as a consulting engineer at St. Louis. The United States patents are owned by the Wagner Co., and the designs for this new line of machines is the work of Mr. Hans Weichsel, the company's very able engineer.

Miners' Safety Lamps.—Lieut.-Col. G. R. Lane-Fox, M.P., Secretary for Mines, announces that on October 27th, 1923, he made an Order under Section 33 of the Coal Mines Act, 1911, approving for use in all mines to which the Act applies, the following types of safety lamps: Patterson miners' electric hand lamp, type G; Kingsway II pillarless electric hand lamp; Gray-Sussmann electric hand lamps, Nos. 5 and 6; "Osram" shaft and roadway lamp, type B. The Order also amends the Schedules to previous Safety Lamp Orders with respect to the specifications of certain types of safety lamps already approved.
NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A New Falk, Stadelmann Fire.

A new three-bar series fire, which has been put on the market by Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, E.C.1, is illustrated in fig. 1. It is claimed that in this fire efficiency and attractiveness have been successfully combined. The refractory material is built in sections and bolted together with steel rods, thus minimising the possibility of mechanical damage. The body of the appliance is of heavy-gauge sheet brass, which is finished in a number of styles. The fire is provided with two switches, which are specially constructed to withstand the strain of foot operation.

The "Unique" Electric Grill.

The Electric Heating and Hardware, Ltd., Crown Works, Berkeley Street, Birmingham, is manufacturing a new panel containing the heating element. In the lower part of the unit a grilling pan is fitted; this can be adjusted in height by means of a number of rests in the sides of the stand. The body of the device is constructed of aluminium die castings and the pan is also of aluminium. By means of this appliance it is possible to boil water and keep food warm in the pan at the same time.

Fig. 1.—A NEW FALK, STADELMANN FIRE.

Relay Type Crane Control Panels.

Fig. 4 illustrates an example of relay-type totally-enclosed crane control panel, made by Mr. George Ellison, Perry Barr, Birmingham. This particular panel is designed for the control of a d.c. three-motor crane. The distinctive features of this panel are a large main, free-handle, overload, and no-volt circuit breaker of ample size and breaking capacity; a small overload inverse time relay in the circuit of each motor; a trip the main breaker when a motor is overloaded or fails backwards; and the assembly of these elements as one compact unit which may be installed in any crane cabin without overcrowding. The method of employing only one circuit-breaker reduces the number of elements and the cost to a minimum, and increases the ease of manipulation. The breaker may be either double- or single-pole as required. In the direct-current panels, the no-volt and shunt coils are connected in series, the no-volt coil is short-circuited by the relays or limit switches, and both coils therefore operate to trip the breaker. Various arrangements of the gear are possible. In the alternating current type the no-volt and shunt trip coils are in parallel. The overload relays and shunt limit switches operate by closing the shunt trip circuit. The shunt limit switches are normally open. The time-lag device, which is an essential part of each motor relay, is a conical piston working in an oil-filled conical cylinder.

Fig. 2.—" MORRIS " VALVE TEMPLATE.

The "Unique" Electric Grill.

The Electric Heating and Hardware, Ltd., Crown Works, Berkeley Street, Birmingham, is manufacturing a new panel containing the heating element (the "Unique"), which is illustrated in fig. 2. The grill consists of a stand, in the top of which is a swivelled pan containing the heating element. In the lower part of the unit a grilling pan is fitted; this can be adjusted in height by means of a number of rests in the sides of the stand. The body of the device is constructed of aluminium die castings and the pan is also of aluminium. By means of this appliance it is possible to boil water and keep food warm in the pan at the same time.

Fig. 3.—THE "UNIQUE" ELECTRIC GRILL.

Fig. 5.—AN ELECTRICALLY-DRIVEN POLISHING MACHINE.

or triple-pole as required. In the direct-current panels, the no-volt and shunt coils are connected in series, the no-volt coil is short-circuited by the relays or limit switches, and both coils therefore operate to trip the breaker. Various arrangements of the gear are possible. In the alternating current type the no-volt and shunt trip coils are in parallel. The overload relays and shunt limit switches operate by closing the shunt trip circuit. The shunt limit switches are normally open. The time-lag device, which is an essential part of each motor relay, is a conical piston working in an oil-filled conical cylinder.

An Electrically-driven Polishing Machine.

The patent polishing machine shown above, fig. 5, is claimed to be the only one of its kind extant. It is of English design and manufacture throughout, and is so simple and easy to manipulate that any worker can quickly become acquainted with it and is conversant with the elements of polishing. The device has interesting and novel features. Above the polishing bench, in a manner of its use is as follows:—A mark is made on the grid socket to lie in the direction of the arrow, which is supported and will then be marked ready for drilling.

Fig. 4.—ELLISSON PANEL FOR THREE-MOTOR CRANE.
THE ELECTRICAL REVIEW.

THE BRITISH BROADCASTING CO., LTD.

A Supplementary Agreement.

A supplementary agreement* has been come into force between the Postmaster-General and the British Broadcasting Co., Ltd., which covers certain points regarding the company’s licence issued on December 31st, 1924, and the new agreement provides that the term for which the company holds its licence shall be extended from December 31st, 1924, to December 31st, 1926, and that the licence shall cover any stations which the Postmaster-General may authorise in excess of the eight originally arranged for. Also that the company shall not without the consent of the Postmaster-General receive money or any valuable consideration from any person in respect of the transmission of messages by means of the licensed apparatus.

Provided that nothing in this clause shall be construed as preventing the company from (1) broadcasting material provided provisionally by any person with or without an acknowledgment of such provision by means of the licensed apparatus; (2) receiving a consideration for broadcasting names of publishers and prices of matter which is broadcast; (3) receiving a consideration for broadcasting the contents of a broadcasting company approved for broadcasting by the Postmaster-General, subject to certain conditions, to which the Postmaster-General may authorise, as well as the licence of the Postmaster-General is required from being for broadcast purposes without payment of copyright, theatrical exhibitions of films, or other broadcast material given in public in London or the Provinces.

The company may work any of its stations at any hour of the day or night, and the whole of the service shall be continually of the most efficient character, and shall comply with any requirements of the Postmaster-General to discharge the work in an efficient and interference-free manner with Government stations or with any other undertaking licensed by him.

The extension by means of the licensed apparatus shall be subject to the consent of the Postmaster-General to be only on wave-lengths of from 300 to 430, and from 460 to 510 metres.

The new agreement provides that the income of the company from all sources during the extended period shall be more than sufficient to meet such expenses as the Postmaster-General shall consider reasonably adequate to provide.

Provided that the company supplies a satisfactory broadcast service and erects additional stations where the Postmaster-General may reasonably consider it necessary to provide a broadcasting service, to provide a reserve fund to meet depreciation and obsolescence, and to pay 7½ per cent. per annum with the company's subscribed capital, the proportion of each licence fee to be reduced and any surplus income shall be surrendered to the Postmaster-General.

The Postmaster-General also reserves the right during the extended period to grant licences to any person other than the company to carry on services, additional to those carried on by the company, whenever he may consider them desirable without withholding from the company any part of the sums to which it may be entitled.

The Influence of Magnetism on Life.—Experiments have been carried out by Mayes, F. W. and C. C. Lee at the Johns Hopkins University, to determine whether a rotating magnetic field had any effect upon the growth of a living organism. Trout were hatched and reared for 3 months in a water tank, and observations were made, but after 45 days, when all the eggs had hatched, no difference was observed between the fish thus produced and those hatched under ordinary conditions. Other organisms were tested, including bali, but always with negative results. Describing their work in "Science," the authors state that the results indicate that the growth of the body which is composed of atoms of which the electrons are in a state of static equilibrium.

New X-ray Machines.—New X-ray apparatus has just been installed at King's College Hospital, London, at a cost said to be £1,500. The new outfit will be used exclusively for the treatment of malignant growths.

*From the Electrical Review, Vol. 32, No. 2939, November 14, 1924, THE ELECTRICAL REVIEW.
was that the value of the shares was nothing like the value that the plaintiff hoped they would have reached by this time. The defendants, in all probability, would not have consented to pay a power station which was contemplated had been abandoned, and in its place was the station resulting from the consortium arrangement. His Lordship said he was satisfied that in entering into that arrangement the defendants had not the same interests as the plaintiff and that the plaintiff had not the right to call the defendants to account for the benefits obtained by the London company. The plaintiff had never seen the letters patent of 1909, which was the reason why the plaintiff declined the alternative offer. His Lordship gave judgment for the defendants with costs.

Passing-Off Action.

Mr. Justice TOLMAN, in the Chancery Division on Friday, had declared that the plaintiff was entitled to a perpetual injunction, had advertised Hoover pattern electric sweepers. The plaintiff was not asking for damages. The court declared that the defendants had infringed the plaintiff's letters patent 27,499 of 1909, "for facilitating working." The infringement was denied by the defendants.

His Lordship granted the injunction as asked.

British Thomson-Houston Patents.

Mr. Justice P. O. LAWRENCE, in the Chancery Division, on November 9th, declared the hearing of the action by the British Thomson-Houston Co., Ltd., incandescent lighting specialists, of Great Eastern Street, E.C., for an injunction restraining an alleged infringement of the patent, as a matter of law. The court recorded the letter that the question was inseparable from the other terms of his employment. The question was open to him at any time that he liked to buy them. But what was wrong with the option of plaintiffs' letters patent 28,499 of 1909, for facilitating working. The infringement was denied by the defendants.

Judge Cure gave judgment for the amount claimed.
CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday cannot appear until the following week. Correspondents should forward their communica-
tions at the latest by 1 p.m. on Thursday. No personal reference excepting that published unless we have the writer's name and address in our possession.

An American Station on One Valve.

You may remember that some months ago I excused myself from writing up a paper submitted by saying that I was severely bitten by the wireless craze, and was devoting all my energies to getting "W 2 B's" on a cat's whisker." I have now succeeded in putting in an appearance, I think, managed to break a record in wireless reception. At about 10.5 I on the 9th of November, I received the following message: "I know that similar claims have been made by others, but (speaking from memory) they have all been experimenters judging on the brink of oscillation with super-
genegrative circuits, or with the adventitious aid of crystal detectors and dual amplification. What I believe constitutes a record in my case is that I was using an absolutely standard B.B.C. model (one of Mann, Egerton & Co.'s "Mecophones"). True, the circuit embodied in it is an unusual one, but it is truly a one-valve circuit, without crystal or i.f. transformer, and one that has been placed by the F.M.G. for use on an on-dial serial circuit.

I do not know the station I got. It was a little higher than Cardiff—which I was tuning in—probably about 35 miles away. Unfortunately I was too impressed with any other case that I did not make a note of it. I probably early in the evening as 10 o'clock are less favourable on the Americas stations. This, and that fact that I received the transmission, encourage me to prophesy that, within a few months, with the aid of similar sets and a good aerial, my experience will be common enough.

J. S.

Norwich, November 9th, 1923.

The Postmaster-General and Electrical Power and Lighting Undertakings.

On reading the editorial comment in your issue of November 2nd I decided to retire from the conflict, turning my back on the tempting bait of Mr. Fenski's letter of the same issue. I cannot resist, however, Mr. Stoker's letter in your issue of November 9th, and I hope you will bear with me to the extent of reproducing it, or to at least the extent of allowing me to call attention to a new and misleading statement in that communication. Mr. Stoker raises a fresh hare in the following:

"I would like to draw attention to the fact for what it is worth, that in the model clauses inserted in Railway Acts authorising the use of electrical power the section requiring the use every reasonable means in the construction of their electric lines and works and work their undertakings as to prevent interference with the telegraphic lines used by the Postmaster-General is qualified by exclusion of any telegraphic line of the Postmaster-General laid down or placed on him along the railway."

Anyone reading this would naturally think that a railway company need not take precautions to prevent injurious affec-
tion to the Postmaster-General's telegraph lines placed by him along the railway. This would be inaccurate. In the very same model clauses referred to by Mr. Stoker there is one dealing with such lines, and it reads:

"2. And the following provisions shall have effect in respect of 

the telegraph lines used by the Postmaster-General laid down or placed on or along the said railway:

(a) The company shall construct their electric lines and other works of all descriptions and shall work their under-
takings in all respect with due regard to such telegraph 

lines and the current in said lines, that they shall use every reasonable means in the construction of their electric lines and other works of all descriptions and the working of the works of their undertaking, to prevent any serious affection 

whether by induction or otherwise to such telegraphic 

lines or the current in said lines, which affection between the Postmaster-General and the company as to to compliance with this sub-section shall be determined by arbitration.

The difference between the two clauses is that in one case, for lines on the railway, the protection is absolute, whilst in the other case, for lines on the railway, it is qualified to the extent of being a subject of arbitration. Fl
On technical matters Mr. Stoker is admittedly at the mercy of those furnishing him with information, but I feel in the above instance he has not fairly represented conditions which should have been known to him.

It is not a little: I have re-read and have asked others to read Section IV of the Electric Lighting Act, 1888, and neither I, nor they, can see how it applies to Statute undertakers. This may not be extraordinary, as I am not a lawyer, but my reading has been confirmed by a legal friend, and it is in turn may not carry it much further, as even lawyers differ.

As regards the 33-volt drop on the uninsulated rail of the Brighton Railway, it can be taken that no such limit was fixed by the Board of Trade, and the reason for this may have been associated with the question: what is intended by such a current? The current in the contact wire being alternating, inductively produces voltages, not only in the rails and neighbouring pipes, but also in the leads which would be used for measuring the p.d.s. between two points. The current produced in this way in the measurement circuit would be divided to a certain extent by the return current in the rails, and although the measurement might be effected by running the leads at right angles to the track for some distance, the resulting figures would need definition.

The final points have very little bearing on the matter raised in Mr. Stoker's original article, which was concerned with what was stated to be the arbitrary action of the Postmaster-General in objecting to the use of a high-pressure mains with one conductor only, and using the earth as a return path. It is supported by Mr. Stoker to the extent of stating that the "Post Office has no case against the use of the earth on technical grounds," and dismissed evidence of what Mr. Ferranti did with the wire sheath, "a thing as 'trilling' with the matter," apparently on the ground that it occurred in parallel to it, and not because locally the laws of electricity governing inductive effects have not changed in the meantime! Might I also suggest that if there are no objections to the return path as a parallel to it, the following would not be included in the "Reports of Joint General Committee of the National Electric Light Association and Bell Telephone System of the U.S.A. on the Relations between Electrical Supply and Signal Systems",- "Ground and Return Circuits."-Ground return circuits or ground return branches of multi-wire supply circuits should not be employed. This does not apply to track return circuits.

This rule is given in the section "Principles and practices for inductive co-ordination of supply and signal systems," and it is to be feared that in some cases the earth returns were a feasible proposition they would have been legally employed in the U.S.A. Neither then nor in this country, have such proposals been put forward by responsible authorities.

I will not add to this "war of words" by replying fully to Mr. Fennell's letter in the issue of November 2nd, but I really must draw attention to the inaccuracy in his dogmatic reference to the inductive effects of a high-pressure line. He says: "A line was objected to on the ground that, being high pressure, the current is in interference with a Post Office line, parallel to it on the opposite side of a wide public road. The officer concerned seems to be unaware that the "Post Office has no case against the use of the earth on technical grounds," and dismissed evidence of what Mr. Ferranti did with the wire sheath, "a thing as 'trilling' with the matter," apparently on the ground that it occurred in parallel to it, and not because locally the laws of electricity governing inductive effects have not changed in the meantime! Might I also suggest that if there are no objections to the return path as a parallel to it, the following would not be included in the "Reports of Joint General Committee of the National Electric Light Association and Bell Telephone System of the U.S.A. on the Relations between Electrical Supply and Signal Systems",- "Ground and Return Circuits."-Ground return circuits or ground return branches of multi-wire supply circuits should not be employed. This does not apply to track return circuits.

In conclusion, I may assure Mr. Stoker that I am at least in this department have never considered myself to be "an infallible angel," and I am sure he would not have fallen into that error had he known me personally. I am not a bit like an angel.

S. C. Bartholomew,
Engineer-in-Chief's Office, G.P.O.,
London, November 28th, 1923.

I have no wish to enlarge on this discussion, but I think that one of the statements in Mr. Fennell's letter in your issue of November 2nd is open to question. Mr. Fennell says: "A line was objected to on the ground that, being high pressure, it might cause interference with a Post Office line parallel to it on the opposite side of a wide public road. The officer concerned seems to be unaware that the "Post Office has no case against the use of the earth on technical grounds," and dismissed evidence of what Mr. Ferranti did with the wire sheath, "a thing as 'trilling' with the matter," apparently on the ground that it occurred in parallel to it, and not because locally the laws of electricity governing inductive effects have not changed in the meantime! Might I also suggest that if there are no objections to the return path as a parallel to it, the following would not be included in the "Reports of Joint General Committee of the National Electric Light Association and Bell Telephone System of the U.S.A. on the Relations between Electrical Supply and Signal Systems",- "Ground and Return Circuits."-Ground return circuits or ground return branches of multi-wire supply circuits should not be employed. This does not apply to track return circuits.

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Local Exhibitions: Glasgow.

With reference to your notes in this week's issue, I would like to draw your attention to the manner in which the above Department secures its isolation as an intending consumer signs the application form for a supply, the form, before it is even acknowledged as being accepted, is handed to the Sales Department, which immediately sends out its circulars calling attention to the nature of circuits; a further call in a few days to book the order. This practice, if carried out by a wholesale house, could be considered, not to say charged as a large-scale plagiarism by securing the order for the installation, a chance to sell his goods, and ought not to be allowed.

A Contractor.

Small British Motors Wanted.

I thank you for your letter of yesterday enclosing correspondence.

The number of letters and callers since the appearance of my letter in your journal is somewhat overwhelming. We are acting with them as quickly as possible.

It is evident that the difficulty is in requiring an induction motor, and with a few people at the larger motors dealers having the leisure to deal with them as quickly as possible.

Please accept thanks for the valuable assistance rendered us in this matter.

F. Patrick.

Leeds, November 8th, 1923.

Telephone Licence.

A licence or certificate for the use of telephones recently issue to me into my possession which dates back to 1875, and I have been wondering whether this is of interest, as it is at the first of the kind I have seen, and I have no doubt there are many at present engaged in the electrical trade who have never seen such a thing, as how it was supposed to be done in the early days of telephone work before a party could use his telephones.

The enclosed copy is of the wording on the printed agreement, and I am forwarding you this as an item of news which you are open to use if you consider it of interest.

F. Patrick.

Bankruptcy Proceedings.—Percy Boswell (trading as Boswell & Co.), electrical engineer, 110, Ebury Street, S.W.—The examination was concluded.

Jonathan Hawick (trading as Hawick & Sons), electrical contractor, 15, Bath Place, S.W.—The examination was concluded.

Alfred James Barlow (trading as Barlow Bros.), electrical contractor, 9, Brunswick Place, City Road, E.C.—A licence or certificate for the use of telephone recently issued to me into my possession which dates back to 1875, and I have been wondering whether this is of interest, as it is at the first of the kind I have seen, and I have no doubt there are many at present engaged in the electrical trade who have never seen such a thing, as how it was supposed to be done in the early days of telephone work before a party could use his telephones.

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cever, debtor stated that during the war he invented a field

for cash advanced to other persons, in respect of which he

The offences reported were (1) insufficient payments in

He added that the present statement of affairs

and plant had also been reduced. It was possible, howeve-

The statement of affairs showed the position as at July 31st

Mr. W. E. Craven has left the board of the Coronium Co. to join the staff of the other

The Coronium Metal Co., Ltd., Brentford, has appointed

The Norra Electric Co. has commenced business in elect-

T. H. Joyce, dealers in electrical supplies, 20th, Shal-

Mr. G. E. Clutterbuck said that at a conference of the cre

Three illustrated leaflets dealing respec-
Mr. H. Crawford, agent, 19, High Street, Paisley.

Mr. R. K. Webster & Co., Purley Downs Road, Purley, Surrey.—A letter advertising vacuum drying and preserving plant.

Mr. A. Pugh, General Secretary of the Iron and Steel Trades Confederation.

"A vast amount of material, all produced within the Empire, has been employed in the construction of these buildings, the framework alone accounting for 2,500 tons of steel. The ducts and accessories; the "Ediswan" house-wiring system; "Perfect" electrical accessories; "Trilux" frame-aerial set. Also "flex" frame-aerial set.

"A comprehensive catalogue of "Cambri formation measures, controlling, and recording instruments, including thermometers and pyrometers of various patterns. Fully illustrated.

"A leaflet advertising "Buston," a transparent rust preventive and preservative for metal.

"A leaflet containing illustrations of lighting fittings of various types. A folder containing illustrations of lighting fittings of various patterns and sizes.

"A leaflet dealing with the "Falco" electric cooker complete sets and components. Priced.

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"A leaflet concerning the crystal and valve amplifier units; No. 381, concerning the crystal and valve amplifier units, and other factors. Mr. Merz contested the idea that competition obtained more favourable terms for the consumer. Experience in other parts of the world showed that the rate of return on investment was the use of more capital and the consumer had to pay. He considered the best interest of the district would be served by a regulated monopoly — a supply the rates for which were regulated by an impartial body, such as the Electricity Board. He also emphasised the importance of the present application.

"A two-coloured advertisement describing the construction of current transformers for railway railways, up to 500 A.

"A week's advertisements prospectives for work on the East African Electricity Commissioners into the application of the Victoria Falls and Transvaal Power Co. for sanction to the erection of a large generating station at Witbank was recently resumed after a delay caused by the loss of the contracts by the mining interests, which propelled that vital information was being withheld by the mining companies, according to a Times report. In his evidence he said that the application was of great importance to the railway administration in view of the general electrification scheme which had adopted. As a result of the special conditions as to coal—there being a practically unlimited supply of very cheap coal in the Witbank field—cost of generating would be comparable with the cost at any hydro-electric plant in the world. Another factor was the extraction of by-products. Mr. Merz considered the general idea that competition obtained more advantageous terms for the consumer. Experience in other parts of the world showed that the rate of return on investment was the use of more capital and the consumer had to pay. He considered the best interest of the district would be served by a regulated monopoly — a supply the rates for which were regulated by an impartial body, such as the Electricity Board. He also emphasised the importance of the present application.

"A circular (136 pp.). London: S. Davis & Co. Price 2s. 6d., post free.—This half-yearly guide for purchasers of electrical equipment is valued to both buyers and to the electrical engineers and contractors, The Arcade, Redcar, Yorks., wish for revision by the Electricity Control Board from time to time. The inquiry adjourned for a week to permit of further conferences with the mining companies.


The Telegraph Manufacturing Co., Ltd., Hollingsworth Works, Martell Road, West Dulwich, S.E.2.—Two colour advertisements advertising "Southware" art metal and electrical fittings, and "True-Music" loud speakers respectively.

The Electrical Review.—October 1928, Vol. 35, No. 289.—Number of the U.S. Bureau of Standards, "Sources of Elementary Radio Information." (10 pp.). Washington: Government Printing Office. Price 5 cents.—In the main, this is a guide to the literature of radio-telegraphy and telephony, containing lists of periodicals, U.S. Government publications referred books upon the subject, both English and American. For the rest the publication consists of notes on regulators, crotal cord, and "where to buy everything electrical." October, 1923, edition (186 pp.). London: S. Davis & Co. Price 3s. 6d. post free.—This is a remarkable book dealing with every kind of electrical goods, in which the names of all electrical manufacturers and agents appear under classified headings, is probably the best publication of its kind, both for the manufacturers and the firms themselves.


British Empire Exhibition Notes.—On November 12th, Sir Robert McAlpine, on behalf of his firm, handed over to the board of the Exhibition the completed Palaces of Industry and Engineering, which together cover an area of about 25 acres. A vast amount of material, all produced within the Empire, has been employed in the construction of these buildings, the framework alone accounting for 2,500 tons of steel. The ducts and accessories; the "Ediswan" house-wiring system; "Perfect" electrical accessories; "Trilux" frame-aerial set. Also "flex" frame-aerial set.

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Catalogues Wanted.—Messrs. Smith & Jordan, electrical engineers and contractors, The Arcade, Redcar, Yorke., wish to receive catalogues of electrical and wireless goods.

Catalogues for Turkey.—The Commercial Secretary at Constantinople reports that he has arranged a representative selection of catalogues of British firms in his office at the British Consular residence at Galata, Constantinople. In order, however, that British catalogues may be available for traders in the interior, arrangements have been made, by courtesy of the Imperial Ottoman Bank, Ltd., Trade Development Department, 70, Tophurn Street, London, E.C.4, which will arrange for their re-transmission to Turkey, subsequently submitting a claim for the postages.

Import Duties Advisory Committee.—It is officially announced that the Minister will appoint an advisory committee to advise his Majesty's Government in connection with the preparation of the proposed duties on manufactured goods.
For Sale.—Gillingham (Kent) Corporation electricity department is desirous of purchasing one 3,750-kw. motor-generator set, one h.p. and one l.p. switchboards, &c. Ilkley Urban District Council has for disposal two 100-kw condensing engines and Photographing panel, and one motor-generator battery charging set. Mountain Ash Urban District Council invites competitive tenders for the purchase of transformers. By direction of Geo. Cohen & Armstrong Disposal Committee Mr. A. Davis will sell by auction, on Thursday, November 29th, the goods of the machinery, &c., at the Hackney Marshes Depot. (See our advertisement pages to-day.)

Electric Railway Workers' Wages.—The Industrial Court has been conducting negotiations with wages of men employed by the London Electric Railways. In the first case the Electoral Trades Union contended, broadly, that the rates at which the railway industries were to be paid to electricians employed on new work by the London Electric Railways, and designated "temporary" employment, as the work in question was not work which men in the regular service of the companies were normally called upon to perform. The Court decided (Award No. 946) that such men should be paid the rates agreed between the National Federation, Electric Association and the E.T.U., less 1½d. per hour. Further, it is stated that men who were afterwards to be absorbed into the establishment is prescribed by Award No. 736.

The other decision relates to an application by the National Union of Railwaymen for an increase in the rate being paid to pipe-fitters in the employ of the London Electric Railways to bring them on the same footing as Grade I fitters. The Corporation considered that the training and training of these men is confined to a particular branch, whereas Grade I fitters are skilled in many branches, the claim of the Union is not established.

Workers' Compensation.—The following resolutions recommended for adoption by the Imperial Economic Workmen Committee were agreed to by the Conference:

That the Committee, taking note of the existing restrictions in the workmen's compensation laws of certain parts of the British Empire on the payment of compensation to workmen killed or maimed in the State in which the accident happened, and having regard to the recommendations made by the Imperial Economic Committee within the subject of opinion that no British subject who is permanently incapacitated, and no organisation which is responsible for him, by accident due to any employment in any part of the Empire, should be excluded from any benefits to which he is entitled in the State in which he was injured (Compensation and Law of that part of the Empire on the ground of his removal or in evidence in that part of the Empire).

The Committee, having had its attention drawn to cases where British subjects have been killed or injured when employed in some part of the Empire, have had no claim in compensation owing to the law of that part of the Empire being restricted, in an application to workmen, to accidents which have occurred in the country where the work is carried on, are of opinion that the Imperial Economic Committee should be advised to suggest to the Governments of the Empire that the benefit of the said regulations should be extended to the Government of any part of the Empire which should ensure that the benefits of the Acts of that country should be extended to workmen employed on the ship and vessels registered within such part of the Empire wherever the ship may be at the time the accident takes place. And, furthermore, the Committee feels that the Government of any British Colony or Protectorate, where there is a register of shipping, where compensation paid by the ship-owners is .not at present paid, to consider the adoption of such legislation.

The Boilermakers' Lock-out.—Negotiations between the Shipbuilding Employers' Federation and the Boilermakers Society lasted for twelve hours on Saturday last, but no definite result was announced. It is considered that further conference at Edinburgh on Wednesday last. The Times understands that a proposal was submitted by the boilermakers which the Union agreed to work the agreement for a limited number of months. The agreement was made for a period of three years from March last subject to termination upon either party's giving six months' notice. The proposal of the Society would therefore have given it power to reopen the question in the spring of next year, and on this account it was unacceptable to the employers. Attention was also devoted to the alleged anomalies caused by the agreement, and the boilermakers were asked to bring specific instances before the Edinburgh conference for investigation and amendment if possible. (See our advertisement pages to-day.)

Lead Report.—Messrs. James Forster & Co., report, under date November 10th: After a steady market for the first four days with a firm undertow, there was a sudden spurt yesterday evening, which was maintained for an hour and a half. The market opened on Monday, 4s. 11d. on January, and 5s. a ton for February, a backwardation of 6d. The London price is firm at 42½. The London price for November, £23 7s. 6d. for December, and £23 7s. 6d. for January, and £27 15s. for February. Imports for October were made in the previous months of this year, and as they promise to be on a small scale again this month, it is anticipated that consumption, particularly in the electrical trades, largely increased and increasing, there will be difficulty in meeting even normal requirements.

Imperial Economic Conference.—The Economic Conference is the subject of a long report in the current issue of the Economist. The opportunity of the Imperial Conference Committee for setting up a permanent Imperial Economic Committee, comprising members of the Governments represented at the Imperial Conference, to consider and advise upon any matters of an economic or commercial character referred to it by any of the respective Governments, apart from matters coming within the scope of the Imperial Shipping Committee, is the subject of a long report in the Economist. The report begins: "The formation of the Committee should be to consider and advise upon any matters of an economic or commercial character, not being matters appropriate to be dealt with by the Imperial Shipping Committee, which are referred to it by any of the constituent Governments; provided that no question which has any reference to another part of the Empire may be referred to the Committee without the consent of that other part of the Empire.

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LIGHTING AND POWER NOTES.

Lithuanian.—Extension of Supply.—The Corporation intends to make application in a new Parliamentary Bill for power to give a supply of electricity to the areas of Hurst Monadhie, Chirnside and Lamellont. Council would be entitled to issue the Bill, provided that the charges for electricity are no case made.

Scotland.—Year’s Working.—The accounts of the municipal electricity undertaking (borough electrical engineer: Mr. A. W. Phillips) for the year ended March 31st, show a profit of £2,975 on £16,794, as against £375 on £22,440, as against £753 on £37,620. Working expenses totalled £33,727, as compared with £36,619 for the previous year. The profit after the payment of interest, &c., was a profit of £2,975, which was contributed to reduce the rate of the rates. The estimated cost, according to recent proposals, of the new power station, after the payment of interest, &c., was a profit of £2,975, which was contributed to reduce the rate of the rates.

Claret.—New Plant.—The Urban District Council is to install a new 750-h.p. Diesel engine, with equipment, at the electricity works, and application is to be made to the Electricity Commissioners for sanction to the borrowing of £10,000 to carry out the scheme.

Continental.—Estonia.—State Power Station.—The completion of a large electric power station has now been completed at Tallinn, and within the course of the first week the supply of electricity has been established between Reval-Hapsal—Baltic, the radio station at Tallinn, the towns of Reval and Haapsal, and various places in the vicinity. Ninety-one large industrial concerns are at present covered by the hydro-electric works. The whole of the electricity has already been consumed by the towns and other localities. The purchase of the plant. The Electricity Committee has also recommended the preference of alternating current wherever possible.

20/127 V for general use; 380 V for high-power installations; 6,000 V for the production and transmission of current; 15,000 V for transmission purposes only. In cases where direct current is used pressures of 110 and 220 V are considered the most appropriate, but in some cases 110 V at 110,000 V may be used. In cases where direct current is employed for electric traction on railways, the current will be 1,000 h.p. and 400 V for the winter quarter of the maximum demand, 104. per kWh, and 4th, beyond, with minimum payments of 10s. for the winter quarter at 1,000 V.

Hazel Grove and Bramhall.—Electricity in Bulk.—The Urban District Council has approved the agreement prepared by the Electricity Supply Commission, between the Council and the Stockport Corporation, for a supply of electricity in bulk from the latter authority.

Ilkeley.—Electricity Agreement.—Negotiations between the Urban District Council and the Yorkshire Electric Power Co. have been concluded, and an agreement signed, for the supply of electricity in bulk by the company for distribution by the Council. The Council has for the past eight or nine years possessed its own generating station, but it has found it inadequate to meet the growing winter demand. Application is to be made to the Electricity Commissioners for permission to borrow £9,000 for the necessary alterations to the station. It is proposed to install a 360-kW rotary-converter so that the service can be maintained without interruption.

Irish Free State.—Thurles.—The Urban District Council has adopted a report of the Electricity Committee, recommending adherence to the d.c. system. The Council and Commerce had suggested that the system should be changed to a.c. to permit, in future, of the linking-up with other towns in the establishment of a network. An agreement is now at present under consideration by the Government, materialising.

Czechoslovakia.—The Corporation is to obtain expert advice with a view to a scheme for public electric lighting, and application is being made to the Ministry of Industry and Commerce for sanction to a loan for the scheme.

Donegal.—Ramsay.—The Gas Co. has applied to the Manx Ynysydd Co., for permission to undertake the supply of electricity. An agreement is being prepared by the company to authorise the company to supply the electricity. The application has been referred to a committee for consideration.

Portsmouth.—Battery.—The Portsmouth Corporation has laid a 6,000-V high-pressure cable from its generating station at Gatacre to a sub-station which has just been completed at Hants Cross, whence a supply of electricity, is now available for general use.

Morocco.—Hydro-Electric Development.—The efforts of a trust to acquire a concession granting it the monopoly of all the water resources in the French Protectorate have raised the liveliest opposition. The Moroccan Government has now decided to change to a.c. to permit, in future, of the linking-up with other towns in the establishment of a network. An agreement is now at present under consideration by the Government, materialising.

Northern Ireland.—Portadown.—The Town Council has decided to oppose the Bill to be presented before the Ulster Parliament in connection with the Braan power scheme, on the ground that serious damage would occur to the town on account of flooding, &c. Efforts are to be made to convene a conference of authorities in Co. Armagh, whose interests may be prejudicially affected by the proposed scheme.

North Wales.—Electricity Scheme.—It is anticipated that operations will commence at an early date in the construction of a huge generating station at Tranterham, Montgomeryshire, by the North Wales Power Co., which has purchased about a dozen farms for the purpose. The proposed station will be five miles long by four miles wide. A large generating station will be erected at Maentwrog, from which electricity will be distributed throughout North Wales. To that end, it is hoped, will facilitate the development of slate quarrying and mines in Merionethshire.

Padiham.—Proposed New Power Station.—Plans have been deposited by the Lancashire Electric Power Co. for a power station which it proposes to erect on a site on Vinegar Farm, Padiham, for the supply of electricity to Padiham and adjacent localities. Burnley Corporation is also seeking powers to carry out a scheme to supply Padiham district with electricity.

Redcar.—Proposed Electricity Supply.—The Town Council has taken a canvas in the area, and intends to erect a power station for the supply of consumers of electricity, and the result, having proved satisfactory, is to be forwarded to the Electricity Commissioners, to whom the Council has applied for an Order.
Ross-Shire.—Electricity Supply.—The County Council has decided to oppose the application of the Strathpeffer and Dingwall Electric Co., Ltd., for an Order authorising it to supply electricity in certain parts of the county.

Stoke-on-Trent.—Special Orders.—A public meeting on November 9th it was stated that an agreement had been entered into with Edmundson's Electricity Corporation for a supply in the district, that the company was applying for an Order authorising it to carry out the scheme. The company offered to give a supply and bear the whole of the cost of the scheme.

Slaithwaite.—Electricity Supply.—The Urban District Council has received the sanction of the Electricity Commissioners to proceed with the extension of mains to Ripponden, thereby furnishing electricity to Soyland, and that it desired to discuss with the Council the matter of street and other lighting. It was pointed out that at present the supply would be for power only, but lighting would be brought into operation as soon as the scheme was sanctioned. A deputation was appointed to negotiate with the Power Co.

Special Orders.—The Electricity Commissioners have submitted a bill for the £2,000 the scheme was then estimated to cost. The application for an Order authorising it to carry out the scheme.

Sleaford.—Loan Sanctioned.—The Urban District Council has received the sanction of the Electricity Commissioners to a loan of £2,000 for mains.

Soyland (Yorkshire).—Electricity Supply.—At a recent meeting of the Urban District Council notification was received from the Yorkshire Electric Power Co. of its intention to proceed with the extension of mains to Ripponden, thereby furnishing electricity to Soyland, and that it desired to discuss with the Council the matter of street and other lighting. It was pointed out that at present the supply would be for power only, but lighting would be brought into operation as soon as the scheme was sanctioned. A deputation was appointed to negotiate with the Power Co.

Stockley.—Electricity Supply.—The Rural District Council has agreed to offer no objection to the Middlesex Borough Corporation's undertaking the supply of electricity to the Parish.

Thames Valley.—Main Extension.—The Metropolitan Electric Supply Co. is extending its mains through Irlaworth and Sunbury to Staines, and through Egham to Slough.

The flat rate for lighting will be 6d. per kWh, and for heating and cooking, 3d. per kWh.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne.—Rainless Cars.—It is proposed to introduce in the next session of Parliament a Bill for the creation of a new service between Ashton and Oldham, which can be put into operation at less than half the cost of electrical rail. The line is over the few electric trams in Ashton.

Australia.—Melbourne.—According to the Melbourne Herald, the Metropolitan Tramways Board expects to spend nearly £2,000,000 in extending tramway lines this year. The extension tramway tracks will becompleted by the end of 1923. New lines will absorb £900,000, and of this amount £450,000 will be unemployed on works in the central suburbs and North-West end of the Yarra. The Board has acquired 16 acres of land at Preston, on which to erect what will probably be the largest workshops in Victoria.

Bournemouth.—Loans Sanctioned.—The Town Council has received the sanction of the Ministry of Transport to the borrowing of £50,000 (subject to reduction by £10,000), to be out of unappropriated balance for track renewals, and £7,000 for new cars, and construction of new routes.

Chile.—Railway Electrification.—Electrification of the Ferrocarril del Llano de Maipo, which extends from Santiago to Fuerte Alto, has recently been commenced by a firm of Chilean contractors. This line connects Santiago with important mining districts, and it is expected that the work will be completed in about 13 months. After the existing line is electrified the present rolling stock will be discarded and new equipment, consisting of a freight locomotive and two electric passenger cars, operated. Power at 60 cycles, 500 volts.

Continent.—Norway.—The Norwegian State has adopted a recommendation of the Railway Committee, sanctioning a vote of 5,500,000 kronen for the electrification of the Drammen-Kongsvinger railway.

Darlington.—Tramway Improvements.—Mr. R. J. P. Lamming, manager of the Electricity and Light Railways Department, has submitted a report on the advisability of certain tramway improvements. He says that before these can be carried out it will be necessary to decide whether to retain a section of the tramway track when the rails are worn out. A considerable portion of the existing track will have to be retained, on account of the work being done with the tramway track would be from about £30,000 to £120,000. Even if a life of 25 years was allowed, the renewal track, therefore, would be from £5,000 to £10,000 per annum, as against about £3,500 per annum on the existing track. The overhead wire was unsatisfactory. The Corporation could adopt some type of railless car to be run at low cost as a tramcar, they would be able to save these capital charges. The present cost of 30 railless cars would be £500 a year, and the expenditure per annum £2,000, to set against the minimum of £5,000 per annum capital charges on the renewed tramway track.

London.—L.C.C. Tramways.—At last Tuesday's meeting of the London County Council the following motion by Mr. A. G. Gillmor, was carried: "That it be referred to the Tramways Committee to consider and report whether the tramway reorganisation of the period 1921-1925 includes the introduction of (a) the electric trams of the District of Wellernorough; the Electrical Distribution of Yorksh—

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Afghanistan.—New Telegraph Line.—A contract for the erection of a telegraph line between Peshawar and Kabul has been given to a European firm, says The Times.

France.—Ships' Radio Apparatus.—A decree of April 6th, 1926, regulating radio-telegraphic on French ships became effective on June 1st, 1926, and is the latest regulation of radio communication in the interests of Siam. It is an adaptation to the telegraphy and telephonc requirements of the International Convention of 1914 for Safety of Life at Sea, and the French war requirements for wireless apparatus. The new regulations provide that every first-class ship with over 2,000 tons and every passenger ship with over 100 passengers shall be provided with a telegraphy and telephonc apparatus capable of transmitting and receiving signals at sea over a distance of at least 150 miles. The apparatus shall be in good order, and if, instead of relaying the track, the Corporation would amount to between £6,000 and £9,000 per annum capital charges on the renewed tramway track.

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RADIO NOTES.

Radio-Broadcasting.—ADVISORY COMMITTEE.—At a luncheon given by the National Association of Radio Manufacturers following the inauguration of the Wireless Exhibition, the Postmaster-General gave a forecast of the lines along which the Post Office considered that development would proceed, and announced that he was about to appoint a Broadcast Advisory Committee, composed of representatives of the industry, the public, and the Press, so that future Postmasters-General would not have to carry the whole burden of the matter. Licences.—He also said that in March this year there were 122,000 broadcast licences current; in September there were 119,000, and in October 280,000 more licences were issued, mostly of the 1s. variety, with the result that there now were 450,000 licences in existence.

STEINFORD RELAY STATION.—The official opening of the Steinfeld relay station, the first in the country, takes place to-day (Friday), the Lord Mayor and the Master Cutler taking part, as well as Mr. J. C. W. Reith, director and manager of the British Broadcasting Co.

BROADCAST THEATRICAL PLAYS.—It is proposed to erect a transmitting station at the "Old Vic" theatre (the home of Shakespeare's plays), for the purpose of relaying performances, possibly to 2LO, whence they will be broadcast in the usual manner. The wave length of the "Old Vic" transmitter will be so unusual and will be changed so frequently that it will be difficult for amateurs to tune in to it directly.—Daily Mail.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW in which the "Official Notice" appeared in our advertisement pages.)

OPEN.

Austria.—St. Petersburg.—City Council. January 7th. Coal-unloading and conveying plant.*

Melbourne.—December 16th. Victorian Railway Commissioners. Fibre for insulation of tramway equipment, &c., as it may be required in the future. (See this issue.)

Belfast.—November 19th. Electricity Department. Steam, water, and other piping, &c., at the Harbour power station. (November 22nd.)

December 16th. Board of Guardians invite schemes for the installation and equipment of a centralised heating and lighting plant. (See this issue.)

Birmingham.—November 21st. Public Works Committee. Construction of 200 yards double-track tramway and about 3,000 yards of wooden-decker construction double-track tramway in Bristol Road and way in Bridgwater and at Exmouth. (See this issue.)

Croydon.—November 26th. Electricity Department. One 50,000-lb. steam-raising unit. (See this issue.)

Dublin.—November 19th. Dublin United Tramways Co. (IBg). Ltd. Stores for six months, including electric lamps, electrical fittings, &c. (November 9th.)

Dundee.—November 22nd. Electricity Department. Single- and three-core l.p. paper-insulated lead-sheathed cable. (November 9th.)

Edinburgh.—November 16th. Electricity Supply Department. Five 3-phase transformers. (November 9th.)

December 4th. Tramways Department. Tramway cars, tracks, and electrical equipment. Tramways manager, 2, St. James' Square, Edinburgh.

Finland.—HELSINKI.—November 22nd. Finnish Ministry of War. 10,000 kg. h.d. tinned-steel wire for field telephones.*

Glasgow.—November 20th. Tramways Department. Six months' supply of stores. Mr. James Dairymple, general manager, 46, Bath Street, Glasgow.

January 16th. Civil Aviation Department. Traders and designs for release disposal works at Govan. (See this issue.)

Govan.—November 23rd. Combination Parish Council. Installing electric lighting at the Southern General Hospital. Mr. John Mitchell, 24, Carlton Place, Glasgow.

Greenock.—December 8th. Electricity Department. Three 3,000-kV transformers, h.p. switchgear, transformers with boosters, and induction regulators. (See this issue.)

Ince-in-Makerfield.—November 30th. Urban District Council. Diesel oil engine driving horizontal pumping sets, in duplicate. (See this issue.)
The ELECTRICAL REVIEW. [Vol. 94. No. 2399, November 16, 1923.

India.—Delhi.—January 21st. Public Works Department. Turbo-alternators, turbo-alternators, condensing plant, cranes, boiler-house, plant, economiser, steel chimney, pipework, switchboards, transformers, sub-station plant, etc., for the Engineer's Section, Indian Stores Department, Delhi, on payment of Rs. 20 per set of two copies (extra Rs. 10).—Reuter's Trade Service (Delhi).

Bombay.—December 17th. One motor-driven air compressor for the Engineer's Section, Indian Stores Department, on payment of Rs. 20 per set of two copies (extra Rs. 10).—Reuter's Trade Service (Bombay).

Liverpool.—November 28th. Tramways Department. Supply of various electrical materials, including tramway rails and fishplates, steel fishplates, steel tiebars, steel bonds, timber sleepers, and steel spikes. City Engineer, Municipal Buildings, Dale Street.

London.—Paddington.—November 3rd. G.W. Railway Stores, including telegraph instruments, cables, wires, lamps, apparatus, etc. (November 2nd.)

India Store Department.—November 28th. Switchboard cable and v.i.r. insulated wire. (November 9th.)

Manchester.—November 21st. Markets Committee. Electric drive for ammonium compressor at Elm Street cold storage, A. Chadwick, general superintendent, Markets Department, Town Hall.

Newcastle-under-Lyme.—November 30th. Electricity Department. One vertical electric motor-driven condensing turbine, capacity 750,000 gallons per hour. (See this issue.)

New Zealand.—Auckland.—November 29th. Electric Power Board. Transformers and accessories.*

Northcote (Glam.)—The Urban District Council is prepared to grant facilities for the installation and operation of an electricity supply scheme (public company) within its district.

Preston.—November 26th. Electricity Department. Two 130-kw rotary converter equipments, h.p. and Lp. switchgear, etc., (300 kw.).

Reigate.—November 21st. Town Council. Electrically-driven drainage pumps. (November 9th.)

Rhyl.—November 27th. Electricity Department. Laying new mains, with control switchgear, certain new lamp columns, lamp heads, fittings, time switches, &c. (See this issue.)

South Africa.—Cape Town.—December 10th. South African Railways and Harbours Boardyard plant, Table Bay Harbour Breakwater extension, 3 electrically-driven concrete mixers, 3 electrically-driven bucket elevators, 3 electrically-driven sand elevators, 1 electric lift for cement, &c., particulars from the Town Clerk, Town Office, Graaff-Reinet.


Southampton.—December 3rd. Electricity Department. Two e.h.p. switch cabinets with control panels and indicating diagrams, &c. (See this issue.)

Spain.—November 30th. The Zunarrage-Zumaya Railway Co., San Sebastian. Material required for the electrification of the railway between the two towns mentioned.

Uruguay.—Montevideo.—December 28th. State Electric Light Works. Electrical supplies, including cable, insulating compound, lamp shades, &c.*

Warrington.—November 19th. Electricity Department. Machinery and apparatus for the leading cables and m.p. rubber-covered cables. (November 9th.)

November 30th. Cheshire Lines Committee, Stores, including telegraph materials, for 12 months. Stores Superintendent, Cheshire Lines, Warrington.

Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, B.W.I.

The Victorian State Electricity Commission. Accepted:-

France.—Marseilles.—December 19th. Public Works, Roads, and Transport Congress and Exhibition.—At the Royal Victoria Hotel, Marseilles. Accepted :- Public Works, Roads, and Transport Congress and Exhibition.—At the Royal Victoria Hotel, Marseilles.

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FORTHCOMING EVENTS.

INSTITUTION OF CIVIL ENGINEERS.—Thursday, November 23rd. At the Institution, Great George Street, S.W. At 6 p.m. Ordinary meeting.

Institute of Marine Engineers.—Wednesday, November 22nd. At the Institution, At 7 p.m. Discussion on "Power Telegraphy and Marine Wireless" by Mr. H. Campbell.

Institution of Civil Engineers.—Tuesday, November 21st. At the Institution, Great George Street, S.W. At 6 p.m. Ordinary meeting, "The Minories, Tower Hill." At 7 p.m. "Paper on "The Construction and Manufacture of Seamless Steel Pipes and Cylinders," by Mr. A. R. Pickering, of the London Canal Companies, and "A Dynamic Model of a Valve and Oscillating Circuit," by Mr. R. W. T. Attenborough, of the Liverpool University.

Institute of Electrical Engineers.—Thursday, November 23rd. At the Institution, The Minories, Tower Hill. At 6.30 p.m. Paper on "The Gas Telegraphy and Marine Wireless" by Mr. H. Campbell.

Institution of Production Engineers.—Wednesday, November 22nd. At the Institution, Great George Street, S.W. At 7.30 p.m. Paper on "The Use of Charts in Engineering," by Mr. A. W. Swain.

Association of Consulting Engineers.—Wednesday, November 22nd. At the Institution, Victoria Embankment, S.W. At 8 p.m. "The Construction and Manufacture of Seamless Steel Pipes and Cylinders," by Mr. A. R. Pickering, of the London Canal Companies.

Commercial Motor Exhibition.—At Olympia, W. November 22nd—December lst.

Public Works, Roads, and Transport Congress and Exhibition.—At the Royal Agricultural Hall, Islington, N. November 22nd to November 26th.

Institution of Electrical Engineers.—Thursday, November 23rd. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "The British Section of the Société des Ingénieurs Civils de France," by Mr. A. B. Eason.

Institution of Civil Engineers.—Monday, November 19th. At the Institution, Victoria Embankment, W.C. At 6.30 p.m. Paper on "The Institution of Civil Engineers," by Mr. A. B. Eason.

Institution of Production Engineers.—Wednesday, November 22nd. At the Institution, Great George Street, S.W. At 7.30 p.m. Paper on "The Use of Charts in Engineering," by Mr. A. W. Swain.

North-Western Counties.—Tuesday, November 21st. At the Institution, At 7 p.m. Paper on "Wireless Telegraphy and Marine Wireless." by Mr. H. Campbell.

Mersey and North Wales (Liverpool) Centre.—Monday, November 21st. At the Institution, Liverpool. At 7 p.m. Paper on "Wireless Telegraphy and Marine Wireless," by Mr. H. Campbell.

Maidenhead.—Town Council. Accepted:-

- Oil fuel for the electricity works for a year (at £4 17s. 6d. per ton) from the British Petroleum Co., Ltd.

Northampton.—Tramways Committee. Accepted:—

- Turbogenerator set for the Luton Tramways Company. Accepted :-

- Electric storage battery industrial truck, Electromobiles, Ltd. (£593)

South Africa.—Cape Town.—December 10th. South African Railways and Harbours Boardyard plant, Table Bay Harbour Breakwater extension, 3 electrically-driven concrete mixers, 2 electrically-driven bucket elevators, 3 electrically-driven sand elevators, 1 electric lift for cement, &c., particulars from the Town Clerk, Town Office, Graaff-Reinet.

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<td>£24,000 for the electrification of the new railway line.</td>
</tr>
<tr>
<td>Newport, South Wales.</td>
<td>£18,000 for the electrification of the town.</td>
</tr>
</tbody>
</table>

The following contracts have been placed :—

<table>
<thead>
<tr>
<th>Contract Details</th>
<th>Quantity/Description</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>
THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Letters for information must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers or suppliers of:-

- BAKELITE wire.
- ENAMEL wire.
- PELLETES (straight and angle type, mounted on brackets) for signal wire as used in railway work.

NOTES.

Concert.—The 10th annual charity concert promoted by the Bradford Corporation Tramways Ambulance and Nursing Union took place at St. George's Hall on November 7th, and the great hall, seating over 5,000 persons, was crowded, and the reception was cordial.

Hydro-Electric Equipment for Canada.—In a report upon recent commercial and industrial conditions in Canada by Mr. F. P. C. Robertson, Commissioner at Toronto, and Mr. J. W. F. Cameron, Electrical Engineer of the Government of Canada, in the "Journal of Trade Journal," it is stated that a number of large orders for hydro-electric equipment have been placed during the past few months. Those British firms which have local sales or representatives in Canada have been active in new orders, and have been successful in securing the business. Orders for a considerable sum were secured by a British firm. A Canadian firm has obtained an order for 120 busses for a hydro-electric enterprise in Quebec Province, valued at nearly $2,000,000. The same firm is building two large electrical generators, the contract price being about $1,000,000. New business is likely to be offered as a result of the development of the pulp and paper industry. Discussions on the electrification of railway lines for-wards heavy expenditure on equipment account.

Royal Institution.—The 89th course of juvenile lectures at the Royal Institution, to be delivered this year by Mr. W. Bragg, F.R.S., is entitled "Concerning the Nature of Things," and will deal with: I. The Atoms of which Things are Made; II. The Nature of Gases; III. The Nature of Liquids; IV. V. and VI. The Nature of Crystals; (a) Diamond; (b) Ice and Snow; (c) Metals. The first lecture will be given on Thursday, December 29th, 1923, and the succeeding ones on December 1st, and January 1st, 3rd, 5th and 8th, 1924.

Appointments Vacant.—Distribution superintendent, for the Paisley Corporation electricity department; assistant electrical engineer (£250 plus bonus = £300); for service in England, for the High Commissioner of India; electrical engineer, for the Holinhurst Urban District Council; and assistant electrical engineer, for the Hensley Corporation electricity department. (See our advertisement pages to-day.)

"Baums" Scholarships.—The Council of the British Electrical and Allied Manufacturers' Association (Inc.) has recently granted the following scholarships, tenable for one year, each of the value of £400 and the payment of college fees. Electrical and Mechanical Engineering: J. D. Cockbain, tenable at Manchester University; A. A. Pennycook, tenable at Birmingham University, Electrical Engineering; G. K. Prisland, tenable at Manchester College of Technology; W. S. Lucas, tenable at City & Guilds (Eng.) College, South Kensington; R. C. Matthews, tenable at City & Guilds (Eng.) College, Glasgow; J. L. Orme, tenable at Birmingham University; C. W. Richards, tenable at City & Guilds (Eng.) College; E. Wright, tenable at City & Guilds (Eng.) College. Mechanical Engineering: J. W. Davison, tenable at Manchester College of Technology; M. Geddes, tenable at Glasgow University; I. H. Hedley, tenable at Durham University; H. T. Lack, tenable at Manchester College of Technology; A. Jeffrey, tenable at Manchester College of Technology; B. S. Pelso, tenable at London University.

Parliament.—Parliament re-assembled on Tuesday, November 29th, the Prime Minister announcing that the Dissolution would take place to-day (Friday).

COMMISSIONERS' COSTS.—Sir James Benn at the Parliamentary Secretary to the Ministry of Transport, the attention had been called to the case of the King's College of Commissioners, in the Court of Appeal, on July 27th, 1923, in which judgment, with costs, was given against the Commissioners, and in favour of London electricity companies; and, if so, whether he could see that these costs were not included amongst the ordinary expenses which the Electricity Commissioners are precluded any differentiation of expenses. Costs against the Commissioners in an action were properly to be included as expenses of the Commissioners.

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The Lord Mayor's Show.—The show this year was largely devoted to a representation of the progress of British industry through the ages. The electrical industry was represented by a car provided by the British Electrical Development Association. In view of the difficulty of dealing with so large a subject, and particularly of a vehicle electrically lit, the display was on the day-time, the car represented the present of the art of cookery, showing, in comparison with the early methods of preparing food without electricity, the modern and rapidly developing use of electricity in the kitchen. The electric cooker, in operation during the progress of the show, was supplied with energy from an Exide battery carried on the vehicle. Apart from this display and supporting features of sundry electrical appliances
Large Indian Hydro-Electric Contracts.—The Industrial Daily News reports that, in connection with the new 67,500-h.p. scheme in the Western Ghats, Bombay State, contracts will be placed in this country in the near future for the generating plant, switchgear and other material. The machinery to be installed, all of which will be manufactured in British works, includes five pairs of water wheels, each of 30,000-h.p. capacity, five 17,500-kW generators, two exciter water-wheels and dynamos, and complete switchgear and distribution gear. Twelve transformers of 9,000 kW and 13,000 KVA 25 kV and 11 kV ratings, a 125-ton travelling crane for the main power house are manufactured in British works, includes five pairs of water wheels, each of 30,000-h.p.

Unemployment.—The number of persons on November 9th, 1923, recorded on the registers of the Employment Exchange in Great Britain was 1,244,000. This was 11,996 less than in the preceding week, and 241,878 less than the figure obtained for the week ending November 15th, has been postponed to November 22nd, at 6 p.m. The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW posted as to their movements.

Institution of Civil Engineers.—President's Address.—On his inaugural address Sir C. Morgan departed from the common practice of dealing with some scientific or technical subject. The Duke of York sent a message regretting his inability to be present. It was agreed that a very successful evening was in the chair at the opening meeting of the Informal Section, which was to have been held on November 29th, 1923, will be in two sessions, viz., 5.30 to 7 p.m. and 7 to 8.30 p.m. By permission of the British Broadcasting Co. arrangements are being made for parties, including foreign countries, to draw from the Union as from the end of the present year.

Institution of Electrical Engineers.—Joint Meetings.—The joint meeting with the Société des Ingénieurs Civils de France (British Section), which was to have been held on November 16th, has been postponed to November 22nd, at 6 p.m. The joint meeting with the Physical Society of London on November 29th, 1923, will be in two sessions, viz., 5.30 to 7 p.m. and 7 to 8.30 p.m. By permission of the British Broadcasting Co. arrangements are being made for parties, including foreign countries, to draw from the Union as from the end of the present year.

Institutional Tramways Union.—The Highways Committee of the London County Council, being of the opinion that the advantages derived from membership of the International Tramways Union are no longer commensurate with the amount of subscription payable, advised the Council to withdraw from the Union as from the end of the present year.

Beard the present date, the British Tramway Federation, which in many countries is represented by a whole volume of principles, data and general propositions, has withdrawn from the local or national organization of its members, and has declared itself for the establishment of a society which shall include engineers from all countries. In many countries, the British Tramway Federation, which in many countries is represented by a whole volume of principles, data and general propositions, has withdrawn from the local or national organization of its members, and has declared itself for the establishment of a society which shall include engineers from all countries.

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Mr. W. H. Cripps.—We record with regret the death of Mr. William Harrison Cripps, F.R.S., who died on November 8th at 19, Bentinck Street, London, W.1. Mr. Cripps, who was a man of distinction in his special profession—surgery—was highly gifted in knowledge and skill, and in the latter connection will be especially remembered by those who were in the immediate medical staff of the British Electric Light and Power Company, Ltd., and by those connected with the Electric Light and Power Company of Ontario. Mr. Cripps was also responsible for the re-organisation of the Metropolitan Electric Light and Power Company Limited, and its association with the Metropolitan Electric Light and Power Company of Ontario, which ended in disaster. Mr. Cripps was a man of distinction in his special profession—surgery—and his death is a great loss to the profession of surgeons in this country.

Obituary.—M. Maurice Lesnanc.—In our issue of November 26th we announced the death of M. Maurice Lesnanc, a well-known engineer and author in the electrical engineering field. M. Lesnanc was the author of several books on electrical engineering, and was a member of the editorial board of the Revue Générale de l'Electricité, of whose editing he was a member. M. Lesnanc was a man of wide experience, and was a member of several committees and panels of the British Electrical Engineering Standards Association.

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The ELECTRICAL REVIEW, Vol. 93, No. 2399, November 16, 1923.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

C. F. Elwell, Ltd.—A. C. Lucas, of Aldermary House, 60, Victoria Street, London, S.W., was appointed receiver on October 27th, 1923, under powers contained in mortgage debentures dated June 3rd and October 29th, 1923.

Halifax and Bermudas Cable Co., Ltd. (25,972)—Returned October 4th, 1923. Capital, £50,000 in £5 shares. All shares taken up. Mortgages and charges, &c.

Lowth & Smith, Ltd.—T. Forster, of 28, Deansgate, Manchester, was appointed receiver and manager by Order of Court, dated July 24th, 1923. (Notice filed November 1st.)

Adams Brothers (Longton), Ltd.—W. H. Lawton, of 74, Church Street, Fenton, was appointed receiver on October 30th, 1923, under powers contained in mortgage debentures dated October 30th, 1923.

Yorkshire and District Electric Lamp Repairing Co., Ltd. —H. Cawood, of 68, Eyre Street, Sheffield, ceased to act as receiver or manager on November 3rd, 1923.

Cables and Telegraphs

The report of the directors for the year ended June 30th last shows a gross revenue £2,473,750, a deficiency of £6,500 has been transferred from the general reserve fund to the debenture redemption fund. The debenture redemption fund stands at £24,195. The invest-ments now held by the company amount to £303,520. Owing to the financial conditions caused by the passing of the new law in Uruguay, the position had improved a little during the past year, was declared.

The annual meeting was held on November 6th. The chairman, Viscount St. Davids, stated that 1922 had been a difficult year. From the beginning of the year to the end of June the sale of aluminum wire, including the necessary repairs. With regard to the hydro-electric works, which had been completed and were just on the point of reaping the fruit of the work, the directors were justly entitled to feel that the full value of the services of the company’s undertaking and assets, including all investment, the whole amount being now issued.

The revenue for the year ended August 31st last was £23,136; working expenses £12,740, to which is added £6,222 brought forward, giving a total of £21,957. The directors recommended a dividend of 8 per cent., less tax, passing £23,136 for debenture redemption fund stands at £24,195. The investments now held by the company amount to £303,520. Owing to the financial conditions caused by the passing of the new law in Uruguay, the position had improved a little during the past year, was declared.

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ground Railways income bonds are practically the only Home Railway stocks which have not failed to make dividends. The reason is, of course, that the coupons are cashable in New York at the exchange rate of the day, and it is assumed that the supply to the American market will be ample. In the case of the others, to be redeemed, although on this point there seems to be little chance of any trouble in the measure of double the coupons. The great extra constructional work in connection with the line in conclusion, the chairman expressed his confidence that the result of the Election is likely to be to the advantage of the shareholders, a view supported by the accounts were adopted, and the shareholders subsequently approved of an increase in the directors’ borrowing powers.

Prospectuses. Board.—The prospectus was published on Friday last week offering for subscription £750,000 5 per cent. debenture stock, at 95 per cent., the principal and interest being payable in London. The proceeds will be used to pay off the debentures due on or before September 15th, 1936. The present issue represents the issue of £1,500,000, which the board has power to borrow, and for which an additional issue was made in August, 1936, and in connection with the issue of £2,975 for the development of the Central Electric Supply Co. and £149,700 5 per cent. secured and guaranteed redeemable notes (registered), Nos. 2,466 and 2,467 of £100, No. 260 of £500, and Nos. 371 to 519 of £1,000.

STOCKS AND SHARES. TUESDAY EVENING.

Some of the companies, in this week’s transactions, are very likely to be quoted at the new figures. The railways stocks would seem to be a good move, though any change in the Exchange rate of the day, and it is assumed that the supply to the American market will be ample. In the case of the others, to be redeemed, although on this point there seems to be little chance of any trouble in the measure of double the coupons. The great extra constructional work in connection with the line in conclusion, the chairman expressed his confidence that the result of the Election is likely to be to the advantage of the shareholders, a view supported by the accounts were adopted, and the shareholders subsequently approved of an increase in the directors’ borrowing powers.

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SHARE LIST OF ELECTRICAL COMPANIES.

HOMELY ELECTRICITY COMPANIES.

<table>
<thead>
<tr>
<th>Name</th>
<th>Dividend</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Charing Cross</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chelsea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>City of London</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County of London</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edinburgh's Ordinary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kentish County</td>
<td></td>
<td></td>
</tr>
<tr>
<td>London Electric</td>
<td></td>
<td></td>
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<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 4% Pref.</td>
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<td></td>
</tr>
<tr>
<td>Newcastle-on-Tyne</td>
<td></td>
<td></td>
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<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 7% Pref.</td>
<td></td>
<td></td>
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<tr>
<td>West India &amp; Pearl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Met. Elec. 6% Pref.</td>
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<td></td>
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<tr>
<td>Urban Ordinary</td>
<td></td>
<td></td>
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<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>James' and Pall Mall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>do. 6% Pref.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Metropolitan Pref.</td>
<td></td>
<td></td>
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<tr>
<td>Westminster</td>
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<td></td>
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<tr>
<td>do. 6% Pref.</td>
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</tr>
<tr>
<td>Whitehall Elec. Invst. 9% Pf.</td>
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</table>

MARKET QUOTATIONS FOR CHEMICALS AND METALS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only estimates and they may vary according to quantities and other circumstances.

<table>
<thead>
<tr>
<th>Chemicals &amp;c.</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>£315 to £499</td>
</tr>
<tr>
<td>Wire</td>
<td>£10 to £60</td>
</tr>
<tr>
<td>Barytes</td>
<td>£3 to £8</td>
</tr>
<tr>
<td>Brass</td>
<td>£10 to £60</td>
</tr>
<tr>
<td>Copper Tubes</td>
<td>£35 to £60</td>
</tr>
<tr>
<td>Copper</td>
<td>£25 to £50</td>
</tr>
<tr>
<td>Electrolytic Bar</td>
<td>£20 to £30</td>
</tr>
<tr>
<td>Electrolytic Rod</td>
<td>£40 to £60</td>
</tr>
<tr>
<td>Electric Lighting of French Trains.—As may be supposed, the French Minister of Public Works, as far back as October, 1923, issued a circular to the railway companies requiring them to discontinue the use of gas for the lighting of passenger trains. The instructions given by the Minister were that the use of gas was to be abandoned by January 1st, 1923, in the case of express trains, a year later in the case of trains performing suburban services in the vicinity of large towns, and by January 1st, 1925, in the case of all other passenger trains. As a result of an inquiry made by the railway supervising authorities it has been ascertained that all the coaches employed in the express passenger service will shortly be lighted by electricity. The transformation is practically complete on the Northern and the State railways, only some luggage vans remain to be electrically equipped on the Lorraine, Lyons, and Mediterranean Railway, the Eastern Railway, the Alsatian and Lorraine, while the Southern Railway is only a month behind in the matter. In the case of the suburban and other passenger trains it is expected that the time limits will be adhered to, especially as the Ministry of Public Works has not permitted any deviation from the original instructions. The total number of passenger coaches on all the railways combined wherein gas still has to be replaced is about 28,000, or about one-half of the total number of passenger coaches in service. But as the companies have obtained exemption from the obligation to substitute electric light in the case of the coaches of old types, which are finally to disappear in ten years' time, the number of coaches yet to be electrically lighted in reality is only 10,000. For coaches in which the discontinuance for passenger service has been ordered, the new ones are to be lighted by means of oil. In general it is stated that the railway authorities made a strong effort to comply with the instructions which were officially given over two years ago.</td>
<td></td>
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</table>
MICA AND MICANITE INSULATION.

The Difficulties Besetting the Choice of Quality best suited to the Work.

By ARCHIBALD A. C. DICKSON.

It is generally admitted by the leading electrical engineers that future economy in the construction of electrical machinery lies in the insulation, a view which I readily endorse.

Mica is admitted to be the best solid insulating material on the market, but, unfortunately, mica, irrespective of quality, is what the majority of buyers seek, especially if they are offered a cheap mica which quite satisfies them, owing to their unenlightenment. They think that they are saving money for their employers, and, in reality, as will be shown further on, they may actually not only be wasting money, but may inadvertently be getting their firm a bad name in the market—a name which spells "unreliability." It should never be forgotten that it is of paramount importance to the manufacturer of electrical machinery that the correct use of insulating materials of high quality not only leads to the greatest economy in construction, but also determines the "reliability" of the machine, which is of far greater value than construction to the actual users of electrical machinery.

If a manufacturer says: "Here is a machine so insulated that it will last for years," against the man who says: "Here is a cheap machine, it looks the same as the dearer, but I cannot guarantee it for any length of time, as I cannot vouch for the insulation,"—whose machine will be bought by the intelligent contractor, buyer, or user?

I have known firms naively to buy and use "biotite" a ferro-magnesian mica with a very high percentage of iron in its chemical composition, which is deleterious to isolation for commutator segments (mineralogically it belongs to the phlogopite, or so-called "amber mica") family, and honestly could, by an ignorant person, be offered under the general trade name of amber mica, as really thought that they were striking quite a good bargain, especially as it seemed, in thin films, brown, and nearly opaque. My experience (covering over 18 years) leads me to consider that the correct use of insulating materials of high quality not only leads to the greatest economy in construction, but also determines the "reliability" of the machine, which is of far greater value than construction to the actual users of electrical machinery.

I will first consider the hardness of mica (when I speak of mica I mean natural mica, which is a matter of importance, as some smaller firms use the term "mica" indiscriminately for both mica and micanite) for commutator work. The hardness or softness is noted on the wearing or cut edge of the mica, and has nothing whatsoever to do with the firmness or rigidity of the plate or segment itself.

My own experience (covering over 18 years) leads me to place the present commercial micas of which I have knowledge as follows:—

1. Soft, fairly clear, brown amber and Madras soft brown and soft green.
2. The physically purer opaque ambers. Some opaque amber micas are unreliable owing to the minute physical air bubbles in their inner laminae. These bubbles easily break and weaken the insulation.
3. White Indian micas and some electric ruby spotted micas and some opaque ambers.
4. Some varieties of Calcutta, Madras, and other micas are spotted and matted micas. Some opaque ambers.

5. Some varieties of ruby, brown, green, and rum.
6. Hard ruby, green, brown, and rum.

There are so many divisions and subdivisions of these different qualities that it would be futile to attempt to definitely place any generic quality to a fixed standard hardness, hence the injunction to leave the selection to the technical specialist.

Physical Properties.—From this point of view it is difficult to judge mica from its generic name as a Muscovite or, more particularly, a Calcutta ruby may be clear, hard, and flawless, or clear and soft with interlaminar defects. Of course, the trouble is less accentuated in Calcutta assortments, as defective clear mica is usually put in a lower grade or class, i.e., the clear soft ruby would not be packed with the clear hard ruby, and would also naturally be cheaper. Clear mica is generally a misnomer. With the amber micas the conditions are quite different—good and bad are packed together, so that the buyer and user have to chance what they get. Madras mica, which is a Muscovite, is like the Calcutta mica classified as a guide to the buyer, but, unfortunately, the classification is not so good as that of the Calcutta mica. An important fact worth recording is that new fields, owing to ignorance, send their micas to London in the crudest and most unreliable condition imaginable.

Colour is often a guide in amber mica, as it frequently means deleterious variations in chemical composition which may make all the difference between good and bad insulating properties. Some Muscovite micas suffer in another way, e.g., a hazy smoky look may mean only water stains, or numerous spherical air bubbles, or even fine rock punctures through some of the internal films, which are hard to discern without testing. The latter failing is decidedly detrimental to insulation. Even slight variations in colour often affect the elasticity, hardness, and dielectric properties of a mica. I might instance the black-looking ambers, which contain 16 per cent. iron, against the lighter ambers, which only contain from 1 to 2 per cent. iron.

Thermal Properties.—Ordinarily micas can be safely heated, without fear of any change, to 400 deg. C., and some even up to 800 deg. C., but, as stated above, the different colours and classes of the magnesia or amber family, and the potassium or Muscovite family, will stand different temperatures, sometimes with a variation of 200 deg. C. Another important factor is that some amber micas on continued heating, if brought in contact with certain acids (among others sulphuric acid may be mentioned, as it is largely used in the electrical trade), are completely disintegrated, but this is not so where the Muscovite micas are concerned, except where combined rare acids not generally used by the electrical industry are in evidence.

Almost each requirement provides some definite properties or qualities which may be wholly possessed by the initially more expensive micas and only partly by the initially less expensive. It will be apparent that by straightaway using the micas recommended by one who knows the dielectric strength, electrical and thermal resistances, chemical compositions, and physical properties of micas best suited to the purpose, even though the initial price may be a few pence higher than the cheaper, poorer, job-line substitute micas. The British electrical industry will benefit a thousandfold, as the word "reliability" will thenceforth be stamped on those machines in contradistinction to the others using the cheaper, poorer, unreliable substitute micas.

A good dielectric mica may have a poor thermal resistance, and a poor dielectric mica may have a high thermal resistance, and yet, perhaps, both may be good
insulators each in its own field, and may not be able to take the place of each other.

A few remarks here about electric spotted mica, before disposing of the natural mica problem, may be apposite. There are several varieties of so-called black spotted mica. Some are hard, some soft, others matted or cross-marked, and popularly called by miners hieroglyphic mica. The proper electric spotted mica is a ruby or green, fairly hard mica, with spots or dots and certain other markings over part, or the whole, of the plate—sometimes so dense that the whole mica looks black in thick plates. Still, it is quite safe to use these for ordinary electrical insulation. But the cross-marked (a lot of South African mica is of this class) are highly charged iron interlaminated micas which are decidedly unsafe to use, except where very low voltages are concerned. Red and yellow, or yellow-brown stained, or blotched micas, the so-called mud-stained mica, is also iron-charged in the forms of hematite and limonite respectively, and may be placed in the same category as the black cross-marked micas.

Micanite and mica goods are as dependent on the quality of the adhesive used as they are on the quality of mica splittings; in fact, in some cases more so, e.g., a cheap moulding micanite can be made at the expense of the quality by heavy adulteration of the shellac with a cheap resin, which latter is so tiritable that it powders, thereby loosening the films it holds, and allowing them to fall away under moderate strains, whereas a purer shellac adhesive will stand very much greater strains. Therefore, not considering the other advantages—we find that the latter quality—the purer shellac adhesive micanite—even though apparently more expensive, will prove, in practice, to be the cheaper, as it will have a much longer life and be reliable. One might almost say that the frenzied competition, reducing price apparently irrespective of costs, but really by adulteration of the adhesive and lowering of quality, is responsible not only for demoralising the trade, but also for greatly injuring the future of the electrical industry in general.

It is a short-sighted, pernicious policy that should be looked into by the technical heads of the insulating departments of the various manufacturing electrical engineers if the reliability of the British-made electrical machinery is to be properly established and stabilised. It is quite possible to detect the difference in quality between the purer shellac adhesive micanite and the inferior adulterated adhesive micanite by inspection of small sample pieces of both qualities.

Commutator micanite, if properly made and if it really contains the specified limits of adhesive—minimum 2 per cent. and maximum 5 per cent.—is a decidedly white micanite, and if, as is supposed to be usual, a uniformly split thin mica splitting be used in the manufacture, there is no need to go to the extra expense of milling the micanite, as this only sends the price up by about 15 to 25 per cent., according to the process of the maker. Here is a good field for improvement and one worthy the notice of the larger users.

Finally, my readers must bear in mind that there are many varieties of natural mica goods, micanite, &c., which are difficult for the buyer to differentiate. Therefore, it is up to the insulation departments of each and every firm of manufacturing electrical engineers to keep their buyers well informed of their testing results of the various samples sent to them, as a guide to the buyer, in order that the reliability and the looked-for economy in the future construction of electrical machinery may be assumed.

MARKET LIGHTING.

The accompanying illustration shows the general arrangement for supplying the stallholders in the centre of the Market Square, St. Albans, with electric light. Saturday evenings from the mains of the Northampton Electric Power Supply Co.

An armoured service cable is laid to a cast-iron service box, which can be seen fixed to the lamp-post in the centre of the square, containing main fuses, circuit fuses, and connecting plugs, of which there are four. Ground sockets are fixed permanently in suitable positions and allow of wooden poles being easily erected and removed.

The poles carry the overhead cables, which are C.T.A. The service lines to the various stalls are also C.T.A.; they are permanently joined to the main cables and have a lamp-holder attached to the other end. By means of lamp-holder adapters, a number of lights can be given to any one stall.

St. ALBANS: MARKET LIGHTING.

The whole of the poles, cables, service lines, and lamps remain the property of the company, are placed in position each Saturday morning, and are removed at the termination of the market the same evening. Two sizes of lamps have been standardised, 60- and 100-watt gas filled, the schedule of charges being as follows:—

<table>
<thead>
<tr>
<th>Number of Lights</th>
<th>60-watt</th>
<th>100-watt</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 light per night</td>
<td>2s. 9d.</td>
<td>3s. 2d.</td>
</tr>
<tr>
<td>2 lights per night</td>
<td>3s. 6d.</td>
<td>4s. 10d.</td>
</tr>
<tr>
<td>3 lights per night</td>
<td>3s. 6d.</td>
<td>4s. 10d.</td>
</tr>
<tr>
<td>4 lights per night</td>
<td>3s. 6d.</td>
<td>4s. 10d.</td>
</tr>
</tbody>
</table>

Payment is collected each Saturday morning before the lamps are put in position, the stallholders being given the option of one or more lamps according to requirements. No stallholder is under any obligation for payment should he not require a supply. A man is available to deal with any failure which may occur during the hours the stalls are lighted. The scheme has met with every success, practically all stallholders taking a supply.

We are indebted to Mr. G. C. Chamberlain, resident engineer, for these particulars and the photographs here reproduced. The electrical features in the view have been purposely emphasised in the process of reproduction.
ERSKINE HEAP SWITCHGEAR.

MESSRS. ERSKINE HEAP & CO., LTD., of Manchester, who for many years have specialised in a.c. switchgear, have put on the market a line of a.c., oil-immersed control gear incorporating some novel features. It is claimed that this switchgear is characterised by simplicity of design, combined with robustness of manufacture. All safety devices necessary for giving ample protection to the motor have been embodied, and every effort has been made to make the starter " fool-proof " in operation, but the use of all unnecessary " gadgets " has been avoided, thus reducing to a minimum those parts most likely to cause trouble.

The starters are of the vertical drum type, as illustrated in fig. 1, which shows an auto-transformer starter with tank removed, fitted with three overload trips and no-voltage release: they combine the functions of a separate circuit-breaker and venting the current being applied to the starter until the tank is in position, and thus avoiding the possibility of current being broken by the starter when the tank is removed. It is not possible to break circuit at the plug contacts, as, when the tank is lowered, in the first part of its travel, it mechanically operates the tripping gear, causing the starter to return to the " off " position.

The rotor starter is designed on the same general lines as the auto-transformer starter, the resistances being mounted in the bottom of the tank, and the stator and rotor contacts being mounted on the same drum; it thus combines in one self-contained unit the double function of a separate starter switch and rotor starter, with a perfect mechanical interlock between the two.

To ensure that an unskilled operator shall not start up a motor too quickly, these starters are fitted with a slow-motion device, which consists of a " gate " arrangement. A stop piece on the underside of the starter handle engages suc-

Fig. 1.—Auto-Transformer Starter With Tank Removed.

Starters of this design are made up to a capacity of 150 amperes for star-delta or auto-transformer starters, and 150 stator amperes and 300 rotor amperes for rotor starters. Above these capacities a separate oil switch and non-automatic starter are used.

Electric Lighting on Motor-cycles.—If there is one direction in which the average motor-cycle lags sadly behind the car (says Motor Cycling) it is in lighting equipment. No car manufacturer would think of listing even the cheapest type of car without including in the specification a satisfactory electric lighting system, yet the great majority of motor-cycles are still sold without any lamps at all. It is true that one or two factories have standardised electric lights on all models, but the example has not been widely followed. Finally will not be reached until every motor-cycle, like every car, is fitted with an electric lighting set of proved reliability, capable of giving sufficient driving light under all conditions.

Automobile Lighting.—For the fifth year in succession electrical equipment made by Messrs. C. A. Vanderwill & Co., Ltd., is fitted, it is claimed, to the largest number of cars shown at the Olympia Motor-car Show, and in view of the numerous foreign exhibitors this speaks highly for the Acton firm.
The Institution of Electrical Engineers.

Mr. E. M. Hollingsworth, chairman, delivered his inaugural address at the above-named Centre of the Institution, on November 9th, at the Liverpool University. By permission of Prof. E. W. Marchant, D.Sc., M.I.E.E., the laboratories will be open during the evening on meeting dates throughout the year. Mr. Hollingsworth, in his introductory remarks, said that the provision of a complete equipment of instruments, to test the efficiency of the plant in use, the necessity to dispense with house sets, and to take the supply from an auxiliary machine on the main generator shaft, with a stand-by supply through transformers, or converting plant. Whilst the majority of stations in this country have adopted the switchgear of the type relying for security against direct circuits by wide spacing of the live parts in air, and enclosed in steel stores, the provision of a complete equipment of instruments, to test the efficiency of the plant in use, the necessity to dispense with house sets, and to take the supply from an auxiliary machine on the main generator shaft, with a stand-by supply through transformers, or converting plant. Whilst the majority of stations in this country have adopted the switchgear of the type relying for security against direct circuits by wide spacing of the live parts in air, and enclosed in steel stores, the provision of a complete equipment of instruments, to test the efficiency of the plant in use, the necessity to dispense with house sets, and to take the supply from an auxiliary machine on the main generator shaft, with a stand-by supply through transformers, or converting plant. 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The total kilowatt capacity of plant ordered in this country during the last twelve years was:

<table>
<thead>
<tr>
<th>Year</th>
<th>Total kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1912</td>
<td>168,205</td>
</tr>
<tr>
<td>1913</td>
<td>221,200</td>
</tr>
<tr>
<td>1914</td>
<td>337,219</td>
</tr>
<tr>
<td>1915</td>
<td>250,000</td>
</tr>
<tr>
<td>1916</td>
<td>250,000</td>
</tr>
<tr>
<td>1917</td>
<td>379,000</td>
</tr>
<tr>
<td>1918</td>
<td>226,000</td>
</tr>
<tr>
<td>1919</td>
<td>214,000</td>
</tr>
<tr>
<td>1920</td>
<td>344,000</td>
</tr>
<tr>
<td>1921</td>
<td>339,000</td>
</tr>
<tr>
<td>1922</td>
<td>353,000</td>
</tr>
</tbody>
</table>

The largest transformers so far built in this country were the 19,500-kVA, 5-phase, 50-cycle transformers for the Barton station of the Manchester Corporation, and the 6,000-kVA, 4-phase, single-phase, 35-cycle transformers for the Dalmarnock station of the Glasgow Corporation. The latter size corresponded to 15,500 kVA at 20 cycles. Both these were of the oil-immersed, forced-cooled type, with oil circulating through external water coolers. The 19,500-kVA Barton transformers were complete with oil, the total weight being 65 tons. British manufacturers had already delivered to the Colonies for 110,000 volts and outdoor transformer substations were now in operation in England, in many instances at 22,000 and 33,000 volts, and in Canada at 110,000 volts. By this time the maximum thermal efficiency did not reach 18 per cent.

The output of turbo generating plant in the U.S.A. was approximately 2,000,000 kW, in addition to which there was a large amount of hydro-electric plant, not included. From the figures given by the Commissioners there are figures that this percentage was decreasing, a splendid result considering that pioneer work was being undertaken all the time.

The progress made in the U.S.A. was that utility was the keynote of all work. Super-excellence was not looked for or expected. Wherever a station was complete with oil, the total weight being 65 tons. British manufacturers had already delivered to the Colonies for 110,000 volts and outdoor transformer substations were now in operation in England, in many instances at 22,000 and 33,000 volts, and in Canada at 110,000 volts. By this time the maximum thermal efficiency did not reach 18 per cent.
construction, and synchronous condensers for transmission-line regulation having a capacity of 30,000 kVA had been installed. A notable advance in high-pressure transmission work was the putting into commercial service of the 230,000-volt system of the Southern California Edison and the South Pacific Gas and Electric Companies. This is the highest voltage yet adopted for commercial work. Some indication of the size of oil switches required might be gathered from the following figures:

<table>
<thead>
<tr>
<th>Weight of switch with oil</th>
<th>35 tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinders required</td>
<td>2,000 gallons per pole.</td>
</tr>
<tr>
<td>Height to top of terminal</td>
<td>37 ft. 11 in.</td>
</tr>
<tr>
<td>Size of tanks</td>
<td>8 ft. x 5 ft. x 8 in.</td>
</tr>
</tbody>
</table>

The first system was a system of electric relays and signalling devices, which linked up all the stations in the putting into commercial service of the 220,000-volt system adopted for commercial work. Some indication of the size and cost connected with this system may be obtained from the following figures:

<table>
<thead>
<tr>
<th>Control points</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of relays required</td>
<td>10,000</td>
</tr>
<tr>
<td>Number of signalling devices</td>
<td>1,000</td>
</tr>
<tr>
<td>Total cost of system</td>
<td>$500,000</td>
</tr>
</tbody>
</table>

The second system was "visual control," developed for large systems with a number of large sub-stations. For such systems a system of relays and signalling devices, which linked up all the stations to be controlled, and was termed "audible supervision," being mainly adopted for hydro-electric plant and small sub-stations. The supervisor could at any time put himself into telephonic communication with any station by means of a specially developed keyboard and automatic dial, and by means of audible signals he could ascertain the head of water, gate opening, &c., the signals being repeated automatically until

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**THE MISUSE OF THE INTERNAL-COMBUSTION ENGINE.**

A paper dealing with the above subject was recently read by Mr. L. Murphy before the Institution of Automobile Engineers. The author's argument will probably form the focus of much useful discussion and the gist of it is accordingly indicated below.

In many of the more notable successes in the art of applied engineering the employment of a compromise has frequently been of great value in producing a well-balanced and economical result, but it is to be deplored that the tendency to over-specialisation has caused criticism, frequently directed at the whole. The supervisor located in the offices of the company, who had full control of all the plant through two pairs of telephone wires, could at any time put himself into telephonic communication with any station by means of a specially developed keyboard and automatic dial, and by means of audible signals he could ascertain the head of water, gate opening, &c., the signals being repeated automatically until

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**SUGGESTIONS FOR ITS MORE EFFICIENT APPLICATION.**

It is the object of any gear-ratio change mechanism to keep the engine at approximately full torque and power output to be obtained under any specific road conditions. What, then, is the indictment with regard to time-economy: enormously in excess of the savings which have resulted from many years of research on engine design, and the orthodox petrol vehicle of to-day must be condemned as a fuel-wasting monstrosity. What, then, is the indictment with regard to time-economy: enormously in excess of the savings which have resulted from many years of research on engine design, and the orthodox petrol vehicle of to-day must be condemned as a fuel-wasting monstrosity.

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**FIG. 1.** "DIESEL-Power" CAS, DIAGRAM OF CONNECTIONS.**

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Petrol consumption of engine 0.075 gallon per b.h.p. per hr. Efficiency of dynamo... 80 per cent. Energy efficiency of battery... 68 per cent. Efficiency of dynamo... 68

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Then the brake horse-power hours which must be developed by the engine per ton-mile travelled =0.197, and therefore petrol consumption per gross ton-mile =0.0147 gallon, or ton-miles per gallon =65.

We thus arrive at the surprising result that it is possible to burn petrol in a stationary engine, convert its output to electricity, store this energy in a battery, withdraw it from the battery and re-convert it to energy of motion, and finally arrive at an consumption which is approximately less extravagant in fuel than the present methods of direct engine application. While, therefore, engine designers have used their utmost endeavours to improve the efficiency of their creations, the method of application to the chassis continues to cause losses.
For this purpose the author has devised the scheme shown in fig. 1. The shunt-excited motor's speed may be varied by regulating its field excitation by an "accelerator" pedal; in addition, an automatic means of converting the speed at which the "accelerator" pedal or control lever corresponds to a fairly definite speed. Furthermore, a depression of the pedal brings the engine into action immediately the speed is high enough, while the release of the pedal produces a braking action by regeneration until the lower desired speed is established. In the majority of driving, therefore, the use of a separate brake becomes superfluous, and the greater part of the energy usually wasted in braking is automatically recovered.

Having now established an electrical scheme which will maintain the speed of the vehicle approximately constant under widely varying conditions of torque, it is possible to select an engine size from which the average output on a fixed nearly full open throttle is sufficient to meet the average demand for propulsive speed. This engine, in the example chosen, will be about 2,000 c.c. capacity, or, say, 2,300, to allow a margin for the contingencies which arise in practice. Durrant has suggested that steam should be utilized for generating the low pressure petrol engine cylinders to be compressed and used at the same time super-heated. But the super-heating of the whole system has been found, after a number of experiments, to be quite unnecessary. The exhaust from the engine carried then utilized in an expansion engine geared to the petrol engine. The exhaust from this engine would then be used for generating the low pressure petrol engine cylinders to be compressed and used at the same time super-heated. A typical torque-speed curve for such an engine is fig. 2, and curve c shows the maximum performance obtainable by compounding the engine and motor curves. As in the case of curve a, the driver can, at will, drive at any speed on the ordinates corresponding with the gradient. In the case of the electric vehicle to an amount which makes it a practical dual-power scheme consisting of a battery-driven vehicle. The result is curve A, fig. 2, which has the same general characteristics as a series motor from the point corresponding to level running up to the most severe gradients, but for this to be of service it must be possible to drive at a higher normal speed when the engine is not in use.

To comply with the maximum discharge-rate of 27 kW per ton of battery, a battery weighing two-thirds of a ton should be sufficient in this application for providing a maximum of 8 tons, while the engine is sufficiently large to contribute as much as may be desired to the charging energy required by the battery. The radius of action of the vehicle may therefore, if desired, be extended to a point which is only limited by the amount of petrol carried, plus the additional energy stored in the battery at the start. It does not appear that the operation that it would be most economical to derive all the propulsive energy from the petrol carried. In cases where cheap electrical energy is available, the battery could be charged in just the same way as with a purely battery-driven vehicle.

It is probably safe to assume that in average practice at least 60 per cent. of the energy at the road wheels may be obtained direct from the petrol engine, and therefore at the rate of 130 tons-miles per gallon. The remaining 40 per cent. will either be obtained as additional energy stored in the vehicle, as energy from the battery-charging mains at a rate equivalent to about 150 tons-miles per gallon, so that under extremely unfavourable conditions the mechanism should operate for a consumption not in excess of 90 tons-miles per gallon, while under the ordinary conditions of use it may be sufficient in this application dealing with a gross load of 8 tons, while the engine is sufficiently large to contribute as much as may be desired to the charging energy required by the battery. The radius of action of the vehicle may therefore, if desired, be extended to a point which is only limited by the power of the engine carried, plus the additional energy stored in the battery at the start. It does not appear that operation that it would be most economical to derive all the propulsive energy from the petrol carried. In cases where cheap electrical energy is available, the battery could be charged in just the same way as with a purely battery-driven vehicle.

The only factor which varies greatly with the load carried is the proportion of time during which the engine must run, and the driver can readily determine when it is absolutely necessary to run the engine from the indications of an ammeter-hour meter. Since the engine is worked at practically constant torque and only through a limited range of speeds, a much more favourable set of conditions is established for the employment of heavy fuels, so that apart from the intrinsic economy of the method, it opens up the way to substantial economies in both the operation of the engine, but for this to be of service it must be possible to drive at a higher normal speed when the engine is not in use.

Psycho-galvanic Phenomena. — Some account of the change in bodily resistance known as the psycho-galvanic phenomenon was given by Dr. E. H. Thouless, senior lecturer in psychology at Manchester University, at a meeting of the Manchester Literary and Philosophical Society on November 13th. He uttered a warning against dealing with a gross load of 0.5 tons per ton of petrol (i.e., 125 tons-per-miles per hour meter. Since the engine is worked at practically constant torque and only through a limited range of speeds, a much more favourable set of conditions is established for the employment of heavy fuels, so that apart from the intrinsic economy of the method, it opens up the way to substantial economies in both the operation of the engine, but for this to be of service it must be possible to drive at a higher normal speed when the engine is not in use.

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The All-British Wireless Exhibition and Convention organised by Mears, Bertram Day & Co., Ltd., was opened by the Postmaster-General, Sir Laming Worthington-Evans, at the White City, Shepherd's Bush, on the 8th inst., and will remain open to the public until November 24th. There are some 600 exhibitors, the show being the second annual one of its kind, but the first to be held in conjunction with the National Association of Radio Manufacturers. It is an unparalleled opportunity for the British Broadcasting Co., Ltd., and the industry as a whole co-operatively to demonstrate to the public the complete and developing facilities of broadcast radio reception, and how worth while such an admittedly inexpensive form of recreation is.

The size and scope of the exhibition show plainly how the public has been attracted by "wireless," and the manner in which manufacturers have seized the opportunity for doing business is revealed by the fact that although the industry is not much more than a year old, it is estimated that some 600 British firms are catering for the needs of its devotees. Quite apart from the business that will be stimulated by the show, its advertising value will be by no means insignificant now that the tide, so recently at a low ebb, is flowing again.

The exhibition, at which every British firm of repute is represented, is even more interesting to the "wireless" show; to the novices the difficulty will be fully to appreciate the progress that has been made during the year, for notwithstanding that new ideas are not conspicuous, the exhibits clearly indicate the improvement that has been made in both performance and workmanship.

With regard to complete receivers, there is a wide choice from simple crystal sets of small dimensions to multivalve and "loud-speaking" sets made to represent any style of furniture in handsomely elaborate cabinets. New thorazine valves, mostly of the low-temperature or "dull-emitter" pattern, are in evidence, and a feature of the exhibits is the "unit" construction adopted by a number of firms—the sets being always complete, but easily capable of extension at any time; complete sets of parts for assembly by the purchaser are also to be seen on several stands.

An innovation this year is a demonstration hall, fig. 1, wherein a stage has been arranged as an exact reproduction of the studio at the British Broadcasting Co.'s London station. There concerts similar to those of 2LO will be given as they are at Savoy Hill, so as to give the public some idea of how broadcasting is done.

In the words of the Postmaster-General, "Wireless has a short past, a flourishing present, and an immense future," and we hope with him that "this exhibition will serve to demonstrate some of its possibilities and to encourage a new and promising British industry."

The Exhibits.

On the stand of the Radio Society of Great Britain are displayed panels on which are indicated the postage-stamp size of all radio societies in the Metropolis and throughout the country. In addition, there is an exhibit of radio apparatus of general interest to experimenters as well, as selected entries for the competition open to members of all the society for the best examples of amateur work, for which prizes are offered.

Messrs. Hazeltine Neuotrodyne Radio Sets, Ltd., are showing, in addition to frame aerials and "loud-speakers," a range of instruments in the construction of which use is made of the "Hazeltine Neuotrodyne" circuit, the design of which follows the invention of the American investigator Prof. Louis A. Hazeltine. This company has the sole rights in the manufacture in this country of apparatus utilising this circuit. The instrument is enclosed in a polished wooden case with a sliding glass front, fig. 3, all the exterior connections being so arranged that those of the battery, being broken a fraction of a second earlier than those of the l.p. one to avoid undue stresses being set up in the transformers. The circuit arrangement has received favorable comment owing to the stable non-distorting, non-noising, and overall efficient qualities claimed for it. Fig. 4 is a rear view of the set.

The set illustrated above is the result of research carried out by Prof. Louis A. Hazeltine and his associates. The circuit embodies four valves, of which there are two h.f., one detector, and one l.f., the first h.f. being also as a l.f. amplifier so that the scope of the outfit is practically equivalent to that of one employing five valves. Practical achievements resulting from the use of the "Neutrodyne" method are, briefly, the elimination of interference and avoidance of distortion, together with selective and manœuvreable stable tuning, so that a set once adjusted to a particular station can be simply switched in or out as required, without any further manipulation.

The Metropolitan-Vickers Electrical Co., Ltd. One of the chief features of this exhibit is the "Cosmos Radiobrix," set of which is illustrated in fig. 4. They are a range of units of uniform size and shape by means of various combinations of which the experimenter or amateur can build any type of receiving set, or circuit, and can employ an desired number of stages of high- or low-frequency amplification. They have been designed with the object of putting them together to make up a standard form of set, but with a view to securing the utmost flexibility, so that they may be connected up in every conceivable way, and an excellently useful book of diagrams is supplied illustrating representative circuits. "Radiobrix" are mounted in mahogany boxes, carrying minute panels; the smallest has a uniform size of 5 in. x 5 in., but in the few cases where larger panels are necessary the dimensions are multiple of 5 in. Thus apparatus may be speedily modified.

The new 6-valve, type VS.4, is a supersensitive set with a self-contained frame aerial, and connects up an outside aerial and earth-lead for loudspeaker.
The high-frequency vario-transformers are coupled together, so that simultaneous tuning of all three inter-valve circuits is affected by the movement of a single knob. Non-radiating adjustable reaction coupling is also employed, and fine tuning is obtained over the whole range of wave lengths with single adjustment. The crystal detector is screwed up tight, and there is no need to search for a sensitive spot. It is adjusted by means of a potentiometer, and once this is set it will remain for weeks without needing further adjustment.

FIG. 4.—"Cosmos Radiobrix."

A pair of head-telephones is connected to a plug, which may be inserted in one or other of two "jacks," according to the strength of signals. When in the first jack the telephones are connected to the first low-frequency valve; on plugging into the second jack they are connected to the second l.f. amplifying valve. In each case the loud-speaker is cut out and the current is cut off from the valves not in use. When head-telephones are not plugged in, the loud speaker is automatically in an outer case or cabinet enclosing a loud-speaker and horn. The sets are arranged for dual-amplification and non-radiating reaction coupling of a type which complies with the Post Office requirements.

Climax Patents, Ltd.—The "Climax monovalve" set employs a single valve in conjunction with a crystal circuit.
to receive any of the other British stations as well as Paris. The makers specifically guarantee each and every "Climax" set to pass this test. The standard set and No. 1 frame aerial is fitted with "Wander" plugs, are on view, as well as "units" for building up high-pressure batteries of cells for radiotelegraphy. On this stand are demonstrated the effects of "Hercules" l.p. batteries when used with "dull-emitter" valves.

The Hart Accumulator Co., Ltd., shows l.p. and l.h. batteries in addition to general types of accumulators and portable hand lamps. A set of 17 cells (62 volts), as supplied for radio transmission on board ship, is also shown.

The Solidite Manufacturing Co., Ltd., is exhibiting a wide range of moulded parts, including knobs of all descriptions, variometers, valve holders, slides, coil plugs, fixed condenser cases and variable condenser ends, telephone ear and telegraph pieces, &c., which indicate the great variety and shapes that can be obtained by the use of "Solidite." The Formo Co. (Arthur Preen & Co., Ltd.), has on view a large collection of component parts and accessories, amongst which are transformers, filament rheostats, and crystal detectors, some of which are of the plug-in pattern for use with valve sets. Such things as condensers, lead-in tubes, variometers, terminals, screws, and small brass parts are also shown.

RURAL DISTRIBUTION OF ELECTRICITY WITH RETURN BY EARTH.

In the Revue Générale de l'Electricité, of August 26th, M. Georges Viel, director of the Compagnie Électrique de la Loire et du Centre, deals with the question of supplying electricity in rural areas for agricultural purposes by means of cheap transmission lines. He states that the chief obstacle to the extended use of electricity in farming, &c., is the high cost of the mains, owing to the small power required, as well as the scattered nature of the load. To cope with this difficulty, he has investigated the distribution of energy by means of single-phase lines at high pressure with return by earth; it would necessitate the repeal—at least in the case of rural areas—of a Government regulation forbidding the use of one phase as part of a distributing circuit. In view of the low value of the current, he considers that there would be no risk of disturbing the operation of telegraph and telephone lines.

This regulation, says M. Viel, continues in existence simply because, hitherto, no one has asked for its repeal. Numerous articles have been published showing that the problem can generally be solved in a manner satisfactory to all parties concerned. Two reports by MM. Barbillon and Rusinksy, on experiments carried out between Lapug and Grenoble, in 1906-7, are cited, from which it is deduced that the disturbing effects of an alternating current of 30 amperes, 11,000 volts, on a twin telephone circuit carefully shielded, are "practically negligible." The line tested at Lapug was 2.3 km. in length, and was at a mean distance of 3.8 m. from the power line.

The author gives details of the comparative cost of a single-phase, iron-wire line, with earth return, and a three-phase line of the normal type, at 10,000 V in each case, the latter being designed to transmit 10 kw to a distance of 10 km. with a loss of 4 per cent.; the single-phase line costs 4,690 fr. whilst the three-phase line costs 10,800 fr., but does not supply the former—whilst the transforming apparatus is also less expensive for single-phase (8,500 fr. compared with 10,100 fr.) type (hypothetical) case of supply to three villages is given by the author, who also briefly deals with the adverse effect of the proposed system on the power factor, and discusses its importance owing to the advantages of the single-phase earth-return system. The advantage of the single-phase earth-return system diminishes as the magnitude of the load and the distance of
transmission increase, but even when these are such that the three-phase system becomes preferable, he would use only one insulated wire, the earth being used for the return circuit. Insulators and poles. Further economies are due to the regulation fixing a minimum size for the furnishing of poles (diam. 0.25 m.) and allowing of the earth being used as a conductor. The earth, however, should be well insulated from the ground in order to reduce the possibility of shock. The fall of pressure in an iron-core line carrying 5 A is about 10 times that in a copper wire of the same cross-section; thus economies are to be expected in the soil. Experiments have been made with earth-return systems, and various depths in field, leading to the following conclusions. The fall of pressure should not exceed about 20 V per kilometre. A galvanised iron plate buried in coke or charcoal, to which a conducting wire such as copper sulphate has been added, is suitable, and should be at a depth of 3 to 4 m., according to the locality. The conductor should be soldered to the plate, and the earth well insulated. The precautions necessary to take when the earth is used for the return circuit are in principle the same as those for the three-phase system, viz., that the plate should be covered with material of low conductance and enclosed on a circumference of 5 or 4 metres. Additional spools, pipes, &c., to increase the metallic surface may be added as cells for the battery. The distribution of the plate should be uniform, and the current in it kept as low as possible. It is therefore advisable to utilise the chief poles and lines as on wire, unless the nature of the supply, the rural distribution, the cost of maintenance, &c., vary. Great care is necessary in the selection of plants; a suitable depth of ground for the earth-return conductor is 2 to 3 m.; the rural areas, where more expensive maintenance is not possible, should be provided with a better system; the cost of insulated conductors is very high. The author concludes that for the small currents with which his article is concerned, the disturbances produced will be less even than those experienced from other causes. 

The October issue of Swiss Industry and Trade gives the following report of the progress made in the electrification of the Swiss Federal railways, communicated by the Secretary of the Swiss Society of Engine-builders:

Since May, 1923, the electrification of the Gotthard route—between Goldau and Lucerne—255 km., has been worked electrically, so that the great line of communication from north to south across the Alps is electrified in phase in its history. As soon as the manifold advantages of electric traction had been demonstrated, it was decided to speed up the electrification of the Federal railways, and by 1928 electric trains will be run on a total length of 1,250 km. The total capital costs involved in electrifying the Federal railway system will amount to 750,000,000 fr., 500,000,000 of which will be devoted to the construction of electric power-houses, substations, high-tension lines, &c. The remaining 200,000,000 will be used for the purchase of rolling-stock; 60 locomotives will be required for the working of the different lines provided for in the aforesaid programme; 171 locomotives have already been or are now being completed. The electrification of the Federal railways, which was begun under exclusive by Swiss industry. The mechanical parts of all the engines have been supplied by the Swiss locomotive building works at Winterthur; the electric equipment has been taken exclusively by Swiss industry. The mechanical parts of all the engines have been supplied by the Swiss locomotive building works at Winterthur; the electric equipment has been taken exclusively by Swiss industry. The mechanical parts of all the engines have been supplied by the Swiss locomotive building works at Winterthur; the electric equipment has been taken exclusively by Swiss industry.

A REVIEW OF SWISS INDUSTRY. 

A survey of interesting information regarding the Swiss electrical industry and allied trades is contained in a report which has recently been issued by the Committee of the Swiss Commercial and Industrial Association. It results that 1923 may be regarded as the most depressing year through which Swiss engineers ever passed. The set-back came from the greatest slackness in the home market, lead to the dismissal of workpeople and the actual stopping of works of certain kinds.

The number of the exchanges in Central Europe added greatly to the difficulty of doing export business, that in 1923 it was necessary to contract the Swiss firm, it is stated, had often to sell below cost. At the same time foreign competition was having a disastrous effect in the home market. There is no reason why this marvellous conductor, the earth, should not be utilised." The question is urgent for the sake of the distribution of the small powers required in rural districts, and the economy that would be realised by the use of the earth under certain conditions as to power, pressure, current, and the country's chances of obtaining foreign orders for machinery are consequently poor. More intensive labour, coupled with improvement in wages, is considered the only means towards strengthening the position of the industry. The report records that progress has continued in the work of the Bureau of Standards of the Swiss Engine-builders' Association, in collaboration with similar organisations in other Swiss industries and abroad, it proposes to deal in detail with the different branches of the industry. Locomotive builders have benefited by the work on electrifying the State railways, but the total volume of orders executed by the electrical machinery manufacturers has been very much below normal. The sole hope of the industry lies in the railway work at home. All forces have been concentrated to the question of reducing costs of production. In one branch of the industry it is calculated that the adoption of a 54-hour week permit of 15 to 20 per cent. increase in output. In another section it is reckoned that a similar extension of the hours of labour would bring about a 20 per cent. reduction in general costs. A decrease in railway and postal rates is also considered essential.

There was a slight recovery in the sales of incandescent lamps and it is noteworthy that nearly all the supply companies have made a practice of placing their contracts with Swiss makers. The October issue of Swiss Industry and Trade gives the following report of the progress made in the electrification of the Swiss Federal railways, communicated by the Secretary of the Swiss Society of Engine-builders:

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of South Africa, November 3rd, 1922.)

26,871. "Crystal detectors." F. Hotwack. October 31st. (France, April 27th.)


PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1922.


