I.E.E. PRESIDENTIAL ADDRESS

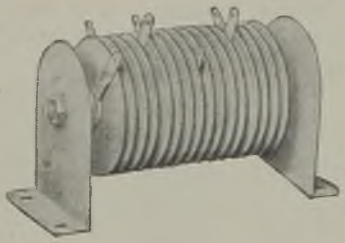
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXV. No. 3490 OCTOBER 13, 1944 9d. WEEKLY

Serving with the SIGNALLERS

URGENT . . . that's the tag on nine out of ten messages: accuracy, too, is imperative. Signalling under war-time conditions is a secret service. STC Selenium Rectifiers are silent in operation; moreover, they keep fit for long periods without main enance and are free from moving parts. Where direct current is required from an A.C. source they ensure sustained and satisfactory service. For Service use they are given a protective finish which withstands the most severe atmospheric conditions.

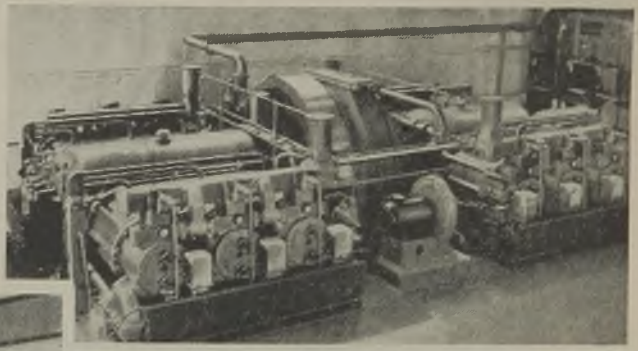


Selenium Rectifiers

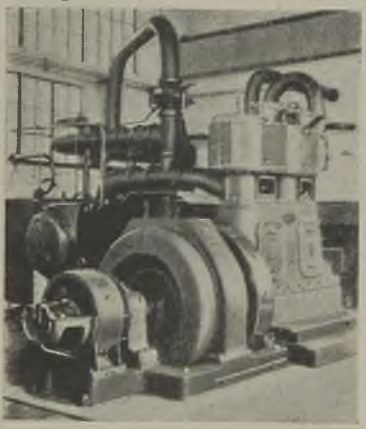
Rectifier Sales Department:
STANDARD TELEPHONES AND CABLES LIMITED, NEW SOUTHGATE, N.11

"Engine Type Generators"

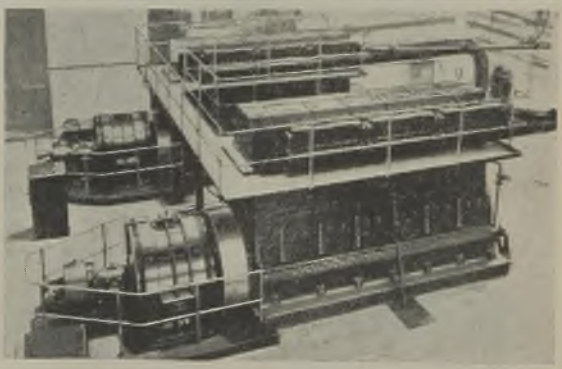
The illustrations on this page show a few installations of Metrovick Engine Type Generators.



1,000 kW Metrovick Engine Type Alternator with closed circuit ventilation. Installed in the West Indies and driven by a Crossley Premier Vis-a-Vis 212 r.p.m. Gas Engine.



375 B.Hp. 375 r.p.m. Browett Lindley Steam Engine driving a Metrovick 250 kW 4,000 Volt Alternator at a Chinese Coal Mine.



450 kW Metrovick Alternators driven by Belliss & Morcom Diesel Engines in a British Power Station.

For all types of Engine Driven Generators send your enquiries to:

METROPOLITAN Vickers ELECTRICAL CO. LTD.
TRAFFORD PARK · MANCHESTER 17

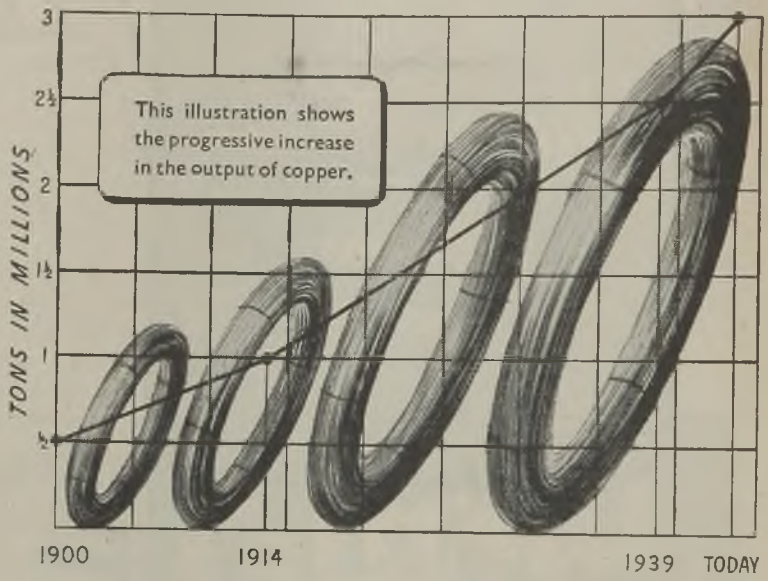
AEI

1 of 2 Metrovick 120 kW 500 r.p.m. Alternators driven by a Belliss & Morcom Steam Engine at a Laundry.

C/A 101

Light aids production IMPROVE YOUR LIGHTING *in consultation with* METROVICK'S ILLUMINATING ENGINEERS

PLAN TO USE COPPER



Post-war development of electrical services of every description will doubtless call for a greater use of copper than ever before. Although it may take a little time after the war to re-stock the world with all the many types of copper products required, the supply of copper will certainly be adequate, and electrical engineers may safely plan to make use of it to the fullest extent.

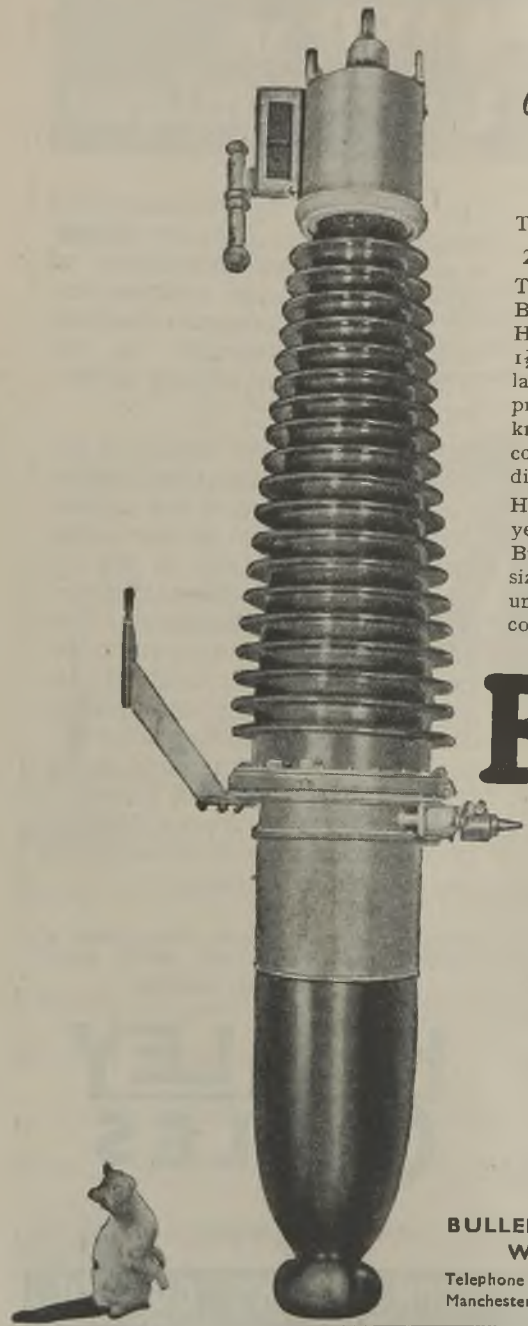
If technical advice or assistance is required the services of the Copper Development Association are available, free of charge.

COPPER DEVELOPMENT ASSOCIATION

A non-trading organization maintained by the British copper industry, to supply information and advice, free to all users of copper

Grand Buildings, Trafalgar Sq., London, W.C.2 and 9 Bilton Rd., Rugby Telephone : Rugby 2369

C20



IN 1924 Bullers made the first big bushing of 66 kV capacity. To-day we are able to show this massive

242 kV OIL FILLED BUSHING.

The porcelain parts were made in Bullers' works for the British Thomson-Houston Co. Ltd. It measures 15 ft. 1½ inches overall and is one of the largest bushings of this kind yet produced. Only the skill and knowledge acquired by long experience could produce insulators of such dimensions free from flaws.

How much larger will be called for in years to come, only the future can say. But one thing is certain, whatever the size, Bullers will be ready with their unrivalled resources and experience to cope with the problem.

Bullers

INSULATORS

AND IRONWORK

BULLERS, LTD. THE HALL, OATLANDS DRIVE,
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Manchester Office : 196 Deansgate, Manchester

The comprehensive range of "**Efesca**" lighting Accessories and Fittings and "**Hitest**" Cables and Conduits are produced in our own several Works. At present, priority orders must receive first consideration but, within the limits imposed, we give, as always, the utmost service.

*

FALKS

An advertisement of Falk, Stadelmann & Co. Ltd., 89-93 Farringdon Road, London, E.C.1 ℗ 89-19B

Trusted by those carrying great responsibility

The engineers responsible for equipping 500 of Britain's Power Stations pinned their faith to Tudor Accumulators. This confidence was justified by the Tudor record of unsurpassed efficiency and reliability. Many of the largest battery installations in the country are Tudor, and some of these have been functioning without pause or hitch for over 30 years. You should specify Tudor for important jobs.

SAFETYLYTE (Patent No. 313248), *the Tudor Emergency Lighting System, is automatic and instantaneous in operation. It is installed in thousands of schools, hospitals, factories and other large buildings.*

TUDOR ACCUMULATORS

The Tudor Accumulator Co., Ltd.,
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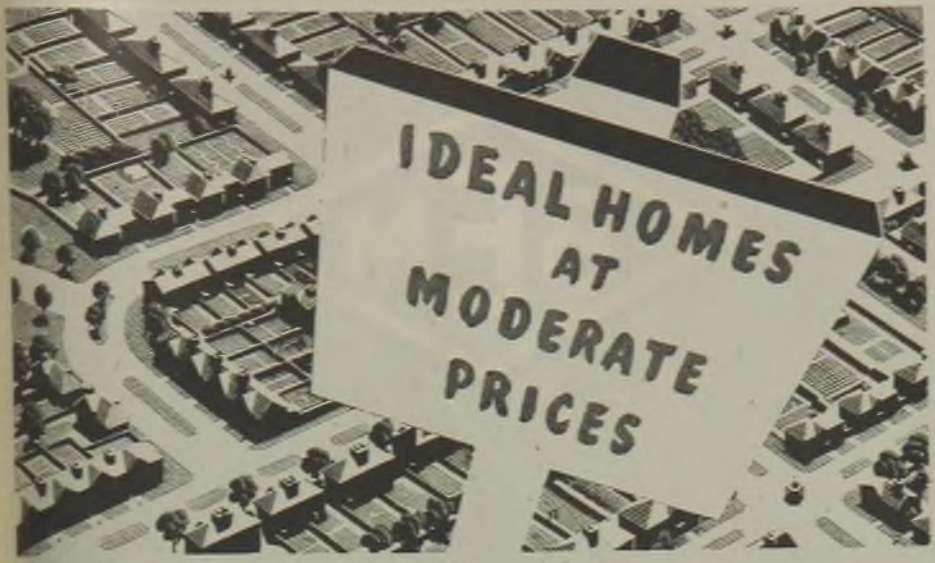


How many homes for how much?

The post-war demand will be for good houses in large numbers at reasonably low prices. How is the building industry to meet it? One thing is clear. As many components as possible will have to be factory-made on the most efficient and highly mechanised lines.

One kind of equipment for every building—electrical switch and fuse gear—has been manufactured by M.E.M. in this way for many years. They have shown how cost can be progressively reduced and quality improved by steadily perfecting large-scale production on the basis of experience. The war has added to this experience and the benefits will be at the service of Installation Engineers when peace comes.

'Meminx' Switch Splitter

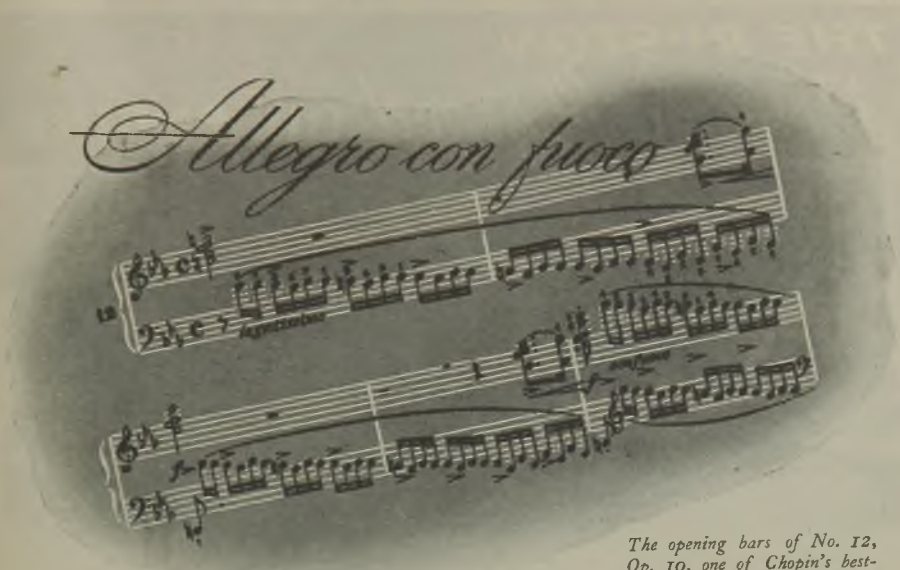
MEM

SWITCHGEAR · MOTOR STARTERS

FUSEGEAR · ELECTRIC FIRES

MIDLAND ELECTRIC MANUFACTURING CO. LTD., TYSELEY, BIRMINGHAM, 11

London Showrooms and Stores: 21-22 Rathbone Place, London, W.1 • Manchester Showrooms and Stores: 48-50 Chapel Street, Salford, 3



The opening bars of No. 12, Op. 10, one of Chopin's best-known studies for the piano.

IN the brave new post-war world the tempo of production may not be quite as 'con fuoco' as it is to-day, but neither will it be 'commodo' nor merely 'andante'. Switchgear that has been working at pressure will most probably be the better for a once over by an Ellison expert so that when the Woolton wand strikes up the reconstruction symphony its part in the ensemble will be played correctly in accordance with the tempo indicated.

ELECTRICAL REVIEW

October 13, 1944

Contents :—

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXV. No. 3490. OCTOBER 13, 1944 9d. WEEKLY

Scientific Approach

Engineering and Sociological Applications

ALMOST anyone can be taught to carry out a specific engineering task, but that does not make him a craftsman, still less a professional engineer. To earn a title to either, he must be able to adapt his training to new situations and this calls for a real understanding of the principles upon which his daily work is based. During his apprenticeship or sojourn at college he acquires something even more important than either manual skill or academic knowledge. He gains an engineering background, or what may be termed an empiric philosophy that will later inspire his professional activities.

Electrical engineers are especially happy in the knowledge that they make an indispensable contribution to human progress. Their training has given them opportunities of realising that any conclusions to be sound must be founded on tested facts and have regard to inevitable limitations. It has shown them the value of tolerance of the opinion of others. Finally, while serving their time, they have had the priceless advantage of mixing with all sorts and conditions of men.

Misused Benefits

They have often received blame because their beneficently intended efforts have been misused by those who direct social policy. They have sometimes retaliated by claiming that they should be allowed to control that policy—a short cut that seems undesirable. Although the sociological implications of their achievements should certainly be a matter of concern to them, the better way surely is that advocated in the inaugural address of Sir Harry Railing as President of the Institution of Electrical Engineers. In pointing out that "life's potentials . . . are neither good nor bad in themselves," he urges the need for a scientific approach not only to technical matters but also to all problems of life, in furtherance of which aim electrical engineers should be imbued with missionary zeal. Their part includes the promotion in all spheres of human activity of the same team spirit as it is their duty to establish in their own more limited field—despite the temptation to become absorbed in intellectually satisfying technical problems.

Self-Assertion and Co-operation

This year's presidential address comes at a time when many young men with the best brains are being attracted by the vast potentialities of an electrical career. It presents them with a classic statement of the broad philosophic principles that should inform their life's work. In addition it reconciles the two major groups of impulses—the self-assertive and the co-operative. Both ought to be developed provided. Sir Harry emphasises, the first enriches and does not obstruct the second.

By logical deduction from established premises in the manner he has himself recommended, Sir Harry arrives at certain conclusions on post-war industrial problems. Of especial interest are those concerning relationships within industry and between industry and the State and the vital need to export goods. These conclusions are summarised in our report

given on page 517. We dwell here upon the less tangible aspects of his address, since they may perhaps be overshadowed by the very immediacy of the more material features, based as these are on great technical and administrative experience. Their significance, however, is measurable in terms of time, whereas, even though the validity of natural laws be questioned, the necessity for a scientific approach to all problems will remain.

Section Meetings

IN pursuance of its policy of avoiding over-centralisation, the Council of the Institution of Electrical Engineers has let it be known on a number of occasions that it considers papers presented at Section meetings to be on par with those presented at ordinary meetings. This viewpoint is reflected in the change now made in the arrangements for awarding premiums. Papers of exceptional merit, whether read before an ordinary or a sectional meeting, become eligible for three major premiums as well as for the three premiums now assigned to each of the Sections.

Explosive Hazards

IT is now thirteen years since the Mines Department established its station at Harpur Hill, Buxton, for the testing, with a view to certification, of electrical apparatus for use in explosive atmospheres. Before that time (dating from 1922) the credit for testing such apparatus for manufacturers belongs to Sheffield University. It is natural that the work of the station should later have been extended to include not only risks due to methane but also those due to inflammable liquids and gases and to carbonaceous and certain metallic dusts found in factories or in ships. Recent research on flame-proof enclosures and intrinsic safety of circuits, of which brief particulars are given in this issue, are of increasing importance in an ever-widening sphere.

Graded Electricians

LAST week we referred to a New Zealand proposal that electricians should be graded under two heads—those competent to carry out any class of installation work and those capable only of the simplest domestic wiring, to be described as " electricians " and " wiremen " respectively. At a recent E.C.A. conference a similar idea was put forward for discussion and the distinction was generally favoured. What the views of the E.T.U. are on this matter are not known. Under the present system there are electricians and mates, the latter receiving a lower rate of pay, so that to some extent there are already two grades. In the absence of a compulsory registration system (which the Union supports) it would be difficult to introduce any further distinction between the skilled and the less-skilled.

Compulsory Registration

THE agenda of the conference mentioned above included two items for consideration " in the absence of compulsory registration of electrical contractors and operatives," a phrase which suggests some doubt regarding the possibility of achieving this. The first proposed " a permanent advertising campaign to secure public recognition of E.C.A. membership as opposed to non-members." This is an excellent idea for it has been very largely the lack of publicity which has rendered the National Register so ineffective. Going further, the second proposal, " visualising the non-existence of the N.R.E.I.C.," was the employment by the E.C.A. of inspectors to ensure compliance by members of proper work and adherence to Association obligations. This is also a laudable object, although it seems to herald the end of the Register. But we hope to be in a position to say more about these matters in the early future.

Body Resistance

WHILE it has long been recognised that current rather than voltage essentially determines the severity of electric shock, it is probably not so widely appreciated that under some conditions consequences may be more serious at low than at high voltages. Data presented in this issue show the influence on shock severity of various factors, including especially skin resistance (which is the chief obstacle to the passage of dangerous currents through the body and may vary between 500,000 ohms when the skin is dry and only 1,000 ohms when it is wet), in relation to the heart and lungs. From the particulars given it will be clear why immediate and prolonged efforts at artificial respiration are effective in a high proportion of cases in which life has seemed to be extinct.

Preparing for the Future

IN our leading article of September 29th we drew attention to the need for the Government to permit British manufacturers to employ at least a small quantity of labour and materials upon the development of post-war designs or preparation for peacetime production. It is gratifying to see signs of a sympathetic attitude on the part of the Government towards manufacturers' desires. In the House of Commons last week Capt. Waterhouse, Parliamentary Secretary to the Board of Trade, said that " facilities to make various preparations for peacetime production are now being granted, provided that the work can be done without impeding war production." He said that since July 18th applications had been received from 160 manufacturers in a dozen different industries; rather more than half of these had already been granted and very few had been rejected.

Home and Export

THIS does not entirely clear up the position. From inquiries which we have made it seems that stress is being laid particularly on export. The Government appears to be willing to help manufacturers to get into the production of peacetime goods at the earliest possible moment but is hesitant to give too widespread permission. This is understandable for the war is not over yet. Nevertheless, if manufacturers can show that the amount of labour and material needed is negligible in comparison with the total volume of their present work they should receive favourable consideration.

Gas-Electric Houses

WRITING to the *Financial News* with regard to the Ministry of Works' demonstration houses at Northolt, a correspondent asks why it is necessary in houses mainly for urban use, where both gas and electricity will normally be available, to concentrate on one or the other. He feels that for certain purposes one medium or the other is inevitably superior, and that the two industries should have got together and demonstrated how in combination they could contribute their maximum to convenient cheap living in a small house. The fact remains, of course, that future technical improvements in the design of electrical apparatus, such as infinitely variable hotplate control, will sweep aside those few apparent advantages which gas now possesses. Since electricity must be installed in any case, the complete elimination of gas possible in an all-electric house would be of considerable importance in the class of house planned, in which cost is a primary consideration.

Unnecessary Flues

THE reduction in building costs also enters into another point raised. One of the great advantages of electricity compared with gas for heating and cooking purposes is that flues are superfluous, yet the correspondent implies that it is an advantage to have gas just in order to have the flues available for ventilation purposes. Surely it is possible to design houses with adequate ventilation without going to this expense.

A Modern Canute

THE necessity for fuel economy is imperative—but so is the maintenance of health. It was, therefore, pleasing that the Order forbidding heating in public buildings and offices was amended to bring the South of England into line with Scotland and the North. The reason for the decision is said to be the " present abnormal conditions," but in this country the abnormal in the way of weather is to be expected. Wintry conditions cannot be staved off by regulations and it would have been less troublesome and quite as effective if the Minister of Fuel and Power had left the matter to the patriotism and good sense of the people concerned. He has been ill-advised.

The Squeers Method

AT Dotheboys Hall it was the custom of the principal, Mr. Wackford Squeers, to combine learning with practice. It will be remembered, for instance, that having learned that " bottiney " meant a knowledge of plants a boy was sent to weed the garden. The system does not appear to have produced uniformly satisfactory results, but this did not deter a member of the Stirlingshire Education Committee (who may or may not have read *Nicholas Nickleby*) from suggesting that the Falkirk Trades School should be wired by the pupils to save expense. It is presumed that the building itself was put up in the usual way: a great deal more *might* have been saved if the job had been left to the building pupils.

British Oil

Electrical Features of the First Field

AN outcome of the pre-war prospecting work about which the public received almost regular reports is the development in this country, mainly in wartime, of an oilfield which is now yielding crude oil at the rate of 100,000 tons (26 million gallons) a year. True, this quantity may be considered very small as compared with the output of some of the world's largest fields, but the English field is comparable in size with some which are being worked sucessfully, the oil is of the highest quality, and the undertaking has reached a suitable stage for ordinary commercial development.

The drill pipe rises vertically through the bore hole and fits into slips in a rotary table at the base of the derrick

The oilfield was proved just before the outbreak of war, and by 1941, when in consequence of the U-boat warfare the need for increasing the yield by every possible ton was urgent, the output was about 25,000 tons per annum. The marked increase since that time has been largely brought about by the improvement and speeding-up of drilling. As a result wells have been in production in as short a time as seven days from the commencement of drilling. An outstanding feature of the whole field, which now has 238 producing wells, is the electrical contribution to this speedy drilling. Much important work goes on, however, before the drilling stage is started, so it will be as well if we start at the beginning.

It seems to be generally accepted in the geological world that the crude oil is of animal origin. The oil is absorbed by limestone from which it is forced to spaces under the peaks in the rock beds; thus a bore at a peak where there is such an accumulation of oil will result in an oil yield. In the first place, however, there is a search for the rock which, in this case, is found at about 2,000 ft. below the ground level. The seismic method of rock identification is used, by which earth tremors are created by electrically firing about 200 lb. of high explosive in a shot-hole about 100 ft. deep, and the tremors are measured on sound detectors spaced at about 1,500 ft. and placed on an arc about six miles from the shot point. In an observation van near the detectors the detector signals are fed to special amplifiers which exclude all but the low frequencies, and the amplified signals are dealt with on a

multi-string galvanometer recording apparatus on which time lines are photographed and cross lines from the detectors are recorded.

Interpretations of the recordings, based on a knowledge of the speeds of sound in different materials (for instance, limestone 20,000 ft. per sound and sand 10,000 ft. per second) enable the geologist to produce a structural map of the rock. With a knowledge of the rock peaks the way is paved for the commencement of the boring operations which involve a good deal of rock sampling and speculation before the actual well drilling is commenced. Once the field is proved, however, the course is straightforward and the site wells are bored and equipped progressively as a normal development.

All the well motors (above) are of the beam type, rather like Cornish pumps. Left: Mud is pumped down the drill pipe by a 150-HP motor driven pump; drilling motor at rear right

At each site a steel lattice derrick is first installed and equipped for the necessary drilling operations. The height of the derrick is decided on by the geological considerations which govern the weight of the metal to be lowered into the ground in suitable lengths, section by section, for driving the drill. The drill proper contains a series of revolving cutting wheels which bear on the rock, and is fitted to the end of the pipe which rises vertically through the bore hole and fits into slips in a rotary table at the base of the derrick. The table and drill speed is decided on by the driller according to the rock formation he is dealing with, so that the table speed may be anything from 20 RPM to 150 RPM. Power is provided by a 150-HP.,

The pump and drill motor control gear is mounted on skids

735-RPM, slip-ring motor which transmits from the motor pulley by Texrope to the draw-works gear box and from the latter a shaft is the driving medium between bevelled gearing on the box and the rotary table. The box affords six mechanical gear changes which, combined with the nine variations on the motor controller, afford a speed range with an unusual number of variations for such heavy-engineering equipment. The change-speed controller and the unbreakable grid resistance are mounted separately, while the motor control equipment also includes an oil circuit-breaker and an air-break isolator.

For supplying the de-waxing current a special m.g. set is housed in a lorry; inset is the terminal pole plug serving the set

During the drilling operations mud is pumped down the drill pipe, through the drill, and up again outside the drillpipe. In this way the drill is lubricated and rock cuttings are brought to the surface where they are screened out so that the mud can be recirculated. The mud also forms a lining to the wall of the bore hole to prevent caving-in, and to help in this binding agents are added to the mud. The bore-hole may vary in diameter from, say, 7 in. to 14 in. The pump motor is similar in all respects to the drilling motor, and power is transmitted to the horizontal pump by a straight "Texrope" scheme. The pump control equipment is also similar to that of the drilling motor, the nine-step controller affording a wide range of speeds to satisfy the requirements of the different rock formations. The whole of the pump and drill motor control gear is mounted on skids. The two 150-HP motors may be coupled by means of friction clutches to provide one 300-HP driving unit. This combined unit is sometimes used separately for both pumping and drill-

Any number of wells may serve one of the oil collecting stations at each of which there is a pump house to transmit the oil to a main collecting station. Left: Equipment in pump house shown below

ing under stubborn working conditions, but it is more normally used for drawing out the drilling pipes on completion of the boring. In this case a hoisting drum is engaged and a rope from this drum is taken over the crown blocks at the top of the derrick. The additional power thus available for this draw-out work results in very considerable time saving.

When the oil sand has been reached a steel casing of suitable size for the bore hole is lowered to a depth determined by the geologist. This is cemented into the ground and a smaller drill and drill pipe are lowered into the casing for drilling through the rock to the oil. Production tubing, selected in size according to the likely yield of the well, is next run into the cased bore hole, and inside this pipe is next lowered the pump proper which is operated by sucker rods.

Installed with the production pipe at its predetermined depth is a spring-steel unit which is screwed to the pipe and makes a push-in contact with the casing. Further, the pipe is insulated from the casing by means of wooden insulators which are placed outside the pipe at 20-ft. intervals during its installation. At the surface or top end of the pipe a special moulded insulator is fitted into the well head in such a way that it carries the weight of the tube. These insulating and contact units are installed as part of an electrical method of de-waxing the oil, to be referred to later.

The production pumping unit and driving motor are next installed at the surface of the well and, according to the well yield, the driving motor varies from 2 HP to 15 HP. These units vary in type, but they all operate on the beam principle, rather like the Cornish pump, and they carry adjustable balance weights by which the pumping peaks can be "ironed out." In some cases the balance weights are on the beam proper, while in others they are carried on the crank motion which links the beams and the reduction gear in the transmission system which has for its initial stage a "Texrope" drive between the motor and the gear box. The motors run at speeds of 480, 960 and 1,440 RPM, and the pump stroke is determined by the pulley size, according to the well characteristics.

The motor and its push-button direct-on

Spring-steel contactor unit and wood insulators on the production pipe; a special moulded top insulator at the top carries the weight of the pipe

At several points in each area a h.v. supply terminates at a switch in a transformer house from which the l.v. lines radiate to the wells. Right: An impression of orderliness is given despite overhead lines, roads and wells

starter at the well head are fully flame-proof, and on the terminal supply pole for each well, which is placed at least 50 ft. from the well to meet the Petroleum Board Regulations, is a triple-pole and neutral weather-proof switch-fuse from which a three-core cable is run underground to the starter. Irrespective of the motor sizes all the motors and switchgear are interchangeable.

The well pumps deliver the oil direct into the vertical tanks and collecting stations, of which there are a number throughout the oilfield. The oil is passed to the collecting stations by the well pumps, and at each station a pump house transmits the oil to a main collecting station at a special railway siding from which the oil is taken by rail tanks to refineries elsewhere in the country. For this secondary transmission of oil there are two 15-HP squirrel-cage-motor-driven three-throw ram pumps with worm transmission. Like the equipment at the wells the motors and direct-on push button starters at the collecting stations are all fully flame-proof, the motors being Metrovick, while the starters are E.A.C. equipments.

For de-waxing, positive and negative leads are connected at the well head to the production pipe and the casing, respectively

The viscosity of the oil varies with its temperature and treatment, and during normal production it is an almost regular procedure to de-wax the production pipes to avoid loss in production due to the settling out of thick wax.

We have already indicated that an electrical method is employed for this, and it involves heating the pipe by the passage of a current through it. The equipment was developed by the oil company and it consists of a special motor-generator set and its associated equipment mounted on a lorry, so that it can be taken from site to site as required. The motor is a 68-HP, 440-V, 970-RPM machine which is supplied by a trailing cable from a plug and socket unit mounted on the terminal pole at each well. The generator is a 54-kW, 44 to 54-V machine and can be loaded up to 1,000 A. By means of trailing cables and suitable lugs and connecting bolts the positive and negative leads are connected to the production tube and the casing at the head of the well, respectively. The circuit is down the tube, through the spring contactor and up the casing. The heating of the tube in this way melts the wax and permits normal production. Usually about an hour's heating run will dissolve all the accumulated wax.

The visitor to the oilfield is at first intrigued to see the well pumps in all sorts of unexpected places, and then he becomes surprised at how little they upset the appearance of the countryside. Add to these the roads and the system of overhead distribution lines to supply all the pumps, and he is astonished at the general orderliness of things. From the electrical viewpoint the whole field may be considered as in three areas, in each of which there are several 11-kV supply points, each terminating at a switch in a transformer house in which the oil company has a 500-kVA transformer.

On the 440-V side the transformer serves a distribution board from which overhead lines to the wells and collecting stations are fed. The lines are simple in character and carry in vertical formation three 0·2-sq. in. phase and one 0·1 sq. in. neutral bare-copper conductors on shackle insulators mounted on 30-ft. poles. For supplying the derrick equipment during drilling a connection is taken from the nearest line by means of a tandem-type overhead-line connection box.

All the overhead line equipment was supplied by Callender's Cable & Construction Co., Ltd., and the derrick and pump electrical equipment by Metropolitan-Vickers Electrical Co., Ltd.

Illuminating Engineering

AS a subject for his presidential address to the Illuminating Engineering Society on October 10th, Mr. E. Stroud gave a historical survey of the work of the Society from its formation by the late Leon Gaster in 1909 with Silvanus P. Thompson as its first president, during which time Mr. J. S. Dow has served as honorary secretary. During the war the membership, he stated, had approximately doubled and was now 1,600, the growth being largely attributable to the development of ten Centres which, with five supplementary groups, accounted for 1,000 members.

Reference was made to the official recognition accorded to the I.E.S. Lighting Code and to the work of twenty-four committees in connection with wartime lighting, apart from service by members on the Ministry of Works Committees dealing with the Lighting of Post-War Buildings and Codes of Practice. A series of lighting reconstruction pamphlets had also been issued. With regard to the immediate future, plans were in hand for providing a "hallmark" for qualified lighting engineers and for other activities, which would entail a full-time secretary and larger staff.

Synchronous Machines

Constructing a Circle Diagram for Salient-Pole Designs

By W. Szwander,
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THE use of circle diagrams, and of circle power-charts which are based on them, is widely adopted in practice when studying the performance of non-salient pole synchronous machines. With both the stator-winding resistance and the influence of saturation of magnetic paths neglected, the circle diagram can be drawn easily and with little expense of work for every value of the constant terminal voltage.

From such a diagram the magnitudes of the field currents and of the internal displacement angle (angle between the vectors of excitation-voltage and of terminal-voltage) can be read for all load conditions (determined *e.g.* by any two of the five values: MVA, MW, MVAr, amperes and power-factor). Due to the saturation being neglected, such readings are only approximate; they are sufficiently exact, however, for the majority of practical purposes.* Though a more exact chart, in which saturation can be accounted for, could be computed, all the simplicity would be lost, because the lines of constant field-currents and of constant displacement-angles are then represented by irregular curves instead of by circles or straight lines, and the amount of work involved in determining such curves is quite out of proportion to the possible uses of the chart.

Similar power charts have been described (O. G. C. Dahl—"Electric Circuits," 1928), which in addition to saturation take also into account the influence of the saliency in salient-pole type machines, but due to the complexity of their computation they certainly cannot play the same part as the simple circle diagrams and charts used for non-salient-pole machines. So far as the author is aware, no simple circle diagram applicable to salient-pole machines has previously been described in technical literature.

The fundamental vector diagrams (Fig. 1a and b) show why the simple circle diagram in use for non-salient-pole machines cannot be applied without modification to salient-pole machines. In the case of a non-salient-pole machine (Fig. 1a) the "working point" F, corresponding to certain load conditions (described by the terminal voltage E_t, the stator-current I and the power-factor angle ϕ) can directly determine on a circle diagram or chart all the parameters which are of interest. These are the active and reactive powers (projections of the vector OF upon the axis OR and OM), the magnitude of current and of the apparent power (the distance of the point F from the point O), the excitation current (the distance FA), the power-factor angle FOR and the internal displacement angle FAO.

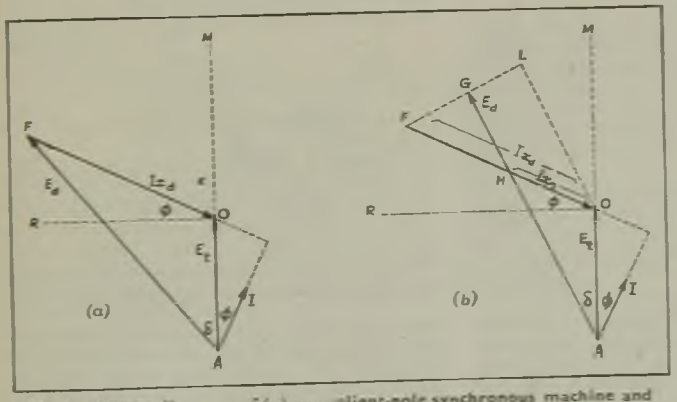


Fig. 1.—Vector diagrams of (a) non-salient-pole synchronous machine and (b) salient-pole synchronous machine

When a salient-pole machine is considered (Fig. 1b), the "working point" F can determine directly, as in the case of a non-salient-pole machine, only the values of power (active, reactive, apparent), of stator current and of power-factor angle. The remaining two values—the excitation current (distance AG) and the internal displacement angle (angle GAO)—can be found only after determining the "excitation point" G by the method used when constructing the vector diagram of a salient-pole machine (*i.e.* by making the ratio OH : OF equal to the ratio of the quadrature axis synchronous reactance x_q to the direct-axis synchronous reactance x_d and by drawing FG perpendicular to AG).

Thus, if the lines of constant excitation currents are to be represented by circles drawn round the centre A, and the lines of constant

* See "Fundamental Electrical Characteristics of Synchronous Turbo-Generators" by W. Szwander, *I.E.E. Journal*, Part II, June, 1944.

internal displacement angles by straight lines passing through the point A—then not the "working point" F, but the "excitation point" G, which is associated with it, must be used for reading the respective values. On the other hand, should all the values be determined by the position of the single point F in the system of power co-ordinates, then the lines of constant excitation currents and of constant internal displacement angles would be given by some irregular curves which could not be determined without a considerable amount of labour.

It is much more convenient, however, to use the simple circle diagram, which can be prepared in a similar way as for a non-salient-pole machine having the same value of x_d as the salient-pole machine under consideration, and to account then for the saliency by using two "working points" instead of one, when taking every reading from the diagram. These two points correspond to points F and G in Fig. 1b, and have a definite position, one in relation to the other (having determined F, OF is divided in the ratio OH : OF = x_q : x_d, and G will be found as the projection of the point F on AG. If G is given, LF must be drawn perpendicular to AG, L found as projection of O on LF, and F obtained from the proportion LF : LG = x_d : x_q).

Usually, in practice, only a few readings from a circle diagram are needed; it is better, therefore, to obtain quickly and easily the diagram itself, even though some additional work is later necessary for every reading, than to spend considerable time and effort in computing a directly-reading chart. A further useful simplification is not to draw any circles on the chart, but only the two axis of co-ordinates, the stability limits and the necessary scales; enough room is then left for the additional constructions to determine the twin points F and G for every reading (which can be made either on white prints of the chart, or on a sheet of transparent paper laid on top of the diagram).

Fig. 2 gives an example of the chart described for a 24-MVA, 0·9-p.f., 11-kV, 214-RPM water-wheel generator, with synchronous reactances : x_d = 155 per cent. (saturation neglected) and $x_q = 0{\cdot}6\ x_d$. When the value of x_q is not known, it can be found if the leakage reactance x_l and the ratio of pole-arc to pole-pitch b : Y are known, because $(x_q - x_l) = K_r (x_d - x_l)$, where (according, for example, to M. G. Say and E. N. Pink) for the values of b : Y of 0·5, 0·6, 0·7, 0·8, 0·9, 1·0, K_r is : 0·2, 0·27, 0·38, 0·53, 0·74, 1·0 respectively. A close enough approxima-

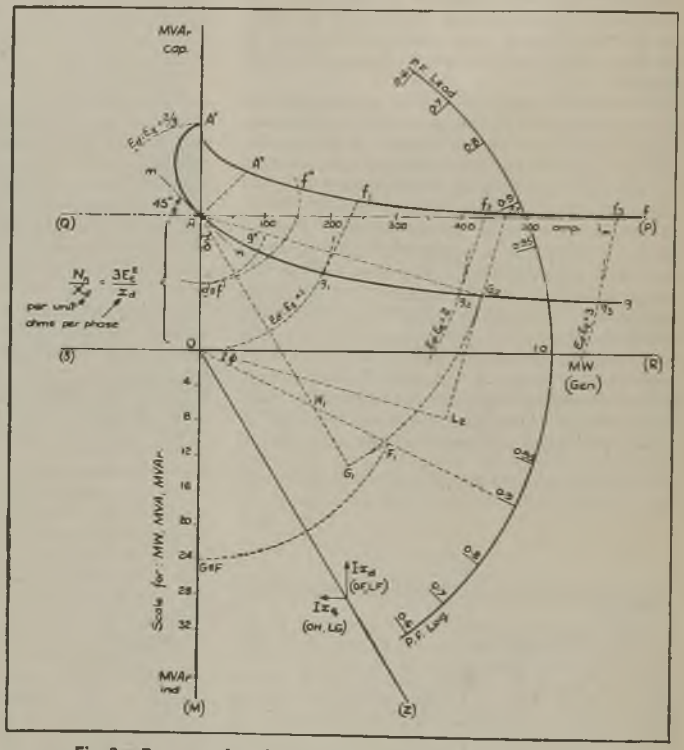


Fig. 2.—Power and excitation chart for water wheel generator

tion is to take $x_q = 0{\cdot}5$ to $0{\cdot}6\ x_d$. Incidentally, the accuracy of the computations can be increased by partly accounting for the influence of saturation on the value of x_q by taking only 90 per cent. of the non-saturated value of this reactance.

In Fig. 2 with a deliberately chosen power-scale, the distance OA (A being the centre of excitation circles) is found as OA (in MVAr) $= Q_s = N_n : X_d$, where N_n is the MVA rating of the generator, and X_d the per-unit value of the direct-axis synchronous reactance at the rated load and rated terminal voltage. At a terminal voltage E^1_t different from the rated value E_t, the expression will be OA =

$\frac{N_n}{X_d} \cdot \left(\frac{E'_t}{E_t}\right)^2$. The length of OA gives the field-current scale, because OA is equal to the no-load excitation current; this last can be taken without neglecting saturation (208 A in the given case), which gives readings of the absolute field-current values closer to their actual magnitudes.

For the rated-load working point F_1 on the diagram (24 MVA, 0·9 p.f.) the excitation point G_1 can be found following the previously described procedure (the auxiliary line OZ helps to find each time the ratios OH : OF = LG : LF = $x_q : x_d$). $AG_1 = 448$ A gives the full-load field current. With this excitation kept constant, the point G_2 on the theoretical, steady-state stability limit A'Ag (for working conditions on infinite busbars) determines the moment of the loss of synchronism by the machine.

The " working point " F_2 corresponding to the " excitation point " G_2 represents a point of the stability limit A'f of the machine in the power co-ordinates.

According to the representation of every working condition by means of two points, one in the power co-ordinates (point F) and the other in the excitation and internal displacement-angle co-ordinates (point G), there are independent stability limits for each of the two systems of co-ordinates, *i.e.* the curve A'f for the points F, and A'Ag for the points G. Points of the curve A'Ag can be determined by differentiation of the power expression for the salient-pole synchronous machine: (all values in the following formulæ are per phase, and with stator-winding resistances neglected).

$$P = \frac{E_t E_d}{x_d} \sin\delta + \frac{E^2_t (x_d - x_q)}{2x_d x_q} \sin 2\delta,$$

$P = P_{max.}$ for $\frac{dP}{d\delta} = 0$, hence $\cos\delta =$

$$-\frac{E_d}{E_t} \frac{x_q}{4(x_d - x_q)} \pm \sqrt{\left(\frac{E_d}{E_t} \frac{x_q}{4(x_d - x_q)}\right)^2 + \frac{1}{2}}$$

which gives values of δ for every value of excitation described by the ratio $E_d : E_t$.

The second curve A'f can be deduced graphically from the curve A'Ag, using the previously described construction of finding points F corresponding to the given points G. Otherwise the co-ordinates of the points of the curve A'f can be calculated for the values of δ and E_d corresponding to the points on the curve A'Ag by making use of the above quoted formula for the active power P, and of the following formula for the reactive power:

$$Q = \frac{E^2_t}{x_q} + \left(\frac{E^2_t}{x_d} - \frac{E^2_t}{x_q}\right) \cos^2\delta - \frac{E_t E_d}{x_d} \cos\delta.$$

With the assumption of $x_q = 0{\cdot}6\, x_d$, which is acceptable for the majority of practical investigations, the formulæ are much simplified (all values are per phase):

$$\cos\delta = -\frac{3}{8} \frac{E_t}{E_t} \pm \sqrt{\left(\frac{3}{8} \frac{E_d}{E_t}\right)^2 + \frac{1}{2}}$$

$$P = \frac{E^2_t}{x_d} \left(\frac{E_d}{E_t} \sin\delta + \frac{1}{3} \sin 2\delta\right),$$

$$Q = \frac{E^2_t}{x_d} \left(\frac{5}{3} - \frac{2}{3} \cos^2\delta - \frac{E_d}{E_t} \cos\delta\right).$$

In the above the term $\frac{E^2_t}{x_d}$ is equal to the distance OA in the power scale. (In Fig. 2 three-phase values are used.) In practical application the drawing of the two stability limits is much simpler than it might appear from the foregoing. The curve Ag (the sector A'A is of no practical interest, corresponding to negative excitation values) is in point A tangential to the straight line mn drawn at an angle of 45 degrees to the co-ordinates. Further, the shape of this curve is so flat that it is not necessary to calculate the cos δ for more than two or three values of the ratio $\frac{E_d}{E_t}$ (*e.g.* equal to 1, 2 and 3), thus determining the points g_1, g_2, g_3. The corresponding points f_1, f_2, f_3 of the curve A'f will be easily determined graphically. In addition it can be also proved that $OA' = \frac{x_d}{x_q} \frac{E^2_t}{x_d}$ (*i.e.* = 1⅔ of OA when $x_q = 0{\cdot}6\, x_d$) and that the curve A'f approaches asymptotically the straight line QAP (which is the stability limit for the non-salient-pole machine), and also that the point A", corresponding to the zero excitation, has the co-ordinates:

$P = \frac{x_d - x_q}{2x_c} \frac{E^2_t}{x_d}$ (*i.e.* $\frac{1}{3} \frac{E^2_t}{x_d}$ for $x_q = 0{\cdot}6\, x_d$) and

$Q = \left(\frac{x_d}{x_q} - \frac{x_d - x_q}{2x_q}\right) \frac{E^2_t}{x_d}$ (*i.e.* $\frac{4}{3} \frac{E^2_t}{x_d}$ for $x_q = 0{\cdot}6\, x_d$).

The stability margin of the machine to which the diagram in Fig. 2 refers, with the full-load excitation $AG_1 = AG_2$, is given by the comparison of the active loads at the points F_2 and F_1, *viz.* 34·5 : 21·6 = 1·6. Incidentally this margin does not differ much from what it would be for a non-salient-pole machine.

When a shunt-exciter is used, its inherent stability cannot be preserved with the excitation-current dropping below a certain minimum (usually no values of less than half of the no-load excitation are admitted). This means that the excitation stability limit A'Ag must be supplemented by the excitation circle g'g" for $\frac{E_d}{E_t}$ equal *e.g.* 0·5, thus making the combined stability limit g'g"g. The corresponding final stability limit in power-co-ordinates will be g'f"f.

With the exciter excited from a pilot-exciter or from any other source of constant voltage, a theoretically stable operation of the synchronous machine is possible down to zero excitation current (and even with certain negative excitation), as long as the excitation-point G is on the correct side of the stability limit A'Ag. In this case the use of a minimum excitation limit (similar to g'g") is

imposed sometimes to provide a safety margin before reaching the theoretical stability limit.

Making sure that the field-current will not be less than a prescribed value is a satisfactory measure of dealing with stability limitations of synchronous condensers, but this will not be enough in the case of generators, which, theoretically, can approach the conditions of instability with every value of their excitation. In this case the stability limits A'f and A'Ag are the only criteria for judging the stability. When using these limits, necessary safety margins must certainly be observed, as in case of all " theoretical " stability limits.

In the present discussion certain practical applications of the simple method utilising the circle diagram for salient-pole machines have been illustrated. There may be many others, *e.g.*, quick determination of pull-out torque of a synchronous motor for various values of excitation and of terminal voltage.

Salient-pole machines, for various design reasons, may be built sometimes, (*e.g.* at low speeds) with comparatively low values of the direct-axis synchronous reactance (around and below 100 per cent.). In such cases, and without exceeding the rated load, the states of synchronous instability may be impossible when working on infinite busbars. Even then, however, the circle diagram described may be found useful for determining the excitation requirements and the internal displacement angles of the machine, the knowledge of which may be essential in solving many general power-transmission and system-stability problems. When the direct-axis synchronous reactance is larger than 100 per cent., or when there is a probability of over-loading the generator, the circle diagram described is the best source of information about the admissible capacitive loading of the machine.

Electricity Reorganisation

Area Basis Favoured by Association of Municipal Corporations

COMPULSORY reorganisation of the distribution of electricity on an area basis, under public authority control, is recommended in a report approved by the General Purposes Committee of the Association of Municipal Corporations. It is also considered that reorganisation should include generation, in view of the drawbacks of divided control.

After reviewing the Reports of the Weir and McGowan Committees and the Association's observations on them, the present report comments that the conclusions of the McGowan Committee were clearly tempered with a desire to avoid any serious dislocation of the industry as it existed at the time. The incidence of war has, however, aroused in the public mind a keen desire for a more positive and vigorous policy to enable the nation not only to repair the devastation caused by the war, but to help to rebuild our industries on a sure foundation. Electricity is essential to the civilised life of the community and should be placed under public authority, ownership and control, which in the Association's considered opinion is the most satisfactory means of ensuring the future prosperity of the country as a whole.

New legislation, the report recommends, should include a direction to the Electricity Commissioners to delimit the country into a number of areas in respect of which it may appear to the Commissioners, after careful local investigation, that a suitable scheme or schemes of amalgamation and co-ordination should be prepared. Where in such an area the undertakings are principally local authority owned, the public control authority for the area should be a local authority, under Basis " A " in para. 7 of the White Paper issued after the McGowan Committee's Report. Where the undertakings are principally company owned, the authority should be a newly constituted board, similar to Basis " C " in the White Paper. In the event of any local authority undertaking being acquired, the terms and conditions should not be less favourable than for a company undertaking. The technical and administrative officer appointed for the area should be responsible through the area authority to the Electricity Commissioners for the technical development and administration of the undertaking. The Central Electricity Board should co-ordinate data concerning power station design and performance for the free use of undertakings.

It is considered that the Electricity Commissioners should be given adequate powers to deal more comprehensively with the supply industry and that the newly constituted area authority should, under the direction of the Commissioners, work towards the standardisation of voltage, uniformity of tariff forms, uniformity of services to consumers, and the development of electricity supply in rural areas.

With regard to generation, the Association's report points out that the existing trading relations between undertakings and the Central Board would not be essentially modified by the proposed reorganisation except that the Board would deal with a smaller number of undertakings. Under the 1926 Act, generation is under a form of national control, which does not, however, involve the separation of generation from distribution within the prescribed areas. Points cited against any such separation are that the economic development of any distribution systems depends upon the size, location and efficiency of the power stations connected thereto; in existing generating stations, most of which are distributing centres, there are large numbers of cables connected to switchgear, which forms an integral part of the station layout; and the control of short-circuit values and settings of protective gear embraces both generation and distribution. The officer controlling the area should not only forecast and locate his load requirements, but should also recommend well in advance the generation points of supply to ensure that the combined unit is properly and economically designed and operated.

Problems of Industry

The I.E.E. Presidential Address

THE extent to which the electrical industry can, and should, contribute to the solution of post-war problems provided the theme for Sir Harry Railing's inaugural address as President of the Institution of Electrical Engineers. The present world upheaval, towards which electrical engineers had a special responsibility, was, he said, greater than any before, because inventions now affected the whole globe simultaneously and many more persons were engaged in scientific and technical matters.

Progress in engineering had been so phenomenal, so satisfying intellectually, so helpful in raising the standard of living that too little attention had been paid to the need to develop and organise not only materials and sources of energy but also human lives. Engineers should have made the world realise that their achievements necessitated adjustments in relationship between the individual and the community and between different communities. A broader understanding by the engineer of sociological problems and also a greater general understanding by the citizen of science and engineering were essential for a better comprehension of life in all its aspects.

Wider Application of Principles

Engineers should teach the principles underlying their work, and arising out of their training, in the hope that they would be generally applied. The first was the need to discover the fundamental facts and to test them before drawing conclusions, taking into account the means at their disposal, shunning universal application where variables applied and realising that cause and effect were inextricably interwoven. Integrity of purpose, disciplined imagination and power of critical analysis, coupled with knowledge of available scientific techniques, provided an essential basis. The same approach should be applied to all problems of life by humanity at large.

The second lesson that could be imparted by engineers was a disbelief in a dogmatic approach to life, in generalisations (with their insistence on partial truths) and in labels. The half-educated tended to over simplify owing to over-confidence in their slight knowledge and to a lack of sense of proportion and a failure to realise human limitations. Engineers knew that nature was manifested in an infinite variety of gradations, that every law functioned only within definite limits and was no more than a picture, representing known facts. From that knowledge should spring humility and tolerance.

Regarding post-war problems, the following conditions had to be accepted:—Raw materials would become increasingly available everywhere; energy could be transported; machinery could be made available and labour could be trained anywhere. Therefore no individual organisation or country would be able in future to maintain monopoly in production unless—and then only for a short time—it could forge ahead in new developments and products or could lead in quality or production cost.

To-day it was more than ever necessary that every individual should receive as good a general education and training in his handicraft or profession as possible and also in team work. Even more than the individual engineer must the individual industrial unit recognise the principle of team work and give-and-take. Success could be achieved only through the co-operation of capital, labour and management, even as it required the co-operation of research, development, design and production. Again the total returns on capital, salaries and wages (the standard of living of each unit) tended to become more and more dependent on the condition of similar units in this and in other countries.

Sir Harry Railing

The increasing volume of interests common to all members of an industry could be furthered by industrial associations on a federal principle, without discouragement of individual effort. Properly constituted associations—and Sir Harry knew of no other in the electrical industry—had all started on a voluntary basis (and he himself was opposed to compulsion); they had not laid themselves out to stifle reasonable competition and had given adequate representation to both large and small undertakings. They had contributed greatly to ordered industrial progress and had proved themselves socially beneficent through such activities as the standardisation of specifications and trading conditions, the pooling and exchange of patents and manufacturing experience, a measure of joint research, the collection of statistics, the maintenance of good relations with other industries, Government Departments and labour.

Such associations were to the advantage of

the country in general, provided the community had sufficient authority to ensure that no anti-social arrangements were made. This involved, *inter alia*, the right of the community to the compulsory use of patents under certain conditions with safeguard to inventors and the right to approve national and international arrangements. If wisely managed these associations made for efficient production, steady employment, and high quality and could limit industrial speculation.

Turning to the position of industry within the State, it was generally accepted, Sir Harry said, that the interests of an individual or group must be subject to the proven interest of the community. For the highest degree of development, however, a community must allow the utmost freedom of thought and action to individuals and groups of individuals. Any central authority should not instruct people what to do so much as restrain them from actions prejudicial to others. There was no intrinsic merit in State industry merely because it constituted the largest individual unit. The most efficient size of unit varied from industry to industry and from product to product.

Functions of the State

The industrial development of Great Britain, he considered, should be that the State should concern itself only with broad policy; its function, decreasing in extent with emergence from the immediate post-war period, should be on the following lines:—To co-ordinate general trade policy, relations and tendencies with those of other countries; to decide, in closest consultation with organised industry, the relative priorities to be given, while shortages existed, in regard to labour, raw materials and new capital, having regard to the needs of the world in general and paying especial attention to export potentialities on a long-term basis; to encourage all measures which would induce (not compel) industry to increase its efficiency in scientific production and management, capital equipment, training and education of labour and staff, long-term planning or closing down of uneconomical units; to encourage properly constituted trade associations, which should become the channels for discussion within industry and between industry and the Government; to adapt the State's purchasing power and methods of taxation to meet abnormal fluctuations in employment of labour. At the present stage, he believed a properly organised directive at the highest level would be in the interest of the community, but the State should not be the operating mechanism of productive industry in this country and at this juncture.

The cost of a product largely depended on the cost per man-hour. The only way of maintaining the present wage standard would be through increased output value per man. This in turn would depend upon continuity of work (by continuity of demand), upon the will to work (by proper wages and conditions and by mutual trust and an understanding of the part played by each partner) and finally upon the capital equipment allocated to each man. Regarding the last named consideration, as wages rose, the ratio of interest and depreciation to labour cost became less. The value produced per man-hour could be greatly increased by a generous provision of capital assistance, provided the turnover was large enough to allow for the additional interest and depreciation.

If wage rates increased more than the normal cost of living, the volume of articles produced would generally be greater owing to the increase in the effective demand. On the other hand, the cost of the product would increase and therefore exports would decrease or else the cost of raw materials and food bought in exchange would be more. There was therefore a wage limit which could not be exceeded so long as other countries lagged far behind our standard of living.

Essentials for maintaining any lead British industry could gain were more research and better education, increased capital assistance per worker (*e.g.*, power supply, tools, transport, lighting and working conditions), enlightenment of management and labour as to the functions of both, and increased exports, especially those which would expand world demand by raising the standard of living in backward countries.

Voluntary Co-operation

Quoting John Stuart Mill that the worth of the State in the long run was the worth of the individuals comprising it, Sir Harry expressed his belief that the basis of the development of the intelligence and sense of responsibility of the individual and the encouragement of the maximum freedom of thought and action, co-operation—national and international—could be built up, as in the case of the British Commonwealth, not by compulsion but by freedom of discussion under an overriding sense of responsibility, which implied that selfish considerations should not prevail where the common welfare was at stake. While progress might appear to be slower if dependent upon voluntary agreement, it was often naturally quicker owing to the avoidance of opposition which enforcement was bound to evoke.

With growing necessity for specialisation, it was becoming more and more necessary that electrical engineers should realise fully the inner meaning of their work and that they should have faith in its being worth doing. It was not enough, however, that they should make their full contribution in their own sphere. They should have the burning desire that the principles applied in their own work should be applied to life in general.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Immersion Heaters in Washboilers

ANSWERING "Immersed's" letter in your issue of October 6th on the use of immersion heaters instead of clamp-on elements for washboilers, I would point out that with the latter a sump has to be used which in a short time becomes filled with soap and particles of material, whilst the danger of running dry with rapid deterioration of the immersion elements is ever constant.

The use of an automatic device on an immersion heater to operate just above boiling point really necessitates a laboratory instrument, which, of course, is impracticable on a washboiler. With regard to costs, an immersion heater costs approximately double that of clamp-on elements.

Certain types of embedded clamp-on elements will not burn out even if the washboiler runs dry, whereas an immersion heater will soon do so. The efficiency of an immersion heater in a washboiler is in the neighbourhood of 86 per cent. and that of clamp-on elements 84 per cent. There is no comparison whatsoever between the operation of a kettle and that of a washboiler. The former deals with from 3 to 4 pints of water, and the latter from 6 to 8 gal. and one does not put clothing or soap into a kettle.

Leeds. D. H. S. SANDERSON.

Cheapening Electricity

REPLYING to Mr. Harker in your issue of October 6th, I definitely do not agree that space heating cannot be economically supplied on a two-part tariff with a running charge of ½d. per kWh. One of my reasons is that in 1938, when in the last two weeks of the financial year there was a cold snap, one undertaking which imposed no restriction of any sort on domestic space heating made a profit with a running charge of less than ½d. per kWh when the number of kWh sold to this class was approximately the same as that sold to power consumers, and the average price, including standing charges, for all kWh sold was less than 1d. This is an extreme case where there was no chance of recovering the extra cost of the higher m.d. from domestic consumers.

In your issue of September 8th, Mr. Harker put the cost of generation at 45s. per kW and 0·27d. per kWh. In that case surely a running charge of ½d. per kWh to consumers would give a substantial profit provided the correct standing charge was made. Whether these costs are right or not, some undertakings are still doing satisfactory business by selling at about ½d. per kWh.

I agree that generally the highest peaks occur during cold weather but I have also found that the highest weekly load factors occur at the times of the highest load. This goes to prove that space heating is used for many hours during winter months. It is questionable whether cooking would be at a higher load factor than space heating. In any case a well-developed domestic load can, and does, give an average load factor of about 32 per cent. and as the m.d. does not coincide with the factory peak the load factor of the undertaking is improved. It is impossible for a factory working forty-seven hours a week to obtain a load factor as high as 28 per cent. With a working week of forty hours factory load factors will be lower.

I have never been able to say with conviction what constitutes a "good" load. Conditions change rapidly. I prefer to consider every load which is not likely to interfere with the supply to other consumers as a good load.

Welwyn Garden City. B. CROWSLEY.

Freedom of Choice

I HAVE followed with interest the various articles and letters upon the subject of "Services for the Home," first with amusement but latterly with consternation. It seems to me high time that someone asked "What does the user want?" instead of driving only from the angle of "What I think is good for you will keep me in employment and that's what you are going to have."

Whilst I am in the electrical industry myself and have no axe to grind for gas companies and do not even own any coal shares, I cannot follow the attitude that to cut out these other forms of heat in order to cheapen the home is desirable. Why not go the limit and have a Government issue of one standard box per person in which to live? The acme of cheapness would then be attained. It seems also time that the electricity supply industry should be honest and openly admit what it knows to be true instead of hiding known facts for its own benefit. I refer to :—

(1) That irrespective of efficiency or cost the vast majority of people *prefer* an open coal fire in at least one room of the house. To sit for an evening at home round a gas or electric fire is *not* the height of comfort.

(2) Electric cookers *cannot* compete with gas whatever is said about cleanliness, etc. The long time taken to heat up and even longer to

cool down again, the necessity for special saucepans, the limited range of control, the desirability of having to have something that can be "warmed up" (that one rarely has) on the hobplate after one has finished with it, make the whole thing a luxury article and not a very clever one at that. (3) That electricity is best for lighting, radio, cleaners and several other home uses is undisputed.

Be satisfied with giving the consumer electricity where it is proved best and be clear-minded enough to allow him to use other methods where they are obviously superior. After all, the user pays for what he has, and fortunately he has a way, in the end, of usually confounding those who try to sell him something he does not want.

Wonersh, Surrey. D. MURPHY.

[If our correspondent's opinion of electric cooking were supported by public experience, there could hardly have been the rapid progress in domestic electrification, with cooking as its major component, that was so notable a feature of pre-war years when freedom of choice was complete. The rapid increase in consumption for the purpose provides a sufficient answer to his question "What does the user want?"—Editors, *Electrical Review*.]

Housing Manual, 1944

THE above-mentioned Manual is commended to the serious consideration of all supply engineers. It is issued under the aegis of the Ministry of Health and the Ministry of Works, and in their own words "is intended for the guidance of local authorities and others concerned," and may, therefore, be taken as the yardstick in regard to the future housing programme of the Government.

The Manual is, in my opinion, definitely an advocate of solid fuel, as will be gathered from the many references to such use and the necessity for the provision of chimneys, fuel store and access thereto. Electricity, yes and gas, are condescendingly referred to as likely to be more economical for intermittent or auxiliary purposes, and it unblushingly makes the statement that unless fuel charges are exceptionally favourable an "all-gas" or "all-electric" installation would be more expensive to run than an installation based on a combination of solid fuel and gas or electricity, but at the same time makes the further statement that the open coal fire has the attraction of cheerfulness and is traditional. It does go so far as to say that socket outlets should be provided to be used either for local lighting or for *small* electrical appliances, such as portable fires, radio, vacuum cleaner, etc.

The only grain of comfort I can find in the Manual is the statement: "It is often thought desirable to provide services, for instance for the possible use of both gas and electric power for heating and cooking, so as to give the householder freedom of choice between different fuels; but it is important to weigh beforehand what extra cost may be involved. A means for providing householders with some freedom of choice between fuels might be to equip different houses of the same group in different ways."

This is a tardy recognition of the point which I have been so repeatedly emphasising that freedom of choice must in the end be more expensive to the domestic user. It has been possible to penetrate the crust of Whitehall, as is shown by their statement that electricity will normally be used for lighting wherever it is available, but this is very belated, and the dunderheads have at last realised that for many years past it has not been possible to sell or let a house, except in remote country districts, unless electric lighting is installed.

What a pitiful story, and this after over sixty years of our existence together with the efforts of the last twenty-five years of E.D.A.! What a hope for the excellent work of the E.A.W. and its efforts to secure the all-electric home! No, I am afraid that Miss Haslett and her women are condemned to the "traditional methods" of dirt and drudgery and the higher cost of the millions of new houses which, the Government states, will be necessary in the next few years.

London, W.C.2. F. W. PURSE.

[Reference to this Manual, and a comment thereon, appeared in our September 29th issue—Editors, *Electrical Review*.]

Provision of Increased Supply

WE wonder if some of your readers could give us any information regarding the position of electric power consumers when faced with the following problem.

The consumers in question wish to increase their output and to do so will have to install several additional motors. They have approached the electricity supply authority and are informed that the existing supply cable, to a point from which the consumers get their supply, is too small to take the proposed extra load, and if the size of this cable is increased the consumers must guarantee a certain sum per annum for a fixed period of years (a sum which is considerably more than they at present pay per annum for electricity) and in addition they must install correction apparatus to improve the expected reduction in power factor after installing the additional motors.

Alternatively the supply authority suggests that a high-voltage supply should be brought into the consumers' works, the transformer and all other necessary gear to be housed in a suitable building provided by the consumer and at no expense to the supply authority. The cable that it is proposed to increase in size is at present used to supply

other consumers and if the h.v. supply was installed it would in all probability be used to supply these other consumers also, who are at present faced with a similar problem but to a lesser degree.

What we should like to know is, has the supply authority the right to demand that its conditions be met before the consumers can get the supply they require? These consumers are on a flat rate, at so much per unit for power used. CONTRACTORS.

Preventing Accidents

WITH reference to Mr. E. W. Ashby's letter in your issue of October 6th, I feel that he must be singularly unfortunate in his experience. Very few owners of buildings having lifts for public use are unaware of the high damages readily awarded for relatively minor injuries sustained by accident, and in our experience all are covered by insurance policies against this. The insurance companies, in turn, are keen and see that old installations are brought up to date in regard to safety precautions in order to guard against accident and consequent claim.

With regard to the goods lift to which Mr. Ashby refers this must surely be in premises within the scope of the Factories Act, and attention to the defects is required as a matter of law.

Leicester. EVANS LIFTS, LTD.
F. G. CHERRY, *Managing Director*.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Council of Liverpool University is inviting applications for the David Jardine Chair of Electrical Engineering ("with special reference to electronics and the relations between electrical engineering and physics") at a salary of not less than £1,500 per annum. Leave of absence would be given to a successful applicant at present engaged in work of national importance. The chair was rendered vacant by the retirement, in 1942, of **Professor E. W. Marchant** who had held it for thirty-eight years.

Mr. E. H. Skinner, deputy borough electrical engineer of Colchester, has been appointed city electrical engineer and manager of the Chichester Electricity Department.

At the end of last month **Mr. H. L. Mills** retired from the position of engineer of the Stoke-on-Trent Corporation Electricity Department which he had held since the retirement of the late Mr. C. H. Yeaman in 1940. As already reported, **Capt. T. Lockett,** O.B.E., who was placed in charge of the commercial side of the undertaking at the same time, has now been appointed general manager and takes control of the whole undertaking.

Mr. Mills was educated at Whitgift School, Croydon. After two years' in the drawing office and shops of S. H. Johnson & Co., engineers, Stratford, E., he entered the electricity supply industry in 1895 as mains assistant under the late Mr. Albert Gay at Islington. In 1900 he was appointed mains superintendent with the Southampton Corporation Electricity Department in which he later became chief assistant. During the last war he served in the R.N.V.R. (North Sea Patrol) from 1916 until the end of hostilities. He joined the Stoke-on-Trent undertaking in May, 1920, as mains superintendent and held the position of deputy electrical engineer from 1934 until his appointment as engineer. Mr. Mills has one son, Mr. E. Mills, who is mains assistant at Ealing.

The Stoke-on-Trent Electricity Committee has approved a number of staff changes recommended by the general manager under a scheme of reorganisation. **Mr. L. Goodall,** at present technical assistant, has been appointed distribution engineer, and **Mr. H. Mc. Cartney** and **Mr. F. R. Ward,** district mains engineers, become technical assistant and mains engineer, respectively. **Mr. E. G. Clark,** now financial assistant, is appointed commercial assistant, and **Mr. J. P. Oliver,** at present administrative assistant, becomes sales development assistant.

At the termination of five years' continuous presidency of the Association of Supervising Electrical Engineers, **Mr. H. W. Swann,** M.I.E.E., is to induct his successor into office at the first meeting of the 1944-45 session at the Lighting Service Bureau, London, on October 21st, 1944. The president-elect is **Mr. E. R. Wilkinson,** M.I.E.E., commercial manager of the Central Electricity Board, who has been on the staff of the Board for over sixteen years and has occupied his present position for the past seven years. His duties in that capacity give him a wide and intimate knowledge of electricity supply and bring him into close contact with electricity supply authorities and industrialists throughout the country.

Mr. E. R. Wilkinson

Mr. Wilkinson received his technical training at the Dick, Kerr Works of the English Electric Co., Ltd., and after gaining practical works experience, concentrated on power station design, operation and costs of production. He subsequently joined Merz and McLellan, with whom he was engaged on power projects for various parts of the world and on many of the investigations into co-ordination of generation and standardisation of frequency which preceded the 1926 Act.

Mr. J. Billcliff, assistant mains engineer at Eastbourne, has been appointed deputy mains superintendent and technical assistant at Cheltenham, and his successor will be **Mr. S. Naylor,**

who went to Eastbourne from Birkenhead in 1942 to take the place of Mr. C. Eastgate upon his appointment as assistant electrical engineer with the Public Works Department in Nigeria. The vacancy caused by Mr. Naylor's promotion is being advertised. Another member of the Eastbourne staff, **Mr. G. E. Pike**, constructional assistant, has accepted an appointment with the Cardiff Corporation, and the position at present held by him at Eastbourne is to be advertised shortly. It may also not be known by many of his former colleagues that **Mr. J. R. Harbour** left the Eastbourne power staff some little while ago to take over the duties of a control room operator at one of the power stations belonging to the Edmundson group.

Appointments Vacant.—The Ashford U.D.C. is advertising for a chief electrical engineer and manager at the " Walker scale " salary of £995 of which 85 per cent. will be paid for the first year, 92½ per cent. for the second and the full amount thereafter. Huddersfield Corporation invites applications for the post of deputy borough electrical engineer at £750 per annum plus war bonus (£34).

Mr. W. J. Drummond, Dr. H. L. Guy, C.B.E., Sir William Halcrow, and **Mr. W. F. Lutyens,** have been appointed members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research. Sir Joseph Barcroft, Sir Harold Hartley and Sir Frank Smith retired from the Council on completion of their terms of office on September 30th.

In preparation for anticipated post-war developments Luton Town Council has, subject to the approval of the Electricity Commissioners and the Ministry of Labour, agreed to appoint an assistant development engineer for the Electricity Department with a commencing salary of £506.

The North West Midlands Joint Electricity Authority has decided to discontinue **Mr. E. B. Sharpley's** services as clerk in view of his retirement from the position of town clerk of Stoke-on-Trent. The Authority is to consider the future of the clerkship, which, it is suggested, might in future be independent of the constituent local authorities.

Mr. Leslie C. Sharp tells us that he has now completed twenty-five years with Venner Time Switches, Ltd. He joined the company as an apprentice in 1919, was appointed to the board in 1937 and succeeded his father, Mr. E. E. Sharp, as sales director on his retirement a year or two ago.

Captain F. Crewe has been presented with a gold watch subscribed for by his colleagues at the English Electric Co., Ltd., Stafford, on his retirement after thirty-one years' service. The presentation was made by Mr. A. R. Blandford, chief engineer and manager of the switchgear department. At a farewell gathering in the Association Hall attended by a large company, which included Mr. J. W. C. Milligan, works manager, and Mr. Blandford, a programme of entertainment was provided by members and friends associated with the switchgear drawing office.

Presentations made to **Mr. A. M. Pooley, M.B.E.,** on the occasion of his retirement from the position of general and works manager of the fusegear section of the English Electric Co., Ltd., included one from the staff and employees of the fusegear works in the form of a silver model of the well-known advertisement depicting an English Electric fuse resting on top of the world. At the same time Mrs. Pooley was presented with a " Minton " tea service. Another gift, from all the staff and employees under Mr. Pooley's control, made at a dance and social evening in honour of Mr. Pooley, was a portrait in oils by the eminent artist Wales. This was presented to him by Mr. C. A. Wilson, chief draughtsman of the fusegear works. A third presentation, of a specially designed easy chair from his many friends and colleagues throughout the whole of the English Electric Company, took place at the company's guest house, The Old Hough, Stafford. Sir George H. Nelson, chairman and managing director, in making the presentation, outlined Mr. Pooley's service with the company, commencing with his appointment in 1919 and his activities in opening up the new fusegear section in 1926. This section was transferred in 1932 and by 1938 four times as many people were employed.

Mr. F. A. Dear, secretary to the Sheffield Corporation Electricity Department, has retired after forty-two years' service.

Mr. C. E. Sexton has been elected a director of the Kalgoorlie Electric Power & Lighting Corporation.

Mr. D. W. B. Ridsdel has resigned from the board of Simms Motor Units, Ltd.

Obituary

Mr. Wendell Willkie.—The death on October 8th of Mr. Wendell Willkie, at the age of fifty-two, brought to a premature end a career which, in the last four years, possessed international significance. Mr. Willkie was the son of a lawyer and himself built up a reputation in this field, particularly as counsel to the Southern and Commonwealth Corporation for whose growth over a very wide area of the United States he was largely responsible and of which he became president. It was in this connection that he came into conflict with President Roosevelt's " New Deal," particularly that part of it which resulted in the creation of the Tennessee Valley Authority. He eventually arranged the sale, at a favourable price, of some of the Corporation's properties to the T.V.A. and secured an undertaking that the Authority would not compete in the Corporation's areas.

In the 1940 presidential election Mr. Willkie opposed Mr. Roosevelt as Republican candidate and later made an extensive world tour making contact with the leaders of the United Nations.

Mr. E. P. Roper.—We record with regret the sudden death on September 25th of Mr. E. P. Roper, chief designer of the transformer department of the Witton Works of the General Electric Co., Ltd. Mr. Roper joined the G.E.C. in April, 1929, from the British Electric Transformer Co. where he had served his apprenticeship. In January, 1938, he succeeded to the position which he held at the time of his death. Despite the great amount of work which had fallen to his share as a result of wartime demands, he played a leading part in civil defence at the Witton works.

Mr. C. J. Bartley.—We regret to learn of the death recently at his home at Leigh-on-Sea of Mr. C. J. Bartley, principal of C. J. Bartley & Co., Ltd., registered electrical contractors. He was seventy-six.

COMMERCE and INDUSTRY

London Building Restriction.

Engineering Cadetships

IN February it was announced that it was proposed to award further engineering cadetships to boys during the autumn of this year, subject to the circumstances then prevailing, and applications were invited. The view subsequently taken, in the light of the war situation and of the latest estimates of the future requirements of the Forces, was that these requirements would be adequately covered without training further cadets and it was decided that the Education Departments should not be asked to award further cadetships this year.

The *Ministry of Labour Gazette* now reports that arrangements have been made, however, to complete the interviewing of candidates selected from applicants who responded to earlier announcements so that those of them who are enlisted into the Services may be specially noted with a view to their consideration for training for commissions in branches of the Services which do not call for engineering qualifications, and to the further possibility of their being sent to technical colleges for specialised training at a later date should circumstances make that desirable.

Repair Work in London

The Minister of Works has made an Order (S.R. & O. 1944 No. 1112) which, from October 3rd, reduces the limit of expenditure up to which building work may be carried out without licence from £100 to £10. The new Order applies only in the London Civil Defence Region. The expression "building work" includes electrical installation work. Licences for works costing £10 but not exceeding £100 in cost will be issued by the local authority for the area in which the work is being carried out; licences for works costing more than £100 will continue to be issued by the Regional Licensing Office, Ministry of Works, 51-54, Gracechurch Street, London, E.C.3. Licences will be issued only for works which are really essential.

Application for a licence to complete essential work already in hand (costing more than £10 but less than £100) should be made immediately to the borough or urban district council and pending a decision the work may be continued. If work is necessary in circumstances of such emergency as to make it impossible to obtain a licence beforehand, it may be put in hand, but the borough or urban district council or the Regional Licensing Office, as the case may be, should be notified as soon as possible of what is being done.

Luton Heating Investigation.

The operation of this Order is designed to release for urgent repair work men engaged on less essential jobs. To the same end the Ministry of Works has addressed an appeal to all firms in the building industry to accept or participate in contracts for repair work in London. They have been asked to furnish particulars of the number of men of various trades which they employ, including electricians.

Improving Coal-Mine Efficiency

A Committee has been appointed to examine the equipment and organisation of coal production and to report to the Minister of Fuel and Power on the technical changes required for full efficiency. The investigation will cover cutting of coal by machinery and by hand, methods of conveyance in the pit and on the surface, and means of loading into wagons at railway sidings. The chairman is Mr. C. C. Reid, Director of Coal Production at the Ministry.

Cable Operators for Gibraltar

Sixteen probationers with the rank of Army lieutenant who left this country last week for Gibraltar constitute the first party of young men to go abroad to operate cable and wireless communications as members of the "Telcom" organisation. Before departing they were entertained to tea by Sir Edward Wilshaw, chairman of Cable & Wireless, Ltd.

Diesel-Electric Traction

Four locomotives now being built by the L.N.E. Railway for shunting work will be of the Diesel-electric type. The equipment, which is being supplied by the English Electric Co., Ltd., will be similar to that of the locomotives of the L.M.S. Railway described in the *Electrical Review* of May 19th. They will, however, embody a novel feature in that they are designed to serve also as mobile power stations in the event of one of the company's works or pumping stations being put out of action.

L.N.E.R. Diesel-electric shunting locomotive

The 350-HP, 680-RPM Diesel engine is

directly coupled to a compound-wound generator, which is provided with a double-wound armature so that a 200-kW supply can be obtained on either a two- or three-wire system at 500 or 250 V or alternatively at 600-V for supplying the two traction motors. The industrial supply can be obtained through two circuit-breakers on a panel mounted on the rear wall of the driver's cab.

Drawing Office Lighting

A lighting system which the L.M.S. Railway Co. has installed in one of its principal drawing offices, where designs and specifications are prepared for the construction and maintenance of rolling stock, comprises about sixty fluorescent tubes in high-efficiency reflectors providing illumination of 25 ft.-candles on the drawing boards. It replaces a number of 200-W tungsten lamps in enclosing glass fittings giving only 5 ft.-candles, and reduces consumption by more than half. The fittings permit some light, which would otherwise be wasted, to be directed upwards through longitudinal apertures in the top of the reflectors, thus obviating a depressing "tunnel" effect. To allow future variations in the spacing of tables and to simplify erection, steel tubes run the whole length of the offices supported by, and clipped to, the roof trusses. There is an almost complete absence of shadow and the daylight qualities are much appreciated. The installation was designed by the engineers of the L.M.S. Rly. Co. and of the Edison Swan Electric Co., Ltd., utilising fluorescent tubes and reflectors of the latter's make.

Fluorescent lighting at an L.M.S. Railway drawing office

Electricians' Wages

In accordance with the Wages (War Adjustment) Agreement made between the National Federated Electrical Association and the Electrical Trades Union on November 24th, 1939, as amended by an agreement dated September 24th, 1943, the cost of living (war) addition as from the third pay day in October, 1944, for the pay period covered by that pay day, will be 5d. per hour, the addition to remain current up to and including the second pay day in January, 1945. In accordance with the agreement of September 6th, 1944, this rate is subject to an addition of 1d. per hour; the resultant payments will therefore be :— Over 21 years of age, 6d. per hour; between 18 and 21, 3d. per hour; under 18, 1½d. per hour.

N.J.B. Schedule Revision

At the last meeting of the National Executive Council of the Electrical Power Engineers' Association a report upon the revision of the National Joint Board agreement was presented by the chairman of the sub-committee dealing with this matter (Mr. Toynbee). Details are not given in the report in the September *Electrical Power Engineer* but it is said that the proposed amendments relate, *inter alia*, to holidays, basis of classification and salaries. As regards classification it was suggested that there should be different bases for inside and outside staffs. For the former plant capacity was favoured but for the outside staff a new basis, taking into consideration both the number of consumers and the amount of energy sold, was proposed. It was considered by the Council that so radical an innovation required very thorough investigation before any decision was arrived at. A survey of the position is to be made and facts and figures obtained to determine the probable effect of introducing the new system. The matter is to be raised again at the January meeting of the N.E.C.

Luton Factory Heating Scheme

Preliminary inquiries are being made at Luton into the possibility of the Corporation's generating station being used to supply waste heat to factories and thereby save fuel. Mr. C. T. Melling, the borough electrical engineer, in a letter sent to the largest industrial undertakings in the town informing them of the project, explains that in conjunction with the Central Electricity Board an examination is being made of the possibility of using the electricity station as a thermal unit on the lines which are familiar in Russia and America, where district heating schemes are in operation. He points out that the supply of heat to private dwellings, as with the more usual district heating systems abroad, is not contemplated. The present investigation is very preliminary and one of the first necessities is information as to the possible demand by industry.

Interviewed on the subject, Mr. Melling estimated that the saving in coal at Luton would amount to about 10,000 tons a year if the scheme came into operation. High-pressure, high-temperature boilers and back-pressure turbines would be installed, and heat would be sent out to the factories in the form of high-pressure hot water. The pipes would have to be heavily insulated to prevent loss of heat. The whole thing was a matter which would need the most detailed examination before it could be established whether heat

could be supplied at an attractive price. He added that industrialists had shown a good deal of interest in the scheme.

Daylight in Buildings

With a view to facilitating design for the purpose of securing adequate daylight in dwellings and schools, the Codes of Practice Committee of the Ministry of Works has issued for comment Chapter 1 (A) of the Code of Functional Requirements of Buildings. Scientific standards are analysed and methods of obtaining them are given in detail. These include a table of general and specific daylight factors and depths of penetration of light from windows for varying types of rooms. Appendices deal with the design and siting of buildings as factors in natural lighting and with the use of daylight-factor protractors. Standard tables of window performance prepared by the National Physical Laboratory enable the lighting efficiency of any window and the effect of obstructions to be readily ascertained.

Preparing for Civil Life

The Army Bureau of Current Affairs has produced a pamphlet, " Brush-up for Civvy Street," in which it sets out arrangements which are being made to prepare men and women in the Army for demobilisation. The scheme provides for compulsory classes in six fields, including a groundwork of electrical and mechanical engineering, occupying from six to eight hours a week, the choice lying with the men and women concerned. It is emphasised that the training is merely " basic " except in cases where a man has already proceeded on the way and can take more advanced correspondence courses.

Jet Propulsion

We were in error in stating last week that the British Thomson-Houston Co., Ltd., was producing engines for jet-propelled aircraft in bulk. Other British companies are making them. The B.T.H. Co. was, however, concerned in the early developments and made both the engine of the Gloster plane which made the first successful flight and that sent to the General Electric Co., Schenectady, New York, to the order of Power Jets, Ltd., for the Americans to study.

Changes of Name

Recent changes of name are:—Bennett Agencies, Ltd., to Bennett Power Products, Ltd.; Delta Transformers, Ltd., to Stewart Transformers, Ltd.; and the Anson (Accumulator) Co., Ltd., to Anson Accumulators, Ltd.

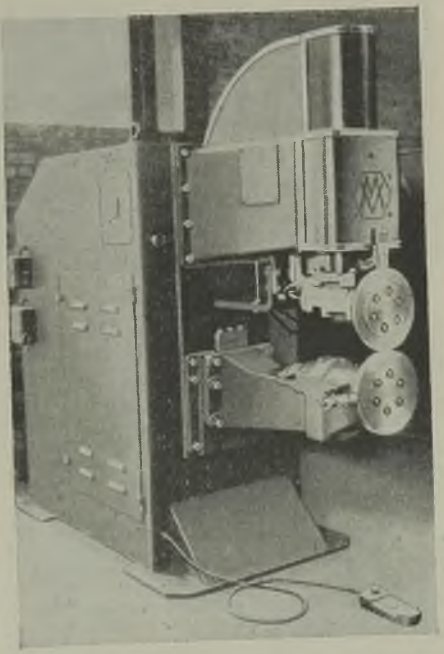
Economical Lighting Installation

In a lighting system recently planned by the Illuminating Engineering Department of Thorn Electrical Industries, Ltd., for a new radio assembly shop some 20,000 sq. ft. in area, it was necessary not only to provide the high standard of artificial lighting demanded by this class of work, but also to attain it in a manner consistent with the fuel economy drive. To this end 110 " Atlas " overlamp dispersive reflectors, incorporating 200-W lamps at a mounting height of 12 ft. provide an illumination of 12 ft.-candles, while supplementary lighting from 285 direct type local lighting reflectors with 60-W lamps and spaced at 3 ft. 3 in. centres bring the aggregate illumination up to 30 ft.-candles. Comparing this system of general plus supplementary lighting with a hypothetical general lighting scheme providing 30 ft.-candles throughout, there is claimed to be a saving in electrical energy of about 25 per cent.

Welding Demonstration

A new roller spot welding machine for light alloys recently developed by the Metropolitan-Vickers Electrical Co., Ltd., was demonstrated at the company's works recently. The opportunity was taken also to show several other types of welder at work, including a 650-kVA spot welder and a condenser discharge spot welder, both for light alloys; air-operated spot welders for general workshop use; and a foot-operated spot welder for mild steel. In addition, demonstrations were given of tool repair work and the hard facing of blanking tools, made from mild steel, by atomic hydrogen welding and the welding of magnesium by an automatic machine using the argon arc process on which the company is carrying out experimental work.

From the point of view of speed, the advantage of spot welding is limited by the fact that the work must be moved and positioned with reasonable accuracy between each successive spot weld. Thus a welding speed of 40-45 spots per minute is considered very good, although the actual welding time per spot may be in the region of only 10/15 cycles. The new roller spot welding machine developed to overcome this disadvantage gives speeds up to 144 spot welds per minute. The work is



Roller spot welding machine for light alloys

passed between two large diameter driven rollers, through the medium of which the required pressure and welding current are applied. The rollers are stationary while the actual weld takes place, but are operated automatically by a suitable intermittent drive to position the work rapidly and accurately for successive welds.

Lighting a Foot Clinic

The war with its transport difficulties has emphasised the importance of regular care of the feet, and in the Chelsea Foot Clinic an average of 100 people a day now receive treatment.

Owing to the close nature of the work, it is important that shadows should be eliminated.

Chelsea Foot Clinic lighted by "Metrovick" fittings

Originally the lighting was from local units, but the clinic authorities have recently installed a number of "Metrovick" translucent troughs with 5-ft. fluorescent tubes. These throw a plentiful and well diffused light over the feet of the patients, and so assist the attendants to carry out accurate diagnosis of each case (a most important point) and to operate with comfort and efficiency.

Fatalities

Linesman's Death.—Three men employed by the Derby & Notts Electric Power Company were tracing a fault in the overhead 11-kV lines on Biggin Moor, near Parwich, when an electrocuted crow was seen near a pole. One of the men, George Blackham, thirty-nine, climbed the pole to examine the line for burn marks and received a fatal shock. At the inquest one of the other men, Hugh Robert Mabbott, district manager, said that he momentarily forgot that the line was "live." He assumed that Blackham knew the position. The third man, Alfred Redfern, foreman linesman, said he was under the impression that the wires were "dead," and if Blackham had not thought the same he would not have climbed the pole.

Accident while Ironing.—While trying to repair the lead of an electric iron which had become disconnected through the iron falling off a table on which she was ironing, a young Macduff (Banffshire) woman, Jean Blair, received a fatal shock. The accident occurred in the concrete-floored kitchen of the house where she was employed.

Overseas Trade Inquiries

An Australian concern informs us that it wishes to get into touch with British manufacturers with a view to acquiring agencies for automatic telephone and hospital call systems.

From a firm of agents in Bagdad we have received a request to put it in touch with British electrical manufacturers desirous of doing business in Iraq and Persia.

Another Bagdad firm seeks agencies with a view to post-war business development and is prepared to purchase direct on its own account. It desires to make contact with British manufacturers seeking outlets for motors, generators, dynamos, centrifugal pumps, household fans, lighting equipment, power switches, control gear, etc.

We shall be pleased to give the names of these concerns to any interested readers or pass on communications to them.

Post-War Cinema Changes

Plans have been completed for three major changes in British cinemas after the war. This was stated last week by Mr. A. Daff, vice-president of Universal International Films, Hollywood, who has just arrived in this country. They are the use of three-dimensional screens; making all films in a new type of technicolour; and the use of television to bring scenes of important events directly to the cinemas.

Carton Sealing

In the article under the above heading in the *Electrical Review* of September 29th we omitted to mention that the carton sealing machine described was designed and manufactured by Rose Brothers (Gainsborough), Ltd., who have asked us to say that it is protected by various patents.

Bedford Exhibition

In our description last week of the farming exhibition at Bedford mention was made of a new type of separator for dressing and grading grain. Unfortunately part of the manufacturers' name was omitted. It should have been E. R. & F. Turner, Ltd.

Trade Announcement

The telephone number of Jackson Automatic Electric Controls, Ltd., has been changed to Abbey 5960. The address is unaltered (Windsor House, Victoria Street, S.W.1).

Electric Shock Effects

Results of Investigations in America

THREE fundamental causes of electrocution are stated in *Electronics* (July, 1944) to be : Cessation of respiration due to a block in the associated part of the nervous system; reduction of blood circulation owing to ventricular fibrillation; overheating of the body. The determining factor is the amount of current that passes (more especially through the heart, brain and spinal column), the two-fold resistance being made up of the skin and of the internal organs. Dry skin has a resistivity of 70,000 to 100,000 ohms per sq. cm., which falls to less than one-hundredth of the value when the skin is wet. High voltages may puncture the skin, causing burns.

At 60 cycles per sec. currents of from 1 to 8 mA are just perceptible; between 8 and 15 mA they become painful, causing contraction of the muscles. Muscular control is lost between 15 and 20 mA. Currents of 20 to 50 mA passed between arms or an arm and leg involve chest muscles, resulting in difficult breathing, and 100 to 200 mA through the region of the heart produces ventricular fibrillation (unco-ordinated beating of the heart muscles). More than 200 mA causes burns; if the current path lies through the region of the heart, its action is suspended but generally is resumed after the passage has ceased. If the path involves nerves controlling respiration (*e.g.* hand to hand, hand to foot, head to hand) a block in the respiratory system is produced; artificial respiration, immediately applied, may restore natural breathing after as long as eight hours. In electrocution introduced as a death penalty in New York State in 1890, voltages of 1,200 to 1,700 are used with currents up to 8A for three to eight minutes.

Interference with Heart Action

Electrocardiograms from various animals indicate that susceptibility to fibrillation increases with current up to a maximum and then decreases. This accords with other observations that the proportion of resuscitations from high-voltage shocks in men goes up with increase in voltage. For shocks of short duration, fibrillation occurs only while contraction of muscles in the heart cycle is decreasing. Susceptibility to fibrillation increases suddenly as the shock length approaches the length of the heart cycle.

There is no practicable way of bringing a fibrillating heart into a normal beat. Although the application of a counter-shock of high intensity and short duration through the heart has proved successful in animals, the risk of worsening the victim's condition is considered too great for application to human beings. Conditions governing respiration differ from those involving the heart in that the nervous centre controlling the lungs is in the brain. The nerves being paralysed by the current no longer transmit stimuli to the lungs and resuscitation consists in supplying the vital cells of the body with oxygen. In the case of burns, death is due to the destruction of some vital organ or to hæmorrhage.

The current that can be tolerated either without distress by human beings or without causing death to animals rises rapidly with frequencies above 60 cycles per sec. The bearable DC voltage is about three times the AC value at power frequencies. Above 100 cycles the only result is in heating, the alternations being too rapid to affect nerve cells.

Voltage and Risk

Victims were revived in two-thirds of the accidents due to electricity alone occurring at less than 40 kV in Canadian and United States industry and in eight out of nine cases above that figure. This indicates that danger does not necessarily increase with voltage, either because the greater muscular reaction tends to throw the person clear of the live conductors or else because fibrillation does not occur with currents above 250 mA. Data are given to show that of those who fell clear of the conductors, 70 per cent. were revived and those who were pulled clear 63 per cent. The difference is less than might be expected, on account of the very short period of contact required to produce fibrillation or respiratory block; after that the effect is a heating of the body. If resuscitation is instituted immediately, the fatality rate can be reduced to 33 per cent.; others give 23 to 24 per cent. as an average.

From tabulated results of brief exposure to AC potentials, it appears that with a very low body resistance, about 1,000 ohms, death accompanied by slight burns is to be regarded as "certain" at 100 V, whereas at 1,000 V death is regarded as "probable" with marked burns, while at 10,000 V survival with very severe burns is to be expected. With a body resistance of 10,000 ohms, only painful shock would be experienced at 100 V and certain death (probably with slight burns) is shifted to the 1,000-V column and probable death (with severe burns) to the 10,000-V conditions. A high body resistance, about 100,000 ohms, with bad contacts would make 100 V practically innocuous, and 1,000-V shocks would be merely painful, but 10,000 V would have fatal consequences, though burns would be slight if resistance remained high.

I.E.E. Meetings

THE inaugural meeting of the 1944-45 Session of the Institution of Electrical Engineers was held on October 5th. The retiring President SIR STANLEY ANGWIN, who was in the chair at the opening of the proceedings, presented the premiums and certificates awarded by the Council for papers presented during the past Session, after which the new President, SIR HARRY RAILING, delivered his address which is given in abstract on another page. The vote of thanks to the new President was proposed by Dr. A. P. M. FLEMING who referred to the problems associated with the transition of the electrical industry from a war to a peace basis as likely to be no less difficult than those of the war period. Those governing bodies which might in future have to concern themselves with industry, should study the suggestions and conclusions in the address, which came from the leader of a great industrial enterprise and one intimately associated with world-wide engineering practice.

MR. PERCY GOOD, in seconding the vote of thanks, made the point that scientific training could be as cultural as any other and that the presidential address had made it clear that the scientific approach provided the essential basis on which to build a world richer in humanities. Sir Harry Railing was then invited to take the chair.

SIR NOEL ASHBRIDGE proposed and MR. T. G. N. HALDANE seconded the vote of thanks to the retiring president.

Scottish Centre.—COL. H. CARTER gave his chairman's address in Glasgow on October 10th and in Edinburgh on the following day. Other meetings arranged are as follows :—October 25th (Edinburgh) : Exploratory wireless meeting, with paper by B. J. Edwards on " A Survey of the Performance of Post-War Television." November 14th (Glasgow) : " An Analysis of the Load on a Modern Electricity Supply System," by P. Schiller. December 12th (Glasgow) and 13th (Edinburgh) : " The Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn. January 9th (Glasgow) : " Transmission and Distribution of Electricity to Mines," by B. L. Metcalf.

Western Centre.—Following the inaugural address by the chairman (J. MORGAN) at Bristol on October 9th, the next meeting is at Cardiff on November 13th when a paper on " Electrostatic Precipitation of Dust from Boiler Plant Flue Gases," will be submitted by J. Bruce. Subsequent meetings are :—December 11th (Bristol) : " The Influence of Maintenance Requirements on the Design of Electrical Installation Equipment," by Hamlyn Drake. January 8th (Cardiff) and 10th (Bristol) : Joint meetings with the Institution of Post Office Electrical Engineers to hear a paper by A. H. Mumford on " The Merging of Line and Radio Technique."

Forthcoming Events

Friday, October 13th.—*Bath.*—Pump Room, 7.15 p.m. I.E.E. Bristol Students' Section. Address by D. Garnett, chairman.

Manchester.—At Engineers' Club, 6 p.m. I.E.E. North-Western Radio Group. Chairman's address by G. J. S. Little, G.M.

Loughborough.—6.30 p.m. I.E.E. South Midland Students' Section. " An Introduction to Circuit Diagrams," by A. J. Lund.

Saturday, October 14th.—*Manchester.*—At Engineers' Club, 1.15 p.m. I.E.E. North-Western Students' Section. Lunch, followed at 2.30 p.m. by chairman's address.

Swansea.—I.E.E. West Wales (Swansea) Sub-Centre. Chairman's inaugural address, by Prof. R. O. Kapp.

Leeds.—Griffin Hotel, 2.30 p.m. I.E.E. North Midland Students' Section. " Plate Glass Manufacture with Electrical Applications," by J. W. Legard.

Monday, October 16th.—*London.*—At I.E.E., 7 p.m. London Students' Section. " Brains Trust " meeting.

Liverpool.—At Royal Institution, Colquitt Street, 5.30 p.m. I.E.E. Mersey and North Wales Centre. " Restriking Voltage as a Factor in the Performance, Rating and Selection of Circuit-breakers," by J. A. Harle and R. W. Wild. " The Influence of Resistance Switching on the Design of High-voltage Air-blast Circuit-breakers," by H. E. Cox and T. W. Wilcox.

Tuesday, October 17th.—*Stockport.*—At Mersey Hotel, 7.30 p.m. A.S.E.E. (Manchester Branch). Branch papers.

Wednesday, October 18th.—*London.*—At I.E.E., 5.30 p.m. Transmission Section. Inaugural address by H. W. Grimmitt.

Friday, October 20th.—*London.*—At I.E.E., 5.30 p.m. Measurements Section. Inaugural address by Dr. W. G. Radley.

London.—Institution of Mechanical Engineers, 5.30 p.m. Presidential address on " Applied Research " by Dr. H. R. Ricardo.

Newcastle-on-Tyne.—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. Address by the chairman, G. E. Topping.

Sheffield.—At Metallurgical Club, West Street, 6.30 p.m. Junior Institution of Engineers (Sheffield Section). Annual meeting and informal discussion.

Saturday, October 21st.—*London.*—At Lighting Service Bureau, 2, Savoy Hill, W.C.2., 2.15 p.m. Association of Supervising Electrical Engineers. Technical film display and presidential address.

Birmingham.—Grand Hotel, 12.30 for 1 p.m. I.E.E. South Midland Centre. Wartime lunch. Chairman's address and visit of Institution president.

Monday, October 23rd.—*London.*—At I.E.E., 5.30 p.m. Informal meeting. Discussion on " The Engineer's Part in Certain Post-War Problems," to be opened by the president.

Birmingham.—Grand Hotel, 6 p.m. Birmingham Electric Club. Paper on "High-frequency Induction Heating," by T. G. Tanner.

Newcastle-on-Tyne.—Neville Hall, 6.15 p.m. " Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn.

Engineers' Organisation

Better Service and Status

MR. WILLIAM KIDD, chairman of the North-Western Centre of the I.E.E., chose as the title of his address "Organisation of the Engineering Profession," his aim being to point to ways of improving the services of engineers to the public, and at the same time raising their status.

Starting at the beginning, Mr. Kidd emphasised the importance of ensuring that only young men with vision and ability to think clearly and constructively entered the profession and that they were given the correct kind of training. He preferred the full-time college course, with summer vacations spent in works, to the "sandwich" system with its too-long breaks. Also, education in large establishments was preferable as giving greater opportunities of association with other people with different interests. College staffs should be selected both for their ability and industrial experience and should be paid commensurately.

It was necessary that the public and employers should be able to assess professional men. To this end there should be national standards of qualification and means of making those standards known to technical men, the lay Press and the public. The standards would be of two classes—educational and practical. The former would comprise associateship of a technical college and degrees; the latter would be certified by the three leading institutions which had already made an effort to set similar standards for membership.

Engineers and Administration

Mr. Kidd maintained that it was untrue that engineers made bad managers. Technical knowledge was certainly no disadvantage in administration. All professional engineers should acquire some knowledge of business and management procedure.

Coming to the subject of remuneration, Mr. Kidd said that engineers were inadequately paid in comparison with those in the commercial sphere and the "closed" professions, in spite of their training and the value of their services. In this respect the value of economic associations was stressed, the A.M.E.E. and the E.P.E.A. being quoted as successful examples. It was advocated that the associations of professional engineers and technical workers should federate for negotiating strength while maintaining their sectional independence of management.

The function of the engineering institutions was mainly technical and educational and they should concentrate on this, leaving conditions of service, etc., to be dealt with by the economic associations. Apart from the three principal institutions there were many specialist associations. It was not the best technical organisation to have all these working independently. It was time that there was complete co-ordination between the three leading bodies with a combined syllabus of meetings which would be open to members of all three; any financial adjustment necessary would only be slight.

There was also a need for the further sectionalisation of the institutions to enable them to provide the required educational facilities. As regards the I.E.E. there should be monthly meetings of the four sections in the provinces. There must be a greater number of meetings and engineers in all branches of industry should be catered for by means of suitable papers.

The speaker concluded his address with an appeal to members to take a greater interest in the management of the Institution and to consider the preparation of papers, putting forward the fruits of knowledge and experience, which would be of value to fellow members.

Ferro-Magnetism

DURING the immediate pre-war decade substantial advances were made in the domain theory of ferro-magnetism, but investigational work on carefully prepared and highly purified single-crystal specimens often revealed a disappointing lack of accord between theory and observation.

In view of the importance of the subject in its relation to improvements in the ferro-magnetic performance of polycrystalline electrical sheet steels, which constitute the essential constructional foundation of electric generators, motors and transformers, a new survey has been made of the competency of the domain theory to account for the observed characteristics of such material. The results of this investigation are given in a paper on "The Magnetisation of Polycrystalline Iron and Iron-Silicon Alloys" which has been presented by G. C. RICHER (John Lysaght, Ltd.) to the Iron and Steel Institute.

The general conclusion arrived at is that the basic theory, in a very simple form, can provide reliable guidance for industrial effort, but that certain as yet unexplained but inherently significant disharmonies between theory and observation are common to laboratory single crystals and to commercial polycrystalline aggregates.

The survey has also yielded a new method o analysis of the technical magnetisation curve, which may be of general utility in assessing variations in the distribution of lattice orientation in ferromagnetic specimens.

Explosive Atmospheres

Flame-proof and Intrinsically Safe Apparatus

A REVIEW of research and testing with regard to " Flameproof Enclosures and Intrinsic Safety of Electrical Apparatus and Circuits " has been issued by the Ministry of Fuel and Power (Stationery Office, price 2s.). The importance of research in regard to routine testing is discussed in relation to apparatus used in coal mines and other places where explosive risks obtain. Proposals upon questions of policy and administration, with particular reference to closer and regular co-operation between all interested parties, are submitted for consideration. The report, of 66 pages, has been prepared by a technical committee comprising Dr. G. Allsop, Dr. J. T. Burdekin, Mr. J. A. B. Horsley, Dr. H. Lloyd, and Messrs, C. B. Platt and H. Rainford, all of whom are associated with research and testing in connection with mines.

A flame-proof enclosure is required (B.S. No. 229) to withstand, within its rating, any internal explosion of a prescribed gas under operating conditions and to prevent the transmission of flame such as will ignite this gas in the surrounding atmosphere. A circuit or apparatus is intrinsically safe when any normal sparking therein is incapable of causing an explosion of the prescribed gas.

Any flame, unless of extremely short dimension, can ignite inflammable gas or vapour, but the effective temperature is not the same in every case, so that the safe gap differs according to the gases inside and outside the enclosure. Incendivity of a spark from a quick break at up to 26 V is mainly determined by the inductance of the circuit. Control of the energy thus liberated is the basis of intrinsic safety.

Factors in Ignition

Whether ignition by a weak spark is due to heat or to excited electrons and molecules has not yet been decided. It is an involved function of voltage, current, inductance, mass, material and rate of separation of electrodes. It has been initiated in various ways, from adiabatic compression to sparks with an energy content of 0·005 joule or less.

The dimensions of a safe gap vary with the nature and concentration of the interior and exterior mixtures and the point of ignition of the former. It bears a roughly linear relationship to the speed of flame propagation. There is no sudden change from safety to danger as the gap varies. The safeguard it affords may be nullified by internal short-circuit or by use beyond the rating of the apparatus.

For the suppression of sparking in low-voltage inductive circuits, a non-inductive shunting resistance, a closed-circuit secondary winding or copper sleeve and a rectifier and a condenser have been employed, the choice depending on the class of apparatus and whether an AC or DC circuit is employed.

Intrinsic safety may be affected by external variables, such as the substitution of another source of energy or interconnection with another circuit that is not intrinsically safe or accidental injection of current from a power circuit. An insulation testing instrument may impart a dangerous charge to a circuit of high self-capacity.

The only essential difference between AC and DC in ignition by weak sparks is the slight possibility of an AC spark being drawn at the crest of the current wave, in which respect frequency and wave form may become factors. Ignitability varies with the nature and construction of the gas and with the manner in which the spark is produced, including the metal of the electrodes. There is no B.S. for the construction of intrinsically safe circuits or apparatus.

Since in routine testing of flame-proof structures it is impracticable to use a large number of inflammable gases, a representative gas has been adopted for each group, *viz.*, methane for Group 1, pentane for Group 2 and a mixture of metrane and hydrogen for Group 3.

Mechanisation of Industry

IN his presidential address of the Manchester Association of Engineers, Mr. H. H. Asbridge points out that Great Britain has been too prone to rely on the inherent skill of her workpeople, setting them problems and, as it were, leaving them to work out their own and, incidentally, the nation's salvation. That haphazard way has been successful, but the president believes the time is fast approaching when the country will be forced to train for the utilisation of a much higher degree of productivity by increasing the mechanisation of operations now performed manually.

The building of machine tools is not so much a key industry as the foundation of all engineering because without some form of machine, even of the crudest type, very little can be done. Any mechanical operation that will obviate hand work, particularly in finishing a job, is bound to play a big part in reducing the cost per piece, while naturally facilitating a much larger output per man-hour employed. So-called fitting must be replaced by real assembling.

Post-war industrialisation, especially in the British Dominions, does not mean that they will start at the bottom ; they will procure the latest types of plant available, so this country must beware of supplying better tools and equipment overseas than those it is using at home.

Parliamentary News

Public Utilities

IN the House of Commons on October 3rd, Miss Ward asked the Minister of Fuel and Power whether he could make a statement on the future re-equipment and expansion of public utility undertakings.

Major Lloyd George replied that his concern was with public utility undertakings supplying gas and electricity. He appointed some months ago a Committee of Inquiry into the structure and organisation of the gas industry and, until he received its report, he was not in a position to make any statement. With regard to electricity, he had been discussing with the associations of the industry proposals which they had put forward for the post-war period, but the Government had not yet reached any decision.

Black-out and Consumption

Replying to questions by Major Thorneycroft, the Minister said that while there would no doubt be some increase in the consumption of fuel as a result of the recent relaxation of lighting restrictions, it was not possible to form any reliable estimate of its extent. Moreover, it did not necessarily follow that, because in some areas "dim-out" conditions had now replaced black-out, there would in every case be an increase in the consumption of gas or electricity.

Water Power Resources

Mr. Ellis Smith asked the Minister when he expected to receive the Severn Hydro-electric Report and if he would appoint a water power resources committee, ask for a report upon the utilisation of tidal power and other water supplies that could be harnessed for hydro-electric power production and make a special investigation of the Conway, Mersey, Dee, Solway, Humber and Thames.

Major Lloyd George said that investigation into hydro-electric resources was proceeding in the North of Scotland, North Wales and in connection with a Severn Barrage. He was hoping very shortly to receive the report of the Committee on the last cheme. Until that was received and a decision reached, it would be premature to consider the appointment of a general water power resources committee.

In reply to Mr. M. Macmillan the Secretary of State for Scotland said he was informed that the North of Scotland Hydro-Electric Board was at present surveying the water power resources of the Outer Hebrides with a view to ascertaining how far they could be used for hydro-electric development. Until this survey had been completed it was impossible to say when a constructional scheme would be put forward.

Parts for Wireless Sets

Mr. Craik Henderson asked the President of the Board of Trade whether he would arrange for spare parts for wireless sets to be made available in larger quantities in view of the fact that new sets could not be produced and large numbers of existing sets were useless owing to small parts not being available.

Captain Waterhouse said he was glad to say that the improvement in the supply of components was continuing and the quantities available should be sufficient for the reasonable maintenance of sets in use. The supply of most types of valves was adequate but some special types were still rather short. The new sets of standard design for the civilian market were now being delivered to the shops.

Lincoln Inquiry

Cooling Towers and the Cathedral

A PUBLIC inquiry was held at Lincoln last week into the proposal to construct two 230-ft. cooling towers, with a base diameter of 160 ft. and 102 ft. at the top, as part of extensions planned at the St. Swithin's power station of the Corporation. The inquiry was conducted by Sir Cyril Hurcomb, chairman of the Electricity Commissioners, with whom were Sir Leonard Pearce (another Commissioner) and Mr. G. L. Pepler (of the Ministry of Town and Country Planning). The immediate proposal is for a scheme which would include one cooling tower, but it is proposed eventually to extend this, and all the models and photographic evidence submitted showed two towers.

For the Corporation, Mr. E. J. C. Neep, said that the station was important as the junction of lines to Rotherham, Grimsby, and Bourne, and the C.E.B.'s contention was that in view of future requirements it was right and urgent to extend at Lincoln. He explained that under a direction of the Board it was proposed to extend the St. Swithin's station, the present capacity of which was 10,000 kW, by the installation of a 20,000-kW turbo-alternator set, two boilers each having a maximum evaporative capacity of 120,000 lb. of steam per hour, together with the necessary ancillary plant and one cooling tower with a capacity of 1,500,000 gal. of water per hour. Under a further direction additional plant and a second cooling tower would be built. It was anticipated that by 1946-7 the load would be 44,000 kW; in the following year 46,000 kW; and in 1948-9 49,000 kW. The C.E.B. had asked that the extra plant should be brought into operation by September, 1946. The net result of the request was to bring the capacity of the station by that time up to 50,000 kW, and for this the existing cooling arrangements were not sufficient, and cooling towers were required. Eventually the capacity of the station was to be 80,000 kW. The actual expenditure on a 40,000-kW plant was estimated at £1,200,000. Only in one place could the towers interfere with the view of the cathedral.

Attracting New Industries

Mr. F. Newey (city electrical engineer) said that it was the city's aim to attract new light industries after the war and increased industrial and domestic demands were expected. He did not agree that there would be considerable precipitation of dirt and grit from the cooling towers. When the station was working at the full capacity of 80,000 kW 4,000,000 gal. of water would be circulated per hour and the rate of precipitation from the towers would be 0.87 per cent. It was very unlikely that the station would ever run for twenty-four hours a day at the full 80,000-kW capacity.

Mr. John Hacking, chief engineer to the Central Electricity Board, agreed, when it was suggested to him by counsel for the opposition, that there were sites on the banks of the River Trent which were suitable for development as generating stations, adding that he knew of

one in particular on which the Board did intend to develop a major station, possibly of 300,000 kW, or more if permission could be obtained to build a bigger station. He was satisfied that it was economically correct to extend the Lincoln station. The cost per kW of a new 40,000-kW station would be £39 compared with £30 at St. Swithin's. If a new station were built instead of extending St. Swithin's there would be an additional annual charge of £63,500 for five years and £17,500 a year afterwards for the remainder of the normal life of a generating plant, say fifteen years. The Lincoln cooling towers had been designed to reduce the risk of nuisance and would do so. In reply to Sir Cyril Hurcomb, he said that if the extensions did not materialise the Board would be deprived for all time from putting in the plant at Lincoln. The Board did not anticipate that the Lincoln station would work on a load of more than 33 per cent., and when the new Trent station was constructed and connected to Bourne it might be possible to reduce the ultimate development of the Lincoln station to 60,000 kW, for which three half-capacity cooling towers, approximately 160 ft. in height instead of 230 ft., and with a base diameter of 120 ft., would suffice.

Objections against the scheme were heard on the second day. In the opinion of the Dean of Lincoln, the Very Rev. R. A. Mitchell, there was no doubt that the cooling towers would spoil the view of the cathedral, the real peculiar splendour of which was not the inside but the outside. The towers might not block the view, but by being part of the landscape they would distract attention from everything else and spoil the perspective.

The Bishop of Lincoln, the Right Rev. H. A. Skelton (chairman of a committee of residents leading the opposition), stated that every member of the committee recognised the great desirability of having an adequate supply of cheap electricity, but hoped that some other suitable site might be found or some other method evolved of supplying it.

Supply in East Africa

Development Programme

PAST difficulties and future developments of electricity supply in East Africa were referred to by Major H. F. Ward, chairman of the East African Power & Lighting Co., Ltd., at the recent annual general meeting of the company. Increased demand for electricity from plant which the company has been unable to extend as it would have done normally, delays in delivery of replacements and spares, increased in some cases by losses at sea, have all imposed a heavy strain on a diminished staff. Inability under present conditions to recruit and train European and other staff has also added to the operating difficulties experienced.

Steady increases in sales of electricity by the company and its subsidiaries in Tanganyika since 1939 have resulted in the sale last year of 44 million kWh, an increase of 76 per cent. over the 1939 figure. The plant position has been somewhat alleviated by the delivery of some on order in 1939 and by the purchase of a quantity of second-hand plant which has been installed at the most needed points in the system. A temporary canal has also been constructed from the upper Mathioya River into the Maragua River, thus increasing the output at Nairobi by 500-750 kW.

Although some 3,000 kW of installed capacity has been procured from these various sources, still further extensions are now necessary. Accordingly arrangements have been made for an immediate programme of development comprising extensions in Nairobi, Eldoret and Kampala and at the Pangani hydro-electric station where the installed capacity is being increased by 7,500 kW to 12,500 kW, and which will be connected by transmission line with Mombasa. Certain smaller extensions at some of the up-country stations are also in hand. Thanks to the easing of war requirements, priorities for the manufacture of the necessary plant have been obtained and work on these extensions has commenced. A tentative programme of post-war development has also been formulated. To finance these additions to plant it is proposed to increase the authorised capital of the company from £1,250,000 to £1,500,000.

Contractors' Policy

Points in Post-War Planning

THE agenda for a recent South Wales regional conference of the Electrical Contractors' Association indicated very clearly the trend of electrical contractors' ideas and policy in relation to the post-war period. As this should interest a wider circle we extract the following details from the October *Electrical Contractor*.

The purpose of the meeting was to consider post-war planning as it affects the electrical contractor with particular regard to: (a) New entrants into the industry. (b) Relationship with labour and the introduction of a guaranteed working week. (c) Achievement of a compulsory Fair Trading Policy. (d) The establishment by the Association of conditions of tender and contract. (e) The desirability or otherwise of instituting minimum percentages to be added by members for overhead charges and profit. (f) The planning of a campaign to secure the employment of electrical contractors for maintenance purposes rather than by the employment of direct labour. (g) The launching by the Association of a national advertising campaign to combat supply authority competition. (h) In the absence of securing compulsory registration of electrical contractors and operatives, to inaugurate a permanent advertising campaign to secure public recognition of E.C.A. membership as opposed to non-members. (i) To regulate distribution of electrical merchandise and to consider what steps can be taken to restrict sales of such merchandise to those who are technically qualified. (j) To consider the establishment of collective showrooms by members of the E.C.A., whether under the auspices of the Association or not. (k) To consider the feasibility and desirability of grading electricians according to their skill and technical ability. (l) In the absence of compulsory registration of electrical contractors and operatives, and visualising the non-existence of the N.R.E.I.C., to consider the establishment by the E.C.A. of inspectors to ensure compliance by members of proper work and adherence to Association obligations.

ELECTRICITY SUPPLY

Manchester's Coal Problem. Sheffield Extensions.

Chesterfield.—TOWN HALL HEATING.—The Corporation is to seek the advice of a consultant in regard to the most suitable method of heating at the town hall.

SUPPLY TO FARM.—The Electricity Committee has obtained sanction to provide a supply to Manor House Farm, Winsick.

Glasgow. — COMMISSIONERS INTERVIEWED. — Representatives of Glasgow Corporation Electricity Committee have interviewed the Electricity Commissioners in London and received an assurance that their claim to increase charges will receive sympathetic consideration. Tariffs for electricity in Glasgow have not been raised since the outbreak of war.

ELECTRICITY FOR ESTATE.—The Housing Committee has consented to Strathclyde Electricity Supply Co., Ltd., laying underground cables, together with link and feeder pillars, for Mill Road housing scheme.

Liverpool.—REPORT ON BREAKDOWN.—The Electric Power and Lighting Committee has considered a report on the breakdown at the Clarence Dock power station on July 18th last, when the supply was interrupted over a large area of the city for a short time. In expressing appreciation of the services of the city electrical engineer and the power station staff in this emergency, it adds that in the Committee's opinion the latent defect left as the result of enemy action could not have been detected in advance, and that it will await the further report of the city electrical engineer on any additional steps which can be taken to obviate the possibility of a similar complete cessation of supply.

Manchester. — COST OF COAL. — Alderman W. Walker stated at Manchester City Council last week that during this year the Electricity Department would obtain the delivery of 701,000 tons of coal and the various increases of price imposed during the war would add over £600,000 to the cost. In addition, there was an extra £133,000 due to the lower calorific value of the coal they had to accept, cartage of incombustible material and reduced boiler efficiency, with further extra costs for the more frequent cleaning and repair of the boilers. Alderman Walker protested against the general mismanagement of the coal and fuel situation by the Government during the war.

MAXIMUM LIGHTING.—The City Council last week adopted a resolution for the maximum light permitted by the Ministry of Home Security to be extended to all streets in the city. The Highways Committee had proposed that the improved lighting should be confined to streets in which modified lighting was already installed.

POWER STATION PLANT. — The Electricity Committee is seeking sanction to borrow £189,170 for plant, cable work and buildings at the power station.

Newbury.—LIGHTING IN CENTRAL AREA.—The Highways Committee has approved a scheme submitted by the Wessex Electricity Co. for the provision of temporary electric street lighting in the central part of the town.

St. Andrews. — CHANGE OF LIGHTING SYSTEM UNDER CONSIDERATION.—The question of lighting streets of St. Andrews by electricity instead of gas as at present is being considered by the Town Council. It is recommended that as soon as circumstances permit the Electric Supply Corporation, Ltd., should put up six sets of lamps so that the effect could be ascertained. The capital cost of installing electric lighting is estimated at from £4,000 to £7,000.

Sedgley.—OVERHEAD LINES.—The Midland Electric Corporation for Power Distribution, Ltd., is to erect overhead lines to a housing site at Lower Gornal.

Sheffield.—POWER STATION EXTENSIONS.—The Electricity Committee has obtained sanction to borrow £450,000 for extensions at Blackburn Meadows station.

ELECTRICITY CHARGES AND RESERVE FUND.—It was recently reported that the City Council, having received a communication from the Electricity Commissioners regarding the increases in electricity charges approved by the Council, had decided to send a deputation either to the Minister of Fuel and Power or the Commissioners. The *Sheffield Telegraph* states that the facts appear to be that the Electricity Department is working at a loss, but the Commissioners think that the reserve fund should be reduced before charges are increased. It is felt, our contemporary says, "that no Government Department should reject the decision of a local authority representative of 500,000 people—the fifth city in the country—without hearing, or rehearing if necessary, the considered opinions on which the decision was taken."

Skipton. — TENANTS' WISHES. — Tenants of Council houses are being asked to express their views on how the designs of houses may be improved in post-war schemes. The questionnaire asks, among other things, whether solid fuel, electricity or gas is preferred for cooking; whether kitchen appliances should be built-in or movable; if they would be prepared to pay a small sum extra per week for a refrigerator; and if they would like a gas or electric water heater in addition to the usual back boiler.

South Shields.—CONVERSION OF STREET LIGHTING.—The acting borough engineer and the borough electrical engineer are to report to the Town Council on the conversion of the remaining gas street lighting to electricity.

SUPPLY TO FACTORY.—The Electricity Committee is applying for sanction to borrow £6,925 to supply electricity to a new factory.

Stirling.—CONTROL OF STREET LIGHTING.—The Lighting Committee is to report on a scheme for the remote control of electric street lamps for peacetime. The cost is estimated at £40,00.

Wainford. — ELECTRICITY A NECESSITY. — When the Rural District Council considered the question of electricity supplies in the area the chairman (Mr. C. S. Skinner) observed that electricity was a necessity, not a luxury. The clerk was instructed to write to the Electricity Commissioners to ascertain their post-war policy

regarding rural supplies. A representative of the East Anglian Electric Supply Co., Ltd., is to be invited to address the Council.

Wigan.—UNIFORM TARIFFS AND INCREASED DISCOUNT.—The Electricity Committee has decided to abolish the differentiation between the out-districts and the county borough with regard to electricity charges. It is also temporarily to increase the cash discount from 5 to 15 per cent.

Overseas

Australia.—BIG POST-WAR SCHEMES.—Projects submitted by the Sydney County Council to the N.S.W. State Committee which is co-ordinating post-war plans by public bodies will cost nearly £8,000,000. According to a report in the August issue of *Erda*, the main proposals, which cover the period 1946-50, are as follows :—Rebuilding and extending the Pyrmont power station, £4,000,000 ; extension of 33-kV transmission system and building of further major substations, £1,500,000 ; distribution improvements and extensions, £2,000,000 ; and new workshops, stores and depots, £350,000.

PLANT FOR PYRMONT.—*Tenders* (Melbourne) states that the Sydney County Council has placed a contract with the Australian General Electric Pty., Ltd., for a 50,000-kW turbo-alternator set to be supplied through the Metropolitan-Vickers Electrical Export Co., Ltd., together with condensing and feed heater plant to be manufactured by Thompsons Engineering & Pipe Co., Ltd. The plant is for installation in the Pyrmont power station and the total price is approximately £492,882. Spare parts to the value of £61,528 are also to be purchased.

TRANSPORT

Manchester. — TUBE SCHEME REJECTED. — A joint meeting of the Manchester Post-War Reconstruction, Town Planning and Transport Committees last week rejected the proposal for a £38,000,000 scheme for a Manchester tube railway system. The view of the meeting was that a tube system would not relieve traffic congestion and would not justify the financial outlay, also that the question of the electrification of the existing railways required further consideration.

St. Helens.—TROLLEY-BUS ORDER EXTENDED. —The Minister of Transport has made the St. Helens Corporation (Extension of Time) Order, 1944 (S.R. & O. 1944 No. 1050). This extends for three years the time for the commencement of trolley-bus services along Routes 1 and 3-8, as authorised by an Order obtained in 1939.

Southend-on-Sea.—EXTENSION OF TIME LIMIT.—By the Southend-on-Sea Corporation (Extension of Time) Order, 1944 (S.R. & O. 1944 No. 1052) the time limit for starting trolley-bus services along the whole of Route 1 is extended by three years.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The London Electrical & General Trust, Ltd.—At the annual general meeting on October 5th, Mr. A. H. Wynn, who presided in the absence of Mr. A. R. Guinness, the chairman, said that the directors considered the results for the past year satisfactory but reminded shareholders that the conversion of maturing fixed-interest securities to a lower rate of interest was still proceeding, and the current yields on first class British equities were now little more than those offered by fixed-interest securities. The market value of the company's investments was again higher and showed an appreciation of 12¼ per cent. on the value given in the balance sheet. This meant that their capital and surplus were intact with a margin of £125,000. Over 80 per cent. of their investments were in Great Britain and the Empire.

The Barcelona Traction, Light & Power Co., Ltd.—In presenting the report and accounts for 1943 at the annual general meeting held in Toronto on September 22nd Mr. Henry Special, the president, said that exchange restrictions still prevented the remittance of funds from Spain except for the purchase of materials and equipment. It had therefore been impossible as yet to resume any payment of interest on the prior lien or first mortgage bonds. This important and difficult problem was, however, receiving constant attention. Not only had the cost of electrical construction work increased but operating expenses had risen very greatly, and it was therefore essential that these should be compensated by a corresponding increase in the selling price of electricity. Some companies had already obtained an initial, if insufficient, increase in their rates, but the case of their companies had not yet been examined.

The Ransome & Marles Bearing Co., Ltd. records a net profit for year ended June 30th of £123,134 as compared with £122,699 in the previous year. These figures are arrived at after providing for taxation and depreciation. A final dividend of 11 per cent. is to be paid, again making 20 per cent. and £85,348 (£78,928) is carried forward.

The Para Electric Railways & Lighting Co., Ltd., reports gross revenue of £186,419, as compared with £162,455 for the previous year. There was a net loss of £38,024, as compared with £33,206, the debit carried forward being increased from £68,218 to £106,242.

The Metropolitan Electric Cable & Construction Co., Ltd., is to pay an interim dividend of 5 per cent., double the amount of last year's interim.

Bennis Combustion, Ltd., is maintaining its ordinary dividend for 1943-44 at 10 per cent. The net profit was £12,184, as compared with £25,570 for 1942-43.

Herbert Morris, Ltd., from a profit of £145,683 for 1943-44 (against £125,444), are paying a final ordinary dividend of 15 per cent., tax free, again making 20 per cent., tax free.

The Cables Investment Trust, Ltd., is again paying a final dividend of 3 per cent., making 5 per cent. (same).

Pinchin, Johnson & Co., Ltd., are maintaining an interim dividend at 2½ per cent.

Ransomes & Rapier, Ltd., are paying an interim dividend of 2 per cent., tax free (same).

The Ever Ready Trust, Ltd., has declared an interim dividend of 3 per cent. (same) in the ordinary and deferred shares.

New Companies

Playle of Maldon, Ltd.—Private company. Registered September 30th. Capital, £3,000. Objects: To acquire the business of electrical and refrigeration engineers, and contractors, and manufacturers carried on by A. S. Playle at Electric House, High Street, Maldon, Essex, as Playle of Maldon. First directors: A. S. Playle and Mrs. A. V. Playle, both of The Temples, Witham, Essex. Registered offices: Electric House, High Street, Maldon, Essex.

Weldonia Radio Accessories, Ltd.—Private company. Registered September 16th. Capital, £200. Objects: To carry on the business of manufacturers of, and dealers in, radio, electronic and electrical apparatus, etc. Directors: Marjorie D. Franklin, Weldonia, The Avenue, N.3, and F. S. Franklin, 73, Byng Drive, Potters Bar, Middlesex. Solicitors: Price & Williams, 38, Great James Street, W.C.1. Registered office: 38, Great James Street, Bedford Row, W.C.1.

Scott Leighton Safety Guard & Engineering Co. (London), Ltd.—Private company. Registered September 26th. Capital, £100. Objects: To carry on the business of electrical, motor and general engineers, wireless dealers, etc. Subscribers: F. O. Scott-Leighton, 68, Morsehead Mansions, Maida Vale; and N. C. Robertson, 50, Marlborough Place, N.W.8. Secretary: S. J. Chubb.

E. R. (Factors), Ltd.—Private company. Registered October 2nd. Capital, £100. Objects: To carry on the business of electrical and wireless engineers and contractors, etc. Directors: C. W. Edwards, 16, Chelmsford Square, N.W.10, electrical engineer; and H. Lasky, 9, Brockley Avenue, Stanmore, Middlesex, radio engineer. Registered office: 4, Woodfield Crescent, W.9.

Tates Radio Co., Ltd.—Private company. Registered September 19th. Capital, £1,000. Objects: To acquire the business of an electrical and radio engineer carried on by Wm. Tate at 33, Nile Street, North Shields. Directors: Wm. Tate and Mrs. Olive C. Tate, both of 9, Millfields Gardens, Hexham. Registered office: 33, Nile Street, North Shields.

A. E. Powell, Ltd.—Private company. Registered September 26th. Capital, £2,000. Objects: To carry on the business of manufacturers of, and dealers in, wireless and television sets, electrical apparatus and accessories, etc. Directors: A. E. Powell and Mrs. M. Powell, 49, Kew Road, Richmond, Surrey.

Companies to be Struck off Register

The following companies will be struck off the Register at the expiration of three months from September 29th unless cause is shown to the contrary:—Gainsborough Radio, Ltd.; Pluperfect Refrigeration Co., Ltd.

Companies' Returns

Statements of Capital

Seaford & Newhaven Electricity, Ltd.—Capital, £120,000 in £1 shares. Return dated May 3rd. All shares taken up. £106,000 paid (£1 on 92,000 shares and 10s. on 28,000). Mortgages and charges: Nil.

South Somerset & District Electricity, Ltd.—Capital, £200,000 in £1 shares (all ordinary). Return dated March 20th (filed May 3rd). All shares taken up. £206,531 5s. 0d. paid, including £6,531 5s. in respect of premiums on 55,000 shares. Mortgages and charges: Nil.

Chasetown & District Electricity Co., Ltd.—Capital, £100,000 in £1 shares. Return dated April 9th. 63,130 shares taken up. £1,000 paid. £62,130 considered as paid. Mortgages and charges: Nil.

Electrical Appliances Guarantee Co., Ltd.—Capital, £1,000 in £1 shares (all ordinary). Return dated April 14th. 800 shares taken up. £800 paid. Mortgages and charges: Nil.

H. J. Cash & Co., Ltd.—Capital, £25,000 in £1 shares. Return dated April 13th. 20,000 shares taken up. £15,000 paid. £5,000 considered as paid. Mortgages and charges: Nil.

Increases of Capital

Vactric, Ltd.—The nominal capital has been increased by the addition of £150,000 beyond the registered capital of £250,000. The additional capital is divided into 600,000 ordinary shares of 5s. each.

Mortgages and Charges

Radio Electrical & Television Co., Ltd.—Mortgage registered September 22nd, to secure £732 and further advances, charged on 76a, Greenway Road, Runcorn. Holders: Leigh Permanent Building Society.

Davey, Paxman & Co., Ltd.—Mortgage and further charge on properties in Colchester, dated September 12th, to secure £340. Holders: Trustees of the Colchester Permanent Benefit Building Society.

Adelaide Electric Supply Co., Ltd.—Satisfaction in full on September 1st, of mortgage or charge dated August 28th, 1929, and registered August 29th, 1929, securing £250,000.

Nevelin Electric Co., Ltd.—Memorandum of deposit of deeds of land and premises in Purley Way, Waddon, Croydon, with fixtures, dated August 30th, to secure all moneys due or to become due from the company to Westminster Bank, Ltd.

De Renzi, Holmes & Co., Ltd.—Satisfaction in full on September 14th, of debenture dated October 7th, 1943, and registered October 11th, 1943.

Liquidations

Shirebrook Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. Gadsby, 17, Gluman Gate, Chesterfield.

Brimington Electric Supply Co., Ltd.—Winding up voluntarily. Liquidator, Mr. J. Gadsby, 17, Gluman Gate, Chesterfield.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange business is running on quiet lines. There is little in any of the markets to attract especial attention, save in that for radio and kindred companies' shares. The front rank industrials hold their prices with firmness, but it is noticeable that where, a month or two ago, to sell several thousand shares was in many cases an easy matter, to-day the buyers seem to be less ready to take anything that approaches a line. Plenty of money is available for investment, and the character of the war news is considered good enough to warrant cheerfulness as regards the outlook.

Effect of T.U.C. Report

This week the General Council of the Trades Union Congress meets at Blackpool, and its report, published in advance, contains sweeping recommendations in the direction of nationalisation, not so much of industry as of industries. The effect of this publication has been to introduce a fresh element of caution into investment and speculative business. Well-known industrial companies are declaring similar dividends, interim or final, to those of a year ago, but these have failed to have any noticeable effect upon prices. So far as the T.U.C. report goes, its suggestions are so extensive as to preclude the likelihood of their being adopted in anything like their entirety. In the meantime, however, they exert a certain amount of influence over the investment of money.

Domestic Securities

Richmond Electrics are a good example of shares which rarely fluctuate in price. Last week, however, the quotation rose 6d. to 26s. The company is a baby of the County of London Electric Supply. County ordinary and Northmet ordinary are easier. Northamptons have gone back to 50s. Scottish Power eased off to 40s. 6d. In the equipment and manufacturing group, Lancashire Dynamo are 2s. up, at 96s. 6d. General Electrics further improved to 93s. 3d. Hall Telephones are 1s. better at 31s. Gains of 6d. lifted Tube Investments to 95s. 6d., Walsall Conduits to 49s. 6d., and Telephone Rentals to 11s. 9d. The Home Railway market is passive. Inquiry for preference shares is returning, and Edmundsons sevens, as an example, at 35s. 6d. are 1s. higher on the week. De la Rue ordinary at 93s. 8d. show a gain of $\frac{1}{16}$.

W. T. Henley's Dividend

W. T. Henley's Telegraph Works have declared the usual interim dividend of 5 per cent., this making the eighth in the series which started for the year ended December 31st, 1937. Since then, the total distribution for each year has been brought up to 20 per cent. The company occupies an extremely strong financial position. At the end of December last year there was £207,800 cash: the stock item stood at £1½ million. The profit and loss account showed £398,000. The capital is £1½ million, of which £1,300,000 is in ordinary stock of 5s. units, the other £200,000 being represented by 4½ per cent. preference stock in £1 units. The present price of the ordinary shares, 25s. 9d., allows a yield on the money of £3 17s. 8d. per cent., which in itself is evidence of the respect in which the investment is held. The fluctuations in the quotations are, as a rule, within narrow limits. That the company will be fully employed with profitable work after the war is taken as being a matter of course.

Prices and Yields

British Insulated can be bought at 107s., to give a return of £3 14s. 9d. per cent. Callender's cost about 1s. less and, at 106s., the yield is £3 15s. 5d., the two companies, like W. T. Henley's, are paying 20 per cent. on their ordinary shares. Johnson & Phillips at 75s. return 4 per cent. Enfield Cables, at 61s. ex dividend, give £4 2s. and Automatic Telephones, at 60s. 6d., yield a trifle over 4 per cent. on the money. Siemens at 35s. give 4½ per cent. The yield on London Electric Wire and Smiths at 38s. 6d.—and 500 shares are offered at this price—comes to £3 18s. Of Globe Telegraph & Trust ordinary shares there are 5,000 offered at 39s. 6d. The company has paid 5 per cent. free of tax annually for some years past, and the yield at 39s. 6d. is £2 10s. 7d. net, equivalent to £5 1s. 2d. with tax at 10s.

Miscellaneous Matters

British Electric Traction deferred is quoted 30 points lower at 1195. Calcutta Trams are jumpy. From 63s. the price rose to 69s. before it reacted to 67s. 6d. Argentine Tramways stocks went better because another Argentine company, the Primitiva Gas, has been accorded better terms by the Argentine Government than those originally offered. Brazilian Tractions keep their rise, reflecting the satisfaction felt with the recently increased dividend. Amongst other movements in Overseas stocks, a fall of 3 points lowered Tokyo sixes to 27. Canadian dollar stocks are down. Perak Hydro-Electrics, at 13s. 6d., have lost 6d.

Murex

Murex, Ltd., did less well in the year which finished last June than in the previous twelve months, the profit, as mentioned in last week's *Electrical Review*, being about £78,000 down. The company is, however, paying the same dividend. 10 per cent.,

(*Continued on page* 538)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Oct. 10	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	12½	12½	64/6	..	3 17 4
Bristol Power and Lights	7	7	33/6	..	4 3 7
City of London ..	7	3½	30/–	..	3 13 4
Clyde Valley ..	8	8	42/–	..	3 16 0
Consty of London	8	8	44/6	–6d.	3 12 1
Edmundsons :					
7% Pref. ..	7	7	35/6	+1/–	3 19 0
Ord.	6	6	31/–	..	3 17 5
Elec. Inv. Yorkshire	9	9	45/6	..	3 19 6
Elec. Fin. and Securities ..	12½	12½	60/–	..	4 10 0
Elec. Supply Corporation ..	10	10	48/6	..	4 2 4
Isle of Thanet ..	Nil	Nil	29/6	..	—
Lancs. Light and Power ..	7½	7½	37/–	..	4 1 1
Liverpool Elec. ..	6	6	26/6	..	4 10 7
Lond. Assoc. Electric	3	4	26/–	..	3 1 6
London Electric ..	6	6	30/6	..	3 18 8
London Power Ord.	5	5	103½	..	4 16 7
Metropolitan E.S.	8	8	44/–	..	3 12 9
Midland Counties	8	8	41/6	..	3 17 0
Mid. Elec. Power	9	9	44/6xd	+3d.	4 1 0
Newcastle Elec. ..	7	7	31/6	..	4 9 0
North Eastern Elec. :					
Ordinary ..	7	7	35/–	..	4 0 0
7% Pref. ..	7	7	35/–	..	4 0 0
Northampton ..	10	10	50/–	–6d.	4 0 0
Notting Hill 6% Pref. (£10) ..	6	Nil	10½	..	—
Northmet Power :					
Ordinary ..	7	7	45/6	–1/–	3 4 4
6% Pref. ..	6	6	30/6	..	3 18 8
Richmond Elec.	6	6	29/–	+6d.	4 12 4
Scottish Power ..	8	8	40/6	–6d.	3 19 0
Southern Areas	5	5	22/–	..	4 7 0
South London ..	7	7	29/–	..	4 16 7
West Devon ..	5	5	23/6	..	4 5 1
West Glos. ..	4½	3½	24/6	..	2 17 0
Yorkshire Elec. ..	8	8	45/–	..	3 14 5
Overseas Electricity Companies					
Atlas Elec. ..	Nil	Nil	7/6	..	—
Calcutta Elec. ..	6*	6*	47/–	–6d.	2 11 1
Canadian Elec. ..	10	7	40/–	..	3 10 0
East African Power	7	7	34/6	..	4 1 4
Jerusalem Elec. ..	7	5	29/6	..	3 8 0
Kalgoorlie (10/–)	5	5	11/6	..	4 7 0
Madras Elec. ..	Nil	4	20/–	..	2 13 4
Montreal Power	1½	1½	23½	–½	—
Palestine Elec. "A"	5*	5*	40/–	..	2 10 0
Perak Hydro-elec.	6	7	13/6	–6d.	—
Shawinigan Power	8cts.	8cts.	16	..	—
Tokyo Elec. 6%	6	6	27	–1	—
Victoria Falls Power	15	15	4½	..	3 10 7
Whitehall Elec. Pref.	—	6	25/6	..	4 14 0

Company	Dividend Previous	Dividend Last	Middle Price Oct. 10	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity :					
1955–60 (Civil Defence) ..	3	3	100	..	3 0 0
1955–75 ..	5	5	114½	..	4 7 4
1951–75 ..	4½	4½	107	..	4 4 1
1965–95 ..	3½	3½	104½	..	3 7 0
1974–94 ..	3½	3½	100xd	..	3 5 0
London Elec. Trans. Ltd.	2½	2½	95½	+1	2 10 9
London & Home Counties 1955–75	4½	4½	112	..	4 0 4
Lond. Pass. Trans. B.I.					
A	4½	4½	120½	..	3 14 5
B	5	5	121½	..	4 2 4
C	3	3½	68	..	4 15 7
West Midlands J.E.A. 1948–68 ..	5	5	106½	..	4 14 0
Telegraph and Telephone					
Anglo-Am. Tel. :					
Pref.	6	6	123	..	4 17 7
Def.	1½	1½	30	..	5 0 0
Anglo-Portuguese	8	8	28/–	–6d.	5 14 4
Cable & Wireless :					
5½% Pref. ..	5½	5½	115½	+½	4 15 3
Ord.	4	4	82	..	4 17 9
Canadian Marconi $1	Nil	4cts.	9/–	..	—
Globe Tel. & Tel. :					
Ord.	5½*	5*	39/6	..	2 10 5
Pref.	6	6	30/6	..	3 18 8
Great Northern Tel. (£10)	Nil	Nil	30	..	—
Inter. Tel. & Tel.	Nil	Nil	21½	..	—
Marconi-Marine ..	7½	7½	36/–	..	4 3 4
Oriental Tel. Ord.	16	10	50/–	–6d.	—
Telephone Props.	Nil	6	22/6	..	5 6 5
Tele. Rentals (5/–)	10	10	11/9	–6d.	4 5 0
Traction and Transport					
Anglo-Arg. Trams :					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	7½	+½	—
Bois. Elec. Traction:					
Def. Ord. ..	45	45	1195	–30	3 15 4
Pref. Ord. ..	8	8	180	..	4 9 0
Bristol Trams ..	10	10	57/–	..	3 10 2
Brazil Traction ..	1½	2	27	..	7 8 2
Calcutta Trams ..	6½	7½	67/6	+3/–	2 4 0
Cape Elec. Trams	5	6	25/6	..	4 14 1
Lancs. Transport	10	10	45/6	..	4 8 0
Mexican Light :					
1st Bonds ..	5	5	105½	..	4 14 9
Rio 5% Bonds ..	5	5	106½xd	+1	4 14 0
Southern Rly. :					
5% Pref. ..	5	5	74	..	6 15 2
5% Pref. ..	5	5	114½	..	4 7 4
T. Tilling ..	10	10	60/–	..	3 6 8
Wess Tilling ..	10	10	46/–	..	4 7 0

(Continued on next page)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Oct. 10	Rise or Fall	Yield £ s. d.
Equipment and Manufacturing					
Aron.Elec.Ord.	10	15	61/–	..	4 18 4
Assoc. Elec.:					
Ord.	10	10	51/–	..	3 18 4
Pref.	8	8	39/–	..	4 2 0
Automatic Tel.& El.	12½	12½	60/6	..	4 2 4
Babcock & Wilcox	11	11	49/6	..	4 8 9
British Aluminium	10	10	47/–	..	4 5 1
British Insul. Ord.	20	20	5 5/16	..	3 15 6
British Thermostat (5/–)	18½	18½	20/–	..	4 12 6
British Vac. Cleaner (5/–)	30	30	29/–	..	5 3 5
Brush Ord. (5/–)	8	9	10/9	..	4 3 9
Burco (5/–)	15	17½	17/–	..	5 3 0
Callender's	15	20	5¼	..	3 16 2
ChlorideElec.Storage	15	15	87/6	..	3 8 7
Cole, E. K. (5/–)	10	15	32/–	..	2 6 11
Consolidated Signal	24	27½	6⅝	..	4 3 6
Cossor, A. C. (5/–)	7½*	10*	25/–	–6d.	2 0 0
Crabtree (10/–)	17½	17½	41/–	..	4 5 4
Crompton Parkinson Ord. (5/–)	20	22½	32/–	..	3 7 3
E.M.I. (10/–)	6	8	34/9	+1/16	2 6 0
Elec. Construction	10	12½	57/–	..	4 7 9
Enfield Cable Ord.	12½	12½	61/–xd	..	4 2 0
English Electric.	10	10	50/6	..	3 19 0
Ensign Lamps (5/–)	25	15	21/3	..	3 10 8
Ericsson Tel. (5/–)	22*	20*	51/3	..	1 19 1
Ever Ready (5/–)	40	40	41/-	..	4 17 5
Falk Stadelmann	7½	7½	34/6	..	4 7 0
Ferranti Pref.	7	7	31/3	..	4 9 7
G.E.C.:					
Pref.	6½	6½	32/9	+3d.	3 19 4
Ord.	17½	17½	93/3	+9d.	3 15 1
General Cable (5/–)	15	15	15/–	..	5 0 0
Greenwood & Batley	15	15	43/9	..	6 17 0
HallTelephone(10/–)	12½	12½	31/–	+6d.	4 0 8
Henley's (5/–)	20	20	25/9	–6d.	3 17 8
4½% Pref.	4½	4½	24/–	..	3 15 0
Hopkinsons	15	17½	69/3	..	5 1 1
India Rubber Pref.	5½	5½	23/–	..	4 15 9
Intl. Combustion	30	30	6⅞	..	4 10 8
Johnson & Phillips	15	15	75/–	..	4 0 0
Lancashire Dynamo	22½	22½	96/6	+2/–	4 13 5
Laurence,Scott(5/–)	12½	12½	13/–	..	4 16 2
London Elec. Wire	7½	7½	37/6	..	4 0 0
Mather & Platt..	10	10	51/3	..	3 18 0
Metal Industries (B)	8	8½	50/6	..	3 7 6
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Murex	20	20	95/–	..	4 4 4
Pye Deferred (5/–)	25	25	33/9	..	3 14 5
Revo (10/–)	17½	17½	40/–	..	4 7 6
Reyrolle	12½	12½	72/6	..	3 9 1
Siemens Ord.	7½	7½	35/–	..	4 5 9
Strand Elec. (5/–)	7½	10	8/9	..	5 14 4
Switchgear & Cowans (5/–)	20	20	19/–	..	5 5 1
T.C.C. (10/–)	5	7½	22/6	..	3 6 8
T.C. & M.	10	10	56/–	..	3 11 6
TelephoneMfg.(5/–)	9	9	11/6	..	3 18 3
Thorn Elec. (5/–)	20	20	25/–	..	4 0 0
Tube Investments	20	20	95/6	+6d.	4 3 8
Vactric (5/–)	Nil	22½	16/6	..	6 16 3
Veritys (5/–)	7½	7½	8/–	..	4 13 9
Walsall Conduits(4/–)	55	55	49/6	+6d.	4 9 0
Ward & Goldstone (5/–)	20	20	30/–	..	3 6 8
WestinghouseBrake	12½	14	75/–	..	3 14 8
West, Allen (5/–)	7½	7½	7/9	..	4 16 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 536)

with a cash bonus of 2½ per cent. making 20 per cent. for the year and so adding one more to the seven past years when a similar dividend and bonus have been distributed. The price of the shares, after dipping to 92s. 6d. on the lower profit, hardened again to 95s., buyers being attracted by the fall. At the end of June, 1943, the company had £251,000 in cash. Patents, rights and goodwill are written down to £1. The accounts for the past year were expected to show the company to be in a sound position, notwithstanding the decline in profits. The highest price reached in recent years was 111s. in 1943; the lowest, 45s. in 1940.

Radio Shares

E.M.I. shares are an outstandingly good feature with a rise of 1s. 3d. to 34s. 9d. Rumour has been busy linking the name of the company to that of another, but television continues the main prop for optimism. Cossors are a trifle easier at 25s. E. K. Cole remain at 32s. and Pye deferred at 33s. 9d. Stone Lighting & Radio have eased off to 7s. 6d. Philco, at 13s., are practically unchanged on the week. The new shares are about the same price as the old. The 6 per cent. redeemable preference change hands on the basis of 22s. 6d.

Isle of Thanet

It is announced that the Isle of Thanet Electric Supply Co. will be taken over by the Margate Corporation and the Broadstairs and St. Peters U.D.C. at the end of this year. The purchase price is to be the value of the undertaking on December 31st., 1935, plus adjustments for subsequent capital expenditure, etc. The present price of the shares is 19s. 6d. and there is an amount of £215,000 in 4 per cent. debenture. The purchase price was determined by the original concession. The company paid 4 per cent. dividends annually from 1930–38 inclusive; for 1939 the dividend was 2 per cent. and nothing has been paid since. Shares change hands occasionally, the last transaction being at 19s. 9d. in September. The local authorities have the right to purchase the company's undertaking in 1945 or in any subsequent ten years. The transaction of purchase and sale is subject to the approval of the Electricity Commissioners.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

ALPHA Accessories, Ltd. and P. G. Wardle. —" Electric dry batteries." 17830. December 15th, 1942. (564264.)

Arrow Electric Switches, Ltd.—" Contact structures for electric switches." 10412/43. July 15th, 1942. (564334.) " Slow make-and-break electric switches." 10413/43. July 23rd, 1942. (564335.)

Automatic Telephone & Electric Co., Ltd. (Associated Electric Laboratories, Inc.).—" Electrical signalling systems." 4491. March 19th, 1943. (564320.)

J. R. Bateman.—" Adjustable holders or supports for electric lamps and like purposes." 9728. June 17th, 1943. (564240.)

Birmingham Electric Furnaces, Ltd., and P. F. Hancock.—" Gas carburising process." 11182. July 3rd, 1940. (564345.)

Birmingham Electric Furnaces, Ltd., and A. G. E. Robiette.—" Manufacture or production of malleable iron." 4499. April 4th, 1941. (564252.)

British Insulated Cables, Ltd., H. M. Steward, R. Blackburn, H. R. F. Carsten and J. L. Packer.—" Extrusion of thermo-plastic materials." 4637. March 22nd, 1943. (564324.)

British Thomson-Houston Co., Ltd.—" High-frequency electron-discharge amplifiers." 9808/43. June 22nd, 1942. (564243.) " Methods of producing blocking layer devices in dry-plate rectifiers." 9810/43. June 22nd, 1942. (564244.) " Inorganic moulding compositions and products produced therefrom." 17423/42. December 18th, 1941. (564263.)

G. R. A. Carr.—" Filled cable-end boxes." 17396. December 7th, 1942. (564354.)

J. A. Crabtree & Co., Ltd., R. F. McLoughlin, W. E. Hill, R. W. Morgan and T. D. G. Wintle. —" Sockets for electric couplings." 3955. March 11th, 1943. (564368.)

Duratube & Wire, Ltd., and J. Veit.—" Manufacture of insulated electrical conductors." 9813. June 18th, 1943. (564245.)

Evershed & Vignoles, Ltd., and J. C. Needham.—" Mechanism for causing a controlled or driven appliance to follow the movements of an initiating device." 6429. April 21st, 1943. (564224.)

H. Fell.—" Means for holding objects and electric switch operating mechanism." Cognate applications 6963/43 and 8265/44. May 3rd, 1943. (564226.)

E. Frank.—" Electric tumbler switches." 4368. March 17th, 1943. (564275.)

General Electric Co., Ltd. and J. B. L. Foot.— " Frequency-discriminating electric circuits." 9661. June 16th, 1943. (564236.)

General Electric Co., Ltd., and L. C. Stenning. —" Frequency modulators." 9660. June 16th, 1943. (564331.)

Hammond & King, Ltd., and T. H. King.— " Electric heating element." 4385. March 18th, 1943. (564276.)

Landis & Gyr Soc. Anon.—" Electromagnetic apparatus with tilting armatures, more especially tilting relays." 11647/42. August 21st, 1941. (564351.)

Linde Air Products Co.—" Electric welding." 8158/43. May 22nd, 1942. (564231.)

Marconi's Wireless Telegraph Co., Ltd.— " Monitor for frequency modulated waves." 9851/43. June 19th, 1942. (564247.) " Cooling systems suitable for electron-discharge devices." 18546/42. December 31st, 1941. (564357.)

Sangamo Weston, Ltd.—" Photo-electric cells." 5777/43. July 22nd, 1942. (564222.)

Standard Telephones & Cables, Ltd.— " Clutch for telecommunication selector switch." 9838/43. July 15th, 1942. (564246.)

Standard Telephones & Cables, Ltd., and M. M. Levy.—" Thermionic valve circuits." 4487. March 19th, 1943. (564319.)

C. R. Thatcher.—" Insulated holders for welding electrodes." 7455. May 11th, 1943. (564229.)

Udylite Corporation.—" Electro-deposition of nickel." 8408/43. August 27th, 1942. (564232.)

J. V. Wallgren and D. V. L. Lindstrom.— " Method of temporarily repairing electric cables damaged by moisture and device for performing said method." 9733. June 17th, 1943. (564241.)

Whipp & Bourne, Ltd., and I. T. L. Whipp.— " Electric circuit-breakers and contacts therefor." 10176. June 24th, 1943. (564308.)

E. L. C. White.—" Thermionic valve amplifier circuit arrangements." 13972. September 7th, 1940. (564250.)

TRADE MARK APPLICATIONS

THE following applications have been received for trade marks. Objections may be made within a month from October 4th :—

LIBERATOR. No. 630,183, Class 9. Electric vacuum cleaners, bells, chimes, fire alarms, measuring instruments and apparatus, soldering irons and electrical apparatus (not included in other classes) for household purposes. Also No. 630,184, Class 11. Cooking, heating and refrigerating apparatus; electric lamps, fans, torches, drying apparatus for domestic purposes.—Wizard Production Co., Ltd., 16, Withy Grove, Manchester, 4.

GENTS' OF LEICESTER (design). No. 628,354, Class 9. Electrical instruments and apparatus not included in other classes; signalling, indicating and alarm instruments and apparatus; measuring apparatus with recording parts; telephones, time switches, time recording and registering apparatus. Also No. 628,355, Class 14. Horological and chronometric instruments.—Gent & Co., Ltd., Faraday Works, Leicester.

CARLEC. No. 627,959, Class 11. Heating apparatus and installations; cooking and baking stoves and ovens.—Carlisle Electrical Manufacturing Co., Ltd., Bentcliffe Works, Salters Lane, Eccles, Lancs.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—NEW SOUTH WALES.—November 2nd. Sydney County Council Electricity Undertaking. L.v. feeder voltage regulating transformer. Spec. 717.

QUEENSLAND.—November 15th. Motor-driven and turbine-driven boiler feed pumps. Spec. 375. City Electric Light Co., Ltd., Boundary Street, Brisbane.

Manchester.—October 23rd. Electricity Dept. Water cooling tower, mercury arc rectifier equipment, and traction switchgear. (See this issue.)

Portsmouth.—October 23rd. Electricity Department. 33-kV underground cable. (See this issue.)

Tynemouth. — October 20th. Electricity Department. 750-kVA 5,600/440-V transformer. (See this issue.)

Orders Placed

Barrow-in-Furness.—Electricity Committee. Accepted. Cables (£85).—Callender's. 300-kVA transformer (£301).—British Electric Transformer Co. Switchboard (£178).—W. Lucy & Co.

Bolton.—Electricity Committee. Recommended in connection with power station extensions:—31,250-kW turbo-alternator set.—English Electric Co., with condensing plant manufactured by Hick Hargreaves & Co. 180,000 lb. per hour steam raising unit.—Babcock & Wilcox.

Cardiff.—Canal Committee. Accepted. Electric locomotive and battery and charging equipment (£2,229).—Greenwood & Batley.

Chesterfield.—Electricity Committee. Accepted. 33-kV switchgear (£2,195).—Asea Electric. 6·6-kV switchgear (£6,432)—Reyrolle & Co.

Essex.—Health Committee. Accepted. Electrical installation at Romford clinic (£93).—Tucker Bros., Hornchurch.

Hereford.—Health Committee. Accepted. Pump and motor for sewage works (£500).—G.E.C.

Manchester.—Electricity Committee. Accepted. Replacement of voltage control equipment. — Metropolitan - Vickers. Traction batteries. — Chloride Electrical Storage Co. Relinking of stokers.—John Thompson Water Tube Boilers. Cables.—Callender's.

Transport Committee. Accepted. Electric wiring at canteen, Princess Road Depot.—E. M. Evans & Son.

Salford.—Light, Heat and Power Committee. Accepted. 125-kW mercury arc rectifier (£791).—Metropolitan-Vickers.

Southport.—Estates Committee. Accepted. Installation of emergency lighting at Cambridge Hall (£545).—Wm. Morris & Bro.

Swindon.—Electricity Committee. Accepted. Switchgear (£249)—Ferguson, Pailin.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Barrow-in-Furness.—Extensions, Risedale Hospital (£1,870); Nicholson & Wright, Ltd.

Bath.—Extension (40 beds) at Winsley Sanatorium, Limpley Stoke; J. Owens, city engineer, Guildhall.

Birmingham.—Maternity home, Greenhill Road, Moseley; and extensions at West Heath Sanatorium (£23,940); city engineer.

Blackpool.—Offices, Stanhope Road; R. Fielding & Sons.

Bolton.—Works extensions, Mule Street; H. Peers & Co., Ltd.

Works additions, Plodder Lane; Jackson's Stone Quarries, Ltd.

Burnage.—Isolation ward at Duchess of York Hospital for Babies; Bradshaw, Gass & Hope, architects, 19, Silverwell Street, Bolton.

Cheltenham.—Home for Children, Badgeworth Court, for Barnardo's Homes; Madge, Lloyd & Gibson.

Extensions, St. Paul's and St. Mary's Colleges; governors.

Chester.—Additions, City Grammar School (£3,984); James Parker.

Kitchen, City Hospital (£2,124); city engineer.

Diss.—Fire station, Park Road; Surveyor's Office, 2a, Mount Street, Diss, Norfolk.

Essex.—Cleansing centre, Culver Street, Colchester (£2,998) and school canteens (£5,000); county architect, Chelmsford.

Hastings.—Town hall, Havelock Road and Middle Street; Borough Surveyor's Office, 37 Wellington Square.

Inverness.—Houses (£22,366); burgh surveyor.

Luton.—Completion of 22 houses (£15,400); D. Nott, builder, Brackendale, Trinity Road.

Manchester.—Workshops, Ringway Airport; E. E. Coleman, Ltd., Sale.

Scotland.—Post-war scheme for 105 new churches in new housing areas for Church of Scotland (£1,000,000); Clerk, Church of Scotland Offices, Edinburgh.

Smethwick.—Works additions, New Street; Smethwick Drop Forgings, Ltd.

Stockport.—Alterations (£4,622), at Stepping Hill Emergency Hospital.

Canteen kitchen at Mersey Street School; W. F. Gardner, borough engineer, Town Hall.

Wallasey.—Hotel, Promenade, New Brighton; G. Wilkie & Co.

Wellingborough.—New church, Penn Road area, for Snowhill Congregational Church Committee; G. F. Chell, secretary.

Whickham (Co. Durham).—Maternity hospital at Whickham, as a war memorial (£10,000); A. E. Willis, chairman of governors.

Wiltshire.—Police station, Chippenham; county architect, County Offices, Trowbridge.

The old phrase "a gem of the purest water" is particularly applicable to Knowles electrolytic plant for the production of hydrogen and oxygen.

Where purity is of prime importance, as in hydrogen for processes involving catalysis, in the hydrogenation of synthetic foodstuffs, etc., the Knowles electrolytic cell produces *direct* and without further purification, hydrogen which is 99·95% pure, with oxygen 99·8% pure.

The Knowles plant is unique in its simplicity, making it possible to operate with a minimum of labour which need not be skilled. Special devices make the equipment safe under all conditions, maintenance is reduced to negligible proportions, and the plant has exceptionally long life.

Equipment for plants of *any* size can be supplied.

KNOWLES ELECTROLYTIC PLANT FOR HYDROGEN & OXYGEN

IEPCO

THE INTERNATIONAL ELECTROLYTIC PLANT CO. LTD.

SANDYCROFT - CHESTER

HO.11

Rewinds of 5,000 volts d.c. are carried out with sufficient frequency to keep us on our toes where this class of work is concerned and for the same reason we welcome any job which is a little out of the ordinary run.

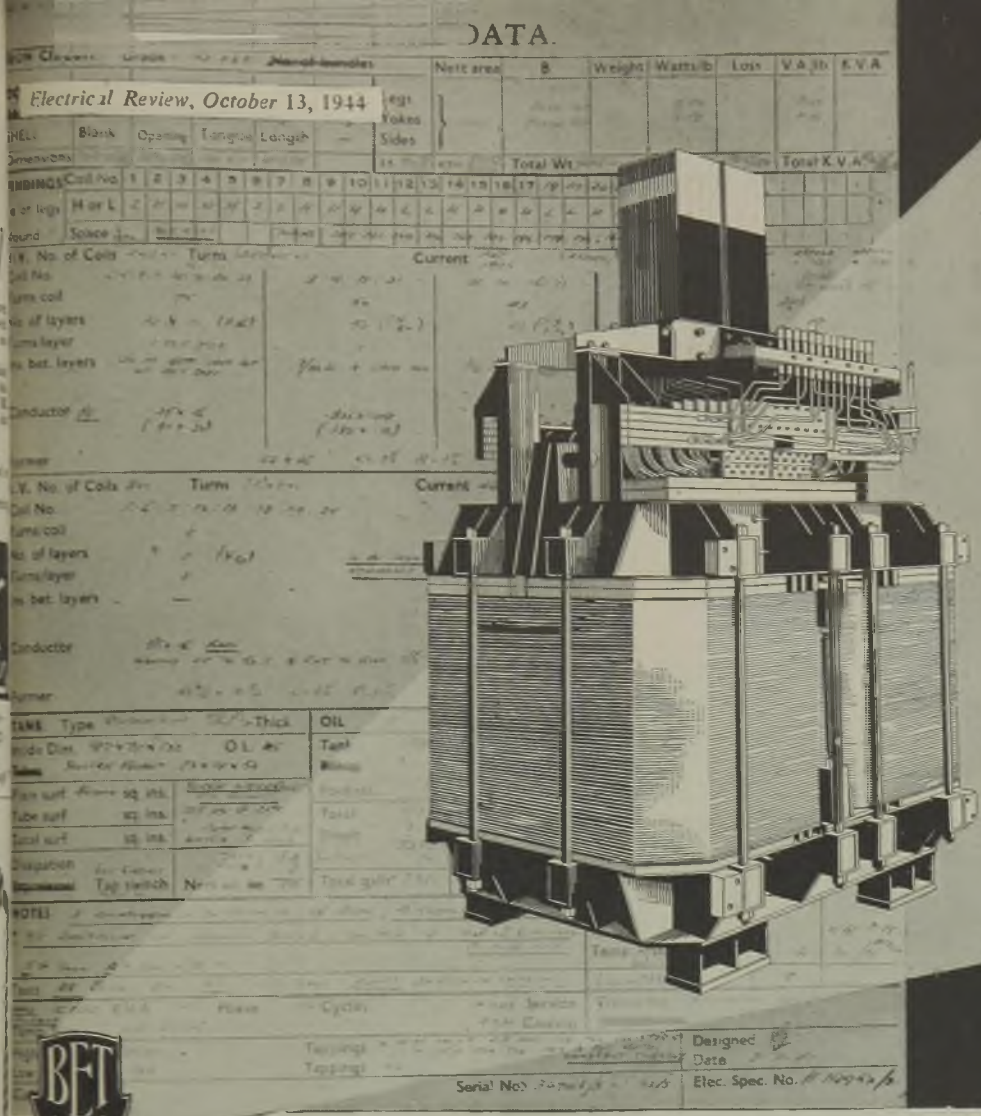
COLLINS

Collins Electrical Ltd.

Head Office
115 Clerkenwell Road London E.C.1
Holborn 0212-3-4
22 St. Albans Place Upper St. Islington N.1
Canonbury 3227-8
9 & 11 Featherstone Rd. Southall
Southall 0168

CEL-5 *sawell advertising*

Electrical Review, October 13, 1944



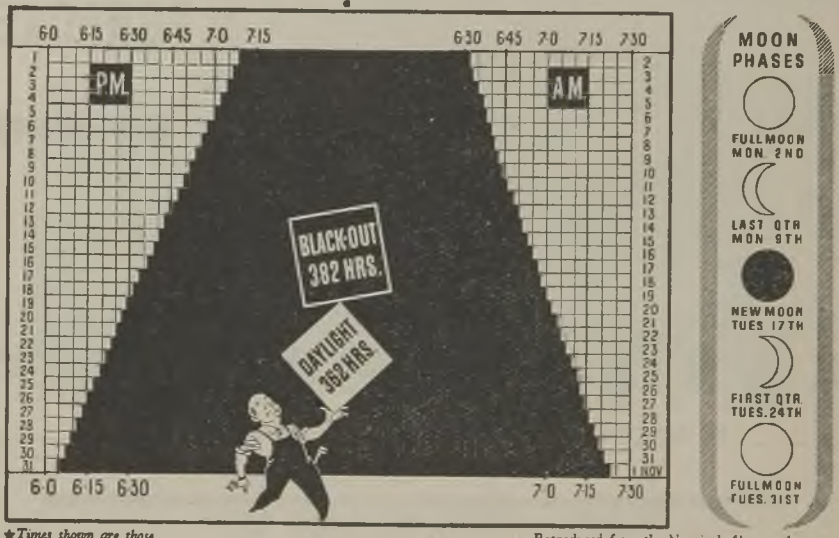
80,000 amps. for ARC FURNACE

Another example of B.E.T.'s technical resources. A 30,360 kVA 3-phase, 50 cycle, 33,000/220 volts O.F.W. cooled Furnace Transformer bank capable of an output of 80,000 ampères (one-phase shown). Three 3-phase banks have been supplied to one user.

The
British Electric Transformer
Company Limited
association with CROMPTON PARKINSON LIMITED
ECTRA HOUSE, LONDON, W.C.2 *and Branches*

"Stand Easy" black-out . . .

BLACK-OUT CHART FOR OCTOBER



★*Times shown are those for the London area.*

Reproduced from the Nautical Almanac by permission of the Controller of H.M. Stationery Office

Although black-out restrictions have been eased, it is still necessary at the time of going to press partially to black-out every day and carry out full black-out during alerts. Therefore you need to know the black-out times. Nevertheless we hope by the time this announcement is published that the black-out will have been completely abolished then we can all Light up and Smile with Osram.

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First post on Monday**, at Dorset House, Stamford Street, London, S.E.1.

THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, minimum 2 lines 4/-, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number there is an additional charge of 6d. for postage of replies.

SITUATIONS WANTED. — Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed.

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES TENDERS, ETC.

CITY OF MANCHESTER

Electricity Department

TENDERS are invited for the supply, delivery and erection of the following:—

(a) WATER COOLING TOWER.
(Specification No. 805.)

(b) MERCURY ARC RECTIFIER EQUIPMENT.
(Specification No. 806.)

(c) 660-VOLT D.C. TRACTION SWITCHGEAR.
(Specification No. 807.)

Specification, etc., from Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona fide tender.

Tenders to be delivered by 10 o'clock a.m. on Monday, the 23rd October, 1944.

R. H. ADCOCK,
Town Clerk.

Town Hall,
Manchester, 2.
4th October, 1944. 762

COUNTY BOROUGH OF TYNEMOUTH

Electricity Department

TENDERS are invited for the Supply and Delivery of:—

1—750-kVA. THREE-PHASE TRANSFORMER.
5,600/440 v.

Specification, together with Form of Tender, may be obtained from Mr. Jas. B. Glen, A.M.I.E.E., Electrical Engineer, Electricity Works, Tynemouth, Northumberland.

Tenders in envelopes specially provided, sealed and endorsed "Tender for Transformer," must reach the undersigned not later than 12 noon on Friday, the 20th October, 1944.

The Corporation do not bind themselves to accept the lowest or any Tender.

Dated this 2nd day of October, 1944.

FRED G. EGNER,
Town Clerk.

14, Northumberland Square,
North Shields. 781

CITY OF PORTSMOUTH

Electricity Undertaking

TENDERS are invited for the supply, delivery and laying of:

3-kV UNDERGROUND CABLE IN THE AREA OF THE UNDERTAKING.

Specification, Conditions and Forms of Tender may be obtained from the Engineer and Manager, Electricity Undertaking, 111, High Street, Portsmouth, and must be returned to the undersigned in a plain sealed envelope marked "Tender for Cable," without bearing any name or mark indicating the sender, on or before the 23rd October, 1944.

FREDERICK SPARKS,
Town Clerk.

Municipal Offices,
Royal Beach Hotel,
Portsmouth.
3rd October, 1944. 780

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 and 41 unless such woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

BOROUGH OF WILLESDEN

Appointment of Borough Electrical Engineer and Manager

APPLICATIONS are invited for the above appointment from qualified Engineers not exceeding 45 years of age who are experienced in the management and administration of an electricity undertaking.

The salary will be in accordance with the Agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers dated 9th July, 1941. The present salary according to the scale is £1,861 per annum.

In accordance with the provisions of Clause 10 of the Agreement, 85% of the salary will be paid for the 1st year, 92½% for the 2nd year, and the full scale salary at the commencement of the 3rd year.

The appointment will be terminable by 3 months' notice by either party and is subject to the provisions of the Local Government Superannuation Act, 1937. The person appointed will be required to pass a medical examination.

Particulars of the conditions of the appointment may be obtained from the undersigned, and applications stating age, qualifications, previous experience and present office and salary, accompanied by copies of three recent testimonials and endorsed "Borough Electrical Engineer and Manager," must be delivered to me not later than the first post on the 23rd day of October, 1944.

Canvassing, either directly or indirectly, will be a disqualification.

W. T. PIRIE,
Town Clerk.

Town Hall,
Dyne Road, Kilburn, N.W.6.
October, 1944. 722

BOROUGH OF DARWEN

Appointment of Electrical Engineer

APPLICATIONS are invited for the appointment of Electrical Engineer. Candidates must be Corporate Members of the Institution of Electrical Engineers and have had practical experience in the generation, conversion and distribution of electricity.

Salary, £650 rising to £700 per annum at the end of one year, plus Whitley Council bonus (at present £49 10s. 9d.).

The appointment will be terminable by three months' notice by either party and is subject to the provisions of the Local Government Superannuation Act, 1937. The person appointed will be required to pass a medical examination.

Applications to the undersigned, endorsed "Electrical Engineer," to be delivered not later than 10 a.m. on Monday, the 23rd October, 1944, and should state age, qualifications, training and experience, and be accompanied by not more than three recent testimonials.

C. C. BYERS,
Town Clerk.

Town Clerk's Office,
Darwen.
30th September, 1944. 742

ASHFORD (KENT) URBAN DISTRICT COUNCIL

Appointment of Chief Electrical Engineer and Manager

APPLICATIONS are invited for the above appointment from engineers not exceeding 45 years of age, who are experienced in the management and administration of an Electricity Undertaking.

The salary will be in accordance with the agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers, dated 9th July, 1941. The present salary according to the scale is £995 per annum, subject to the provisions of Clause 10 of the agreement, under which 85% of the salary will be paid for the first year, 92½% for the second year, and full salary from the commencement of the third year.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, and the person appointed will be required to pass a medical examination.

Applications, with copies of two recent testimonials and particulars of age, education and experience, to be returned to the undersigned not later than Monday, 30th October, 1944.

Canvassing, either directly or indirectly, will disqualify.

J. SUDLOW,
Clerk to the Council.

The Cedars,
Church Road,
Ashford, Kent. 778

COUNTY BOROUGH OF HUDDERSFIELD

Electricity Department

Appointment of Deputy Borough Electrical Engineer

APPLICATIONS are invited for the position of Deputy Borough Electrical Engineer at a salary of £750 per annum, plus war bonus, at present £33 16s. per annum.

The appointment will be subject to the Local Government Superannuation Act, 1937, and the successful applicant will be required to pass a medical examination.

Knowledge of the operation of a large Power Station, together with experience of D.C. Traction Supplies with Rectifier Substations and Mains Distribution Systems, will be required. The successful candidate will also be expected to generally assist the Borough Electrical Engineer in his administrative work.

Applications, endorsed "Deputy Borough Electrical Engineer," stating age and giving full particulars of technical and practical training and experience, together with copies of not more than three recent testimonials, must be delivered to the undersigned not later than 8th November, 1944. Canvassing, either directly or indirectly, is prohibited and will be a disqualification.

SAMUEL PROCTER,
Town Clerk.

Town Hall,
Huddersfield. 761

THE COUNTY OF LONDON ELECTRIC SUPPLY COMPANY LIMITED

Barking Power Station

APPLICATIONS are invited for the position of Assistant Combustion Engineer for shift duties at the Barking Power Station of the County of London Electric Supply Company Ltd. Applicants must have had a good technical training and should have served an apprenticeship in mechanical engineering. Previous experience in the operation of power station boiler plant is essential. The position is graded under the E.P.E.A. Schedule as Grade 9, Class M, and the present salary under the above is £482 per annum.

Applications in writing, giving full particulars of education, training and experience, to be addressed to: The Generating Engineer, Barking Power Station, Creeksmouth, Barking, Essex. 768

CHARGE Engineer required for Power Station in India. Experience with large water tube boilers and steam turbines essential. Salary, Rs. 800 per month, with free quarters and passage. Apply—Box 721, c/o The Electrical Review.

ELECTRICAL Contractor in London requires Manager, must have thorough knowledge of trade, able to control labour and estimate, good all-round organiser. Own car an advantage. Write—Box 767, c/o The Electrical Review.

THE UNIVERSITY OF LIVERPOOL

THE Council of the University of Liverpool invites applications for the David Jardine Chair of Electrical Engineering (with special reference to Electronics and the relations between Electrical Engineering and Physics). Salary not less than £1,500 per annum. The University is prepared to grant leave of absence on the ground of work of national importance to a professor who is unable to take up his duties upon appointment. The last date for the receipt of applications is December 29th, 1944. Candidates who are overseas may apply by cablegram, giving the name of three referees. Further particulars can be obtained from the undersigned.

STANLEY DUMBELL, Registrar.

September, 1944. 757

ELECTRICAL Engineer with practical experience in the manufacture of electrical accessories required in a permanent, part-time advisory capacity by small, progressive manufacturer. Our staff are aware of this advertisement, and strictest confidence in every way will be observed. Write fully to—Box 654, c/o The Electrical Review.

LEADING firm of electrical manufacturers has a number of vacancies for post-war Sales Representatives. Sound technical education with works and drawing office training essential. Experience in the installation and maintenance of distribution equipment an advantage. Applications will be considered now. Reply, giving particulars of age, education, training and experience, to—Box 15, c/o The Electrical Review.

MEN or Women Packers, by electrical and radio wholesalers. Applications in writing, stating age, experience and salary required, to—Box 752, c/o The Electrical Review.

PROGRESSIVE transformer manufacturing company requires full-time Representatives for the Midland and Southern Counties. Applicants, age 35 to 45, should have experience of meeting responsible engineers and be capable of discussing technical matters. Corporate membership of the I.E.E. is desirable. Apply in confidence, giving full particulars, including suggested terms of remuneration, to —Box 709, c/o The Electrical Review.

SALES Engineer Assistant required for Glasgow branch of large manufacturing firm making heavy electrical equipment. State age, salary, experience.—Box 719, c/o The Electrical Review.

SALES Engineer for leading manufacturers of lighting equipment, London district. State age, experience, salary expected.—Box 6335, c/o The Electrical Review.

SALES Representative required for illuminating engineering department of lamp manufacturers. Experience in planning industrial lighting essential. Write, with details of age, experience and salary required, to—Box C.D.6, c/o 5, New Bridge Street, London, E.C.4. 753

SALES Representatives required. Remunerative position with excellent post-war prospects for keen, energetic men not liable for national service. Connections among electrical and hardware trade and large wholesalers an advantage. Salary, commission and expenses. Write in confidence, with details of past record, to—Box D.H.7, Thorn Electrical Industries Ltd., 105-9, Judd Street, London, W.C.1. 711

SOUTHERN Electrical Contractors require in the near future an Engineer Manager to take charge of their Tyneside branch engaged on installation work on H.M. ships, collieries, and general shore work. Applicants preferred with a personal connection amongst shipyards, etc. Salary £600, plus expenses and commission. Applications treated with strictest confidence. Box 6352, c/o The Electrical Review.

STOREKEEPER wanted by a City firm of electrical contractors. Suitable opportunity for ex-service man. Write, stating age, experience and salary required, to—Box 6282, c/o The Electrical Review.

SUB-Editor Reporter for "Electrical Trading." Must have technical knowledge, preferably from practical experience in the industry. Apply, by letter only, to—Editor, "Electrical Trading," 92, Long Acre, W.C.2. 777

SWITCHBOARD Attendant required for steel works power station in North-East area. Must be experienced in operation of E.H.T. switchgear, synchronising and control of turbo-alternators. Salary £314 12s. per annum. Apply—Manager, Employment Exchange, South Bank, Yorks. 779

TRAVELLERS, Commission Agents are required throughout the U.K. by wholesale house to market industrial and other electrical articles, also large range of electrical fancy goods. Connections essential with industrial organisations, large turnover. Good commission basis only. Write to—Box T, c/o Pethicks, 30, Bouverie St., E.C.4. 692

TRADE Counter Salesmen required by electrical wholesalers. Previous experience of electrical installation supplies material essential. Applications in writing, stating age, previous experience and salary required, to—Box 751, c/o The Electrical Review.

WORKS Maintenance Engineer required by leading firm of cable manufacturers to fill vacancy caused by approaching retirement of present holder; first-class qualifications and industrial experience will be called for in electric cable-making or similar field; ability to design new plant for a developing industry essential; responsibility direct to works director; age 40-45. Reply in confidence, stating experience and salary required, to—Box 776, c/o The Electrical Review.

APPOINTMENTS FILLED

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

STRETFORD and District Electricity Board—Deputy Chief Engineer.

SITUATIONS WANTED

A Technical Engineer, age 39, general distribution experience, including consumers' installations, knowledge of generation, specialised experience measurements, testing and protective gear, A.M.I.E.E., seeks post offering scope for experience, moderate salary. Box 6295, c/o The Electrical Review.

ADVERTISER (exempt) seeks position as Sales Representative where energy and initiative could be employed to advantage.—Box 6290, c/o The Electrical Review.

B.Sc. (24), 7½ years' experience well-known electrical firm, including apprenticeship, plus 2-year special course in modern administration, desires change.—Box 6348, c/o The Electrical Review.

CHARGE-Hand desires change, view to promotion, under 40, 16 years' experience mass production radio equipment.—Box 6339, c/o The Electrical Review.

ELECTL., Mechl. Engineer-Foreman, 28 yrs.' exp. construction, maintenance installations, steam and diesel plants, factory, ships, hospitals, home and abroad.—Box 6334, c/o The Electrical Review.

ELECTRICAL Eng. desires position of responsibility, 20 years' experience in power general distribution, factory installation erection and maintenance of plant. Own car used for journey work. Available now.—Box 6346, c/o The Electrical Review.

ELECTRICAL Engineer, 24 years' experience in power company supplies, general distribution, factory installations, erection and maintenance of plant, requires permanent post, just released from Government appointment.—Box 6280, c/o The Electrical Review.

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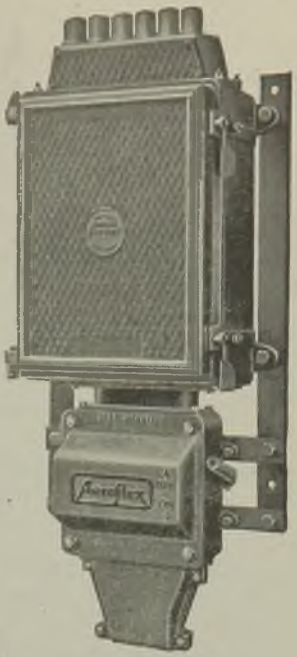
The fact that goods made of raw materials in short supply owing to war conditions are advertised in this Journal should not be taken as an indication that they are necessarily available for export

SWITCH AND FUSEGEAR



To comply with the Electricity Regulations — "Efficient means suitably located shall be provided for protecting against excess current every part of a system."

Efficient means are embodied by the modern Aeroflex high breaking capacity, rewirable cartridge fuse, which combines the property of opening circuit on comparatively low overloads if continuously maintained, with time-lag without ageing under operational peaks of a permissible character, at the same time offering ample breaking capacity to meet all requirements.

Suitable location consists in grouping the fuses in safe and properly designed distribution boards, so that each cable and conductor is fused at the origin where it is supplied from another of larger capacity, and in providing that each group can be isolated at will by adequate switchgear, for inspection, renewal or extension.

These requirements are met by installing Aeroflex-Fluvent ironclad switch and fusegear, the product of continued experience and contact with practical conditions of service.

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