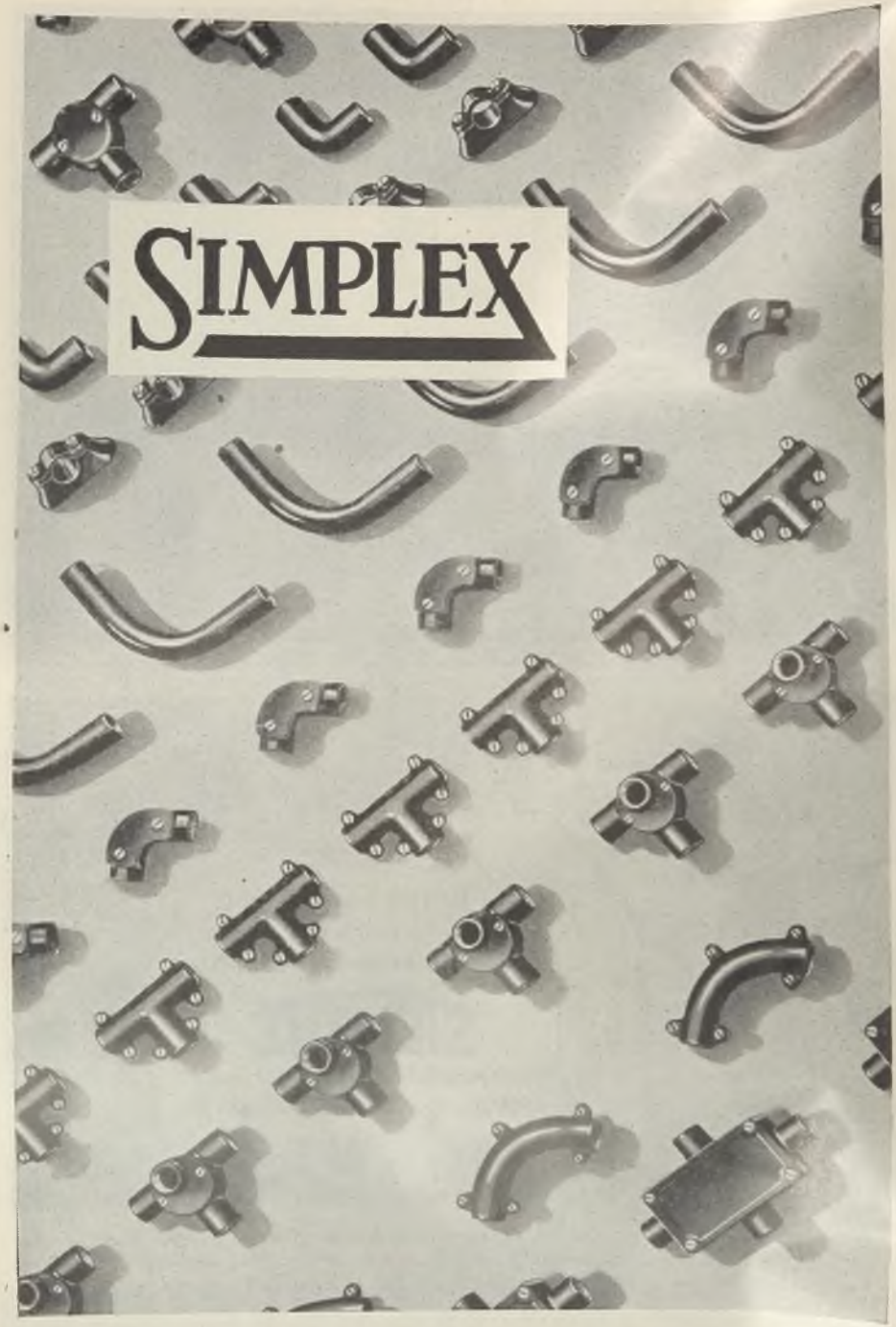
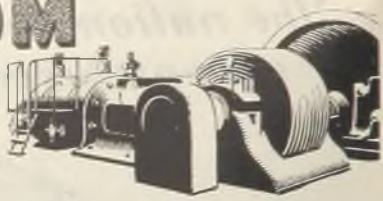
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXVII. No. 3551 DECEMBER 14, 1945 9d. WEEKLY


SIMPLEX

POWER FROM STEAM



How to make a servant of your power-producing medium

A good captain knows the idiosyncrasies of his team ; a good workman knows his tools—a bad one blames them. You cannot expect to get the best out of your steam unless you know what its properties and capabilities are.

You may think that you know all that is necessary for the operation of your power plant, but unless you understand the Steam Tables thoroughly you cannot be sure. Do you know whether your steam engine is operating efficiently, what its steam consumption should be, what it actually is ? Do you know *all* the possibilities of using the exhaust for process purposes ?

These bulletins will help you :

STEAM FOR PROCESS AND HEATING (*Bulletin No.* 25)

A simple introduction to the properties of steam leading to a more critical understanding of the steam tables.

COMBINED POWER AND HEATING (*Bulletin No.* 40)

A complete survey of the possibilities of using the exhaust steam from an engine for process purposes, or for developing power from the steam before it reaches the process. This bulletin is written in a form suitable not only for the engineer and the specialist but also for the management.

STEAM FOR POWER (*Bulletin No.* 33)

An explanation of the power-producing properties of Steam. Read No. 25 first and then this bulletin, which, among other things, explains " entropy " without advanced mathematics.

THE EFFICIENT OPERATION OF STEAM ENGINES (*Bulletin No.* 34)

The practical side of steam engine operation : how to get the most power from the least steam. What the indicator diagram is and what it means.

Few people know how interesting steam can be until they have had to learn about it. These bulletins make the learning easy. If you haven't all the copies you require, they can be obtained free on demand from the Ministry's Regional Offices.

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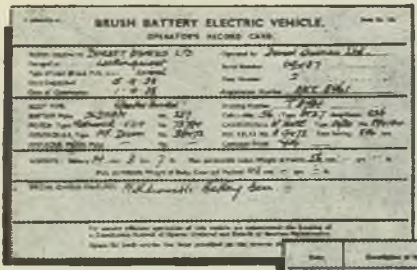
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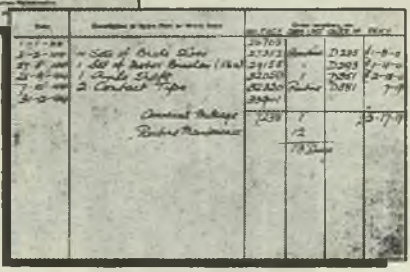

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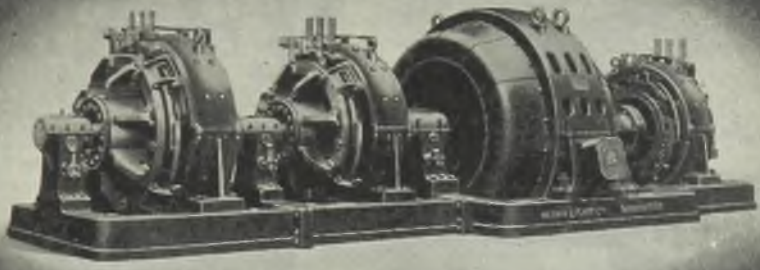

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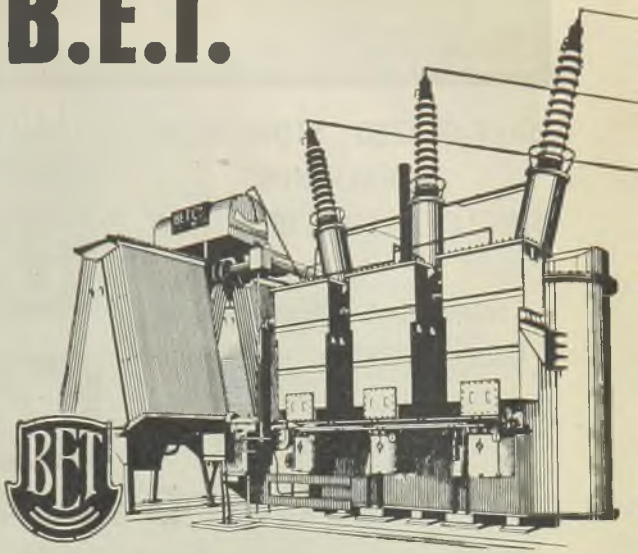

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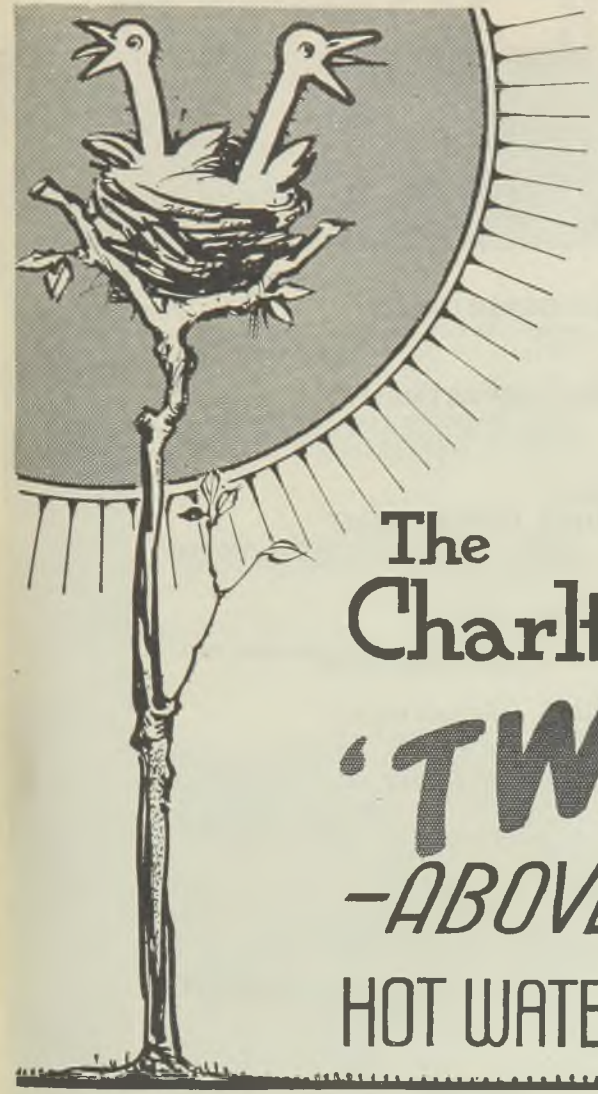

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ELECTRICAL REVIEW

December 14, 1945

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVII. No. 3551. DECEMBER 14, 1945 9d. WEEKLY

Public Utility Control

Where Gas and Electricity Differ

SUPERFICIALLY the electricity and gas supply industries have much in common and the proposals of the Heyworth Committee on the reorganisation of the latter are widely regarded as having some bearing on the future of electricity also. The mistaken designation in the daily press of the Report as a "White Paper" has given it the appearance of being more in accord with Government views than is warranted, since it is actually only a Command Paper having much the same status as the McGowan Report, though it will probably not be similarly related to Limbo.

Since the structure and fate of electricity's principal competitor in certain fields should be of interest to our readers, we give this week some of the outstanding particulars of the Report. To draw too close a comparison between the two public services may, however, be misleading, because in many important respects the differences are more fundamental than are the similarities and may call for treatment on quite other lines.

Technical Limits

Common to both Reports is an insistence on the need for larger supply areas, but the technical limits imposed on gas do not apply to electricity. It is significant that in each of the ten gas regions there would be a chief production engineer having duties on a par with those performed by the Central Electricity Board for the country as a whole. No central co-ordinating gas authority is proposed, presumably because transmission at very high pressures and hence area interconnection is impracticable and there are manifest advantages in being able to compare one independent region with another in efficiency. There are many more gas than electricity undertakings in existence and they tend far more to fall below the best attainable economy, since nearly all make as well as distribute their product, whereas it is the general practice for their electrical counterparts to take bulk supplies.

Outstanding Variations

Technical differences between the two public utilities are very marked in rural areas with low load densities. As the Report states, gas cannot be economically provided everywhere. That means that gas can of itself make little contribution towards serving the countryside, whereas, except in extreme instances, electricity can be, and, but for the war, would have been, supplied at any required point on commercial terms.

Another difference is that while the use of electricity is expanding rapidly, the output of gas for many purposes, the Report shows, seems likely to be stationary or even to decline. From the national aspect that may not be a disadvantage, since increased gasification of coal would disturb the balance between gas and coke produced upon which efficient high-temperature carbonisation is based. The making of gas is but one aspect of the carbonisation of coal of a type in great demand of which the natural resources are limited. On the other hand the

low-grade coal used in the generation of electricity is a near-waste product, thus placing electricity supply in the category merely of an ordinary purchaser of fuel.

Although the question of gas by-products was outside the scope of the inquiry, the Report contains nothing that would militate against integrating the gas industry with a larger scheme. Whether its proposals would develop and cheapen gas supplies is not for us to judge, though electrical men are not likely to under-rate the efficiency and zeal of their rivals. One conclusion of the Report, however, commands our unequivocal agreement. That is the reiterated statement that competition between the fuel industries furnishes the main stimulus towards efficiency.

Secondary Industries

ONE of the matters considered at the October conference held in London, of the Federation of Chambers of Commerce of the British Empire (the report of which has just been published) was the establishment of "secondary" industries in countries which are fundamentally primary producers. The opinion was expressed that these industries should strive to stand on their own feet in the world markets although it was recognised that in the early stages some form of State assistance was necessary. This assistance should be regarded as temporary only and should be progressively reduced, "consistent with the progress which the industry might reasonably be expected to make." British exporters to Empire countries would welcome the adoption of this principle but experience has shown how difficult it is to get a protective duty reduced once it is instituted.

Lighting Education

ALTHOUGH when it took over the Lighting Service Bureau twenty-one years ago the Electric Lamp Manufacturers' Association's intention was to increase the sales of its members' lamps, the Bureau has become a great deal more than a selling agency. Those responsible for it have given the staff a free hand and to-day it is a recognised school of lighting efficiency. Its aim is still to sell light—but it is better light and that does not necessarily mean more lamps, or even E.L.M.A. lamps. During the war it did much good work in the industrial sphere, notably by sponsoring the National Industrial Electric Lighting Service. That work is still to go on but the Bureau is now able to resume its activities in other directions and some indication of its intentions is given in this issue. Among its aims are the "refreshing" of lighting men now coming out of the Forces, the education in lighting matters of young architects, as well as the full resumption and intensification of its pre-war lighting design courses. The first of these has already been held; the next is in February.

Dangerous Cable

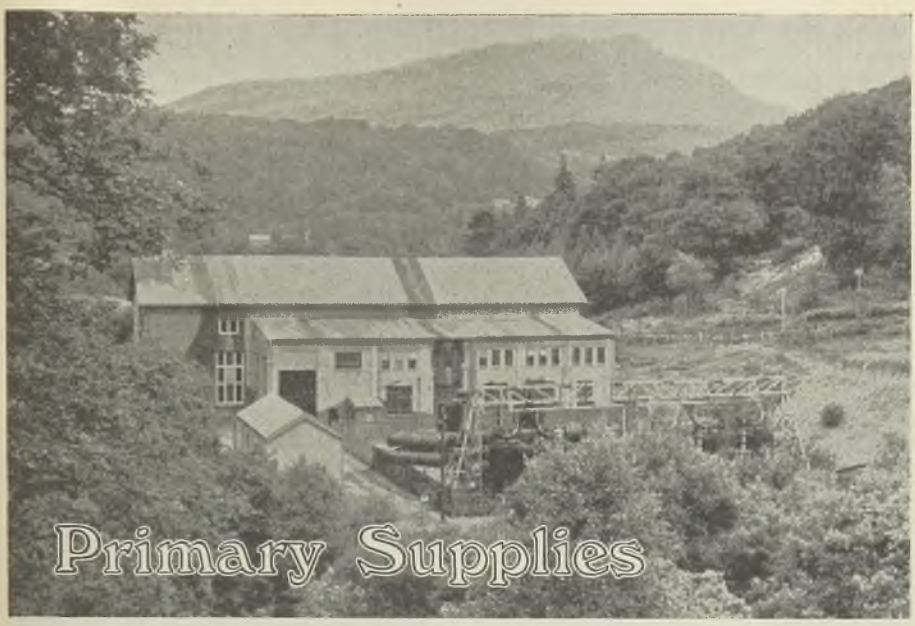
ONE of the risks attending the unthinking use of Government surplus stocks is being brought to the notice of supply undertakings by the Electricity Commissioners with the request that they warn contractors against it. Cables designed for radio relaying and for installation in aeroplanes are being used for wiring domestic premises. Consisting of four single-core 1/·029 conductors, each insulated with a thin rubber sheath with a further rubber sheath over each pair, the whole being lead covered, they are quite unsuited for the purpose. First, the conductor is appreciably less than half the minimum size (0·0015 sq. in.) required by the I.E.E. Regulations; secondly, the dielectric thickness is insufficient for 230 V.

Alternator Rotors

MANY electrical hypotheses, even when well based on investigations into typical cases, need confirmation by tests over many years under service conditions. An outstanding example was provided in the I.E.E. paper by Messrs. R. H. Coates and B. C. Pyle last week—a valuable contribution towards the solution of an urgent problem concerning the effectiveness of generating plant capacity which has been troubling power station engineers in all countries.

Economy and Æsthetics

SPEAKING at Manchester last week, Mr. Harold Hobson, chairman of the Central Electricity Board, referred to delays caused by the existence of so many planning authorities with widely-differing points of view. There was a clash between economy and æsthetics and until some means of reconciling these was worked out delays would continue. Mr. Hobson called for a clear statement of policy from the Ministry of Town and Country Planning.



Generation and Supply-Exchange Scheme in North Wales

FOR our second post-war load-building article we have selected the North Wales and South Cheshire area under the jurisdiction of the North Wales Power Co., Ltd., and as in the description of the Ayrshire Electricity Board's activities in the *Electrical Review* of July 27th, 1945, we have decided to outline the technical aspects of the generation and distribution sides of the undertaking because this background is essentially a part of the load-building structure. In these days of a nationally connected transmission scheme, however, "generation" does not bear the exclusive relation to load-building that previously was the case, and to make the picture complete the points of actual connection with the grid must be included.

There are three hydro-electric stations in the area, all to the west, having a total capacity of 47,000 kW, and the two points of interconnection with the grid are at Mollington, near Chester, and at Crewe. The oldest of the power stations is that at Cwm Dyli, near Beddgelert, which has been in continuous operation since 1906. The location was determined because the Snowdon area has a rainfall varying from 125 to 193 inches per annum, the heaviest precipitation in Great Britain.

Our title photo shows the Maentwrog power station which is situated in the valley of the Afon Prysor

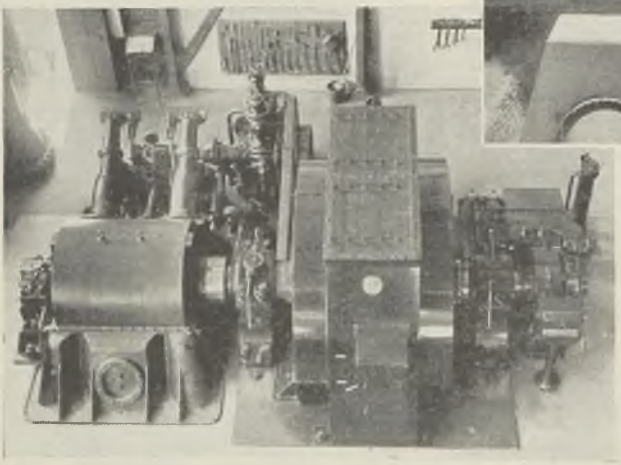
The water is drawn from a natural reservoir, Llyn Llydaw, at 1,424 ft. O.D. on Snowdon, 1,150 ft. above the power station, and is conducted through a tunnel and two 30-in. diameter steel pipes. The total capacity is 6,500 kW and the annual output, varying with the rainfall, averages about 9 million kWh. Generation is at 10 kV, and a seven-panel Reyrolle iron-clad type switchboard controls the individual generator output and the outgoing 10-kV circuits.

As substantially the greater part of the output is supplied, under normal circumstances, to the surrounding slate quarries, the transformer capacity consists of only one 3,000-kVA 10/20-kV transformer for transmission to the general system. On the 20-kV switchboard served by this transformer are units controlling outgoing supplies to Dolgarrog, Llanfrothen and Caernarvon.

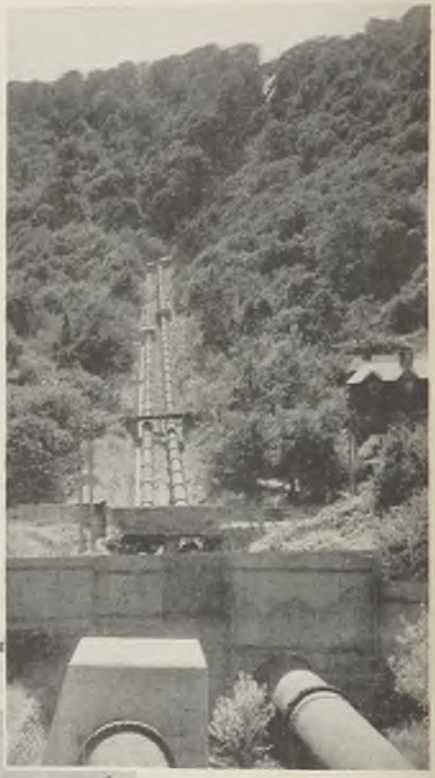
The hydro-electric station at Dolgarrog, which initially served the Aluminium Corporation exclusively, was acquired by the Power Company in 1929. The catchment area of approximately 13,000 acres lies on the slopes of Carnedd Llewellyn

and has been divided into two areas, one of which is connected from the Cowlyd and Eigiau reservoirs through a pipe-line and tunnels to the generating station, with an effective full head of 1,150 ft. The areas below the Cowlyd and Eigiau reservoirs drain into a low-level reservoir at Llyn Coety, having an effective net head of 850 ft. above the generating station. The average rainfall on the catchment area above the 1,000-ft. contour is 85 in. per annum, and this represents an output approaching 50 million kWh in a normal year. The pipe-lines are capable of carrying water for the maximum output of the station up to 20,000 kW.

The station main plant consists of two 7,500-HP overhung Pelton-type turbines coupled to 5,000-kW English Electric alternators, and a 6,500-kW high-speed turbo-alternator set with a double-runner impulse turbine with four jets developing 10,000 HP at 600 RPM. The last set has its maximum efficiency at a head of 1,150 ft., but it will operate satisfactorily at 850 ft. Generation is at 6·6 kV, and an eight-unit cubicle switchboard controls the generators, main transformers and local distribution, including the adjoining aluminium works. There are also eight 33-kV and 20-kV switches for controlling the primary connections to Maentwrog power station, two circuits to Legacy, *via* Hawarden, a 33-kV line to the primary substation at Bangor, for Anglesey, a 33-kV single-circuit to Llandudno, a 20-kV line direct to the Penmaenmawr and Welsh Granite Company's quarries, and a 20-kV interconnector to the Cwm Dyli power station. To complete these interconnection arrangements there are one 6·6/33-kV 10,000-kVA, two 6·6/33-kV 7,500-kVA, and two 6·6/20-kV 2,500-kVA transformers.



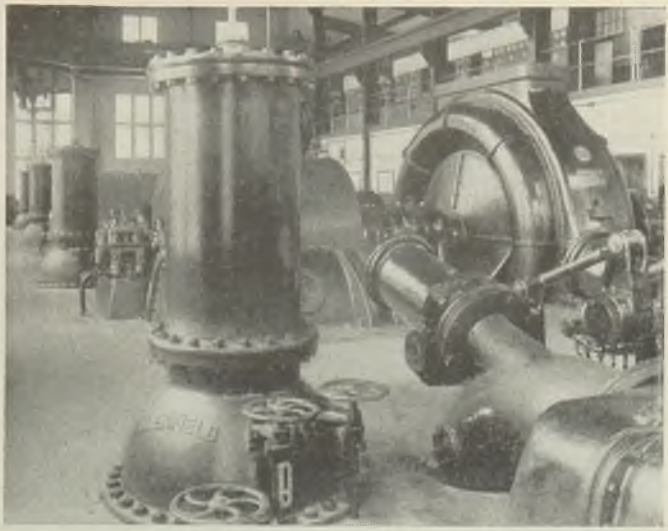
The latest set at Dolgarrog is a 6,500-kW alternator with a 10,000-HP double-runner impulse turbine



The Dolgarrog power station operates with an effective full head of 1,150 ft.; lower pipe-lines on 500 lb. per sq. in. pressure

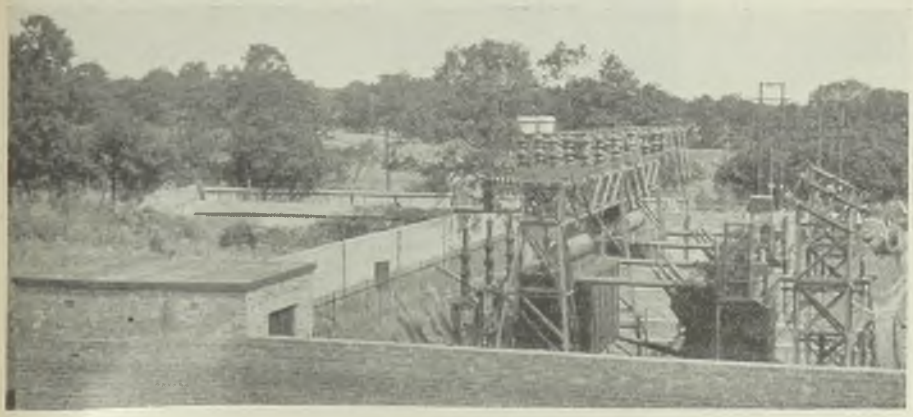
The Maentwrog power station is in the valley of the Afon Prysor which joins the Afon Dwryd near the village of Maentwrog. An artificial reservoir was formed near Trawsfyndd by the construction of four dams. The main dam across the Afon Prysor is of the arch type and constructed of concrete and the other three dams are of the mass-construction gravity type, without spillways, and are

intended to serve as "cut-off" dams. The catchment area is extremely well placed meteorologically, having a precipitation of 70 to 110 in. per annum which represents an output of 35 to 40 million kWh. The capacity of the reservoir is 1,200 million cu. ft. From the main dam there are two tunnels connected by a low-pressure steel pipe-line about 2,000 yards long, and from the down-stream end of No. 2 tunnel commences a high-pressure pipe-line constructed of lap-welded steel pipes with riveted joints. At suitable intervals there are automatic self-closing butterfly safety valves to guard against excessive water velocity. In the station proper there are four 6,000-kW turbo-alternators, each with a horizontal impulse type 9,000-HP 333-RPM turbine operating on a maximum static head of 650 ft., directly coupled to English Electric alternators.



There are four 6,000-kW turbo-alternators in the Maentwrog power station

The turbines each have two runners, each runner carrying 22 cast-steel buckets. There are four nozzles per turbine, so arranged that two jets impinge on the buckets of each runner. The speed control is obtained by means of deflectors and needle valves. Generation is at 6·6 kV, and in addition to a 12-unit switchboard dealing with both generation and transmission circuits at this voltage there is a Reyrolle five-panel 33-kV duplicate-bus-bar switchboard controlling outgoing feeders to Llanfrothen, Dolgarrog and Festiniog, and two 3,500-kVA 6·6/20/33-kV step-up transformers. Served also from the 6·6-kV switchgear there are six single-phase transformers arranged in two 10,000-kVA banks to transmit to the Wrexham and Crewe areas *via* the primary 66-kV



The 66/33-kV transformers at Legacy receive from Maentwrog *via* the main system 66-kV interconnector

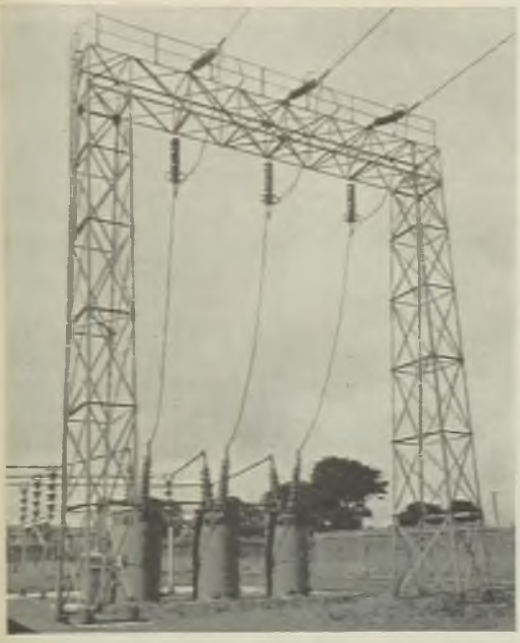
transmission system. The 66-kV sides of these banks are directly coupled to the overhead circuits, there being no 66-kV switchgear.

The meeting point of the main 33-kV and 66-kV circuits on the eastern side of the territory is at Legacy, near Wrexham, where the system control point has been established. This substation is equipped with duplicate switchhouses and a control room. No. 1 switchhouse is equipped with five Ferguson Pailin 33-kV metal-clad switches controlling an incoming circuit from Maentwrog power station, through a 66/33-kV transformer, a 33-kV line to the Central Electricity Board's substation at Crewe, a feeder to Hawarden, one to Oswestry and the south, and a 33/11-kV 5,000-kVA local transformer, as well as a seven-panel 11-kV single-bus-bar switchboard fitted with a bus-bar coupler. No. 2 switchhouse is equipped with four 33-kV Ferguson Pailin metal-clad switches controlling an incoming supply from Maentwrog, through a 66/33-kV transformer, a 33-kV line to the Crewe substation, one circuit of the Hawarden feeder, and a 33/11-kV 5,000-kVA local transformer.

The control room accommodates vertical-type control panels with a mimic diagram, and a special feature of the whole installation is that the Hawarden substation can be brought completely under the supervision and control of the Legacy substation through a multi-core pilot cable laid direct in the ground. In addition to the 13,000 kVA of 33-kV voltage regulating equipment at Legacy, there is a bank of two 7,500-kVA, 66/33-kV on-load tap-changing Ferranti transformers. The tap-change range is $\pm$ 7½ per cent. on the secondary side. Further, for local distribution, there are two 5,000-kVA 33/11-kV on-load tap-changing transformers.

Although Hawarden substation is generally regarded as the point of interconnection with the grid, in actual fact this takes place at Chester some eight miles away. The intervening gap is bridged by a 132-kV double-circuit line owned and operated by the Power Company. The incoming supplies are metered direct at 132 kV at Chester by the Central Electricity Board. The incoming 132-kV lines are fed through outdoor bus-

The Hawarden substation can be brought completely under the supervision and control of the Legacy control room. The Hawarden control room (right) houses vertical remote control panels in addition to supervisory equipment

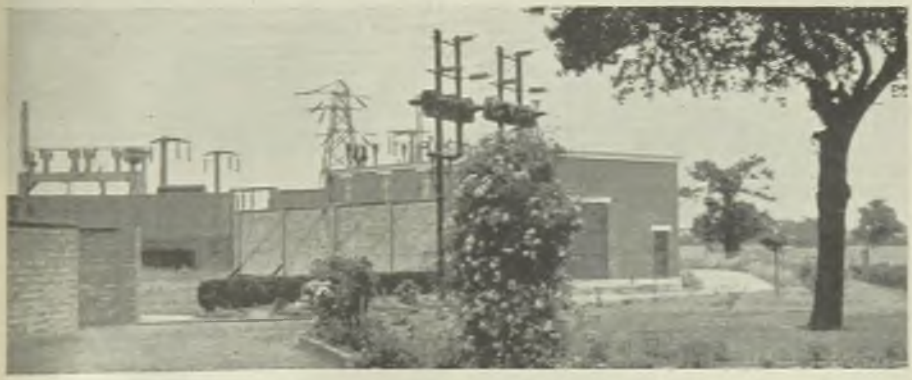


The 15,000-kVA 132/33-kV outdoor transformer at Hawarden is separately controlled by a 132-kV switch

bar arrangements, with isolators for cross-connection to two 20,000-kVA and one 15,000-kVA 132/33-kV outdoor English Electric on-load tap-change transformers. The 15,000-kVA transformer is separately controlled by a 132-kV switch with a rupturing capacity of 1,000 MVA. Control of the two 20,000-kVA transformers is effected on the 33-kV side, intertripping by G.P.O. circuits with the 132-kV controlling switches at the Central Electricity Board's substation at Mollington, Chester.

No. 1 switchhouse contains five 33-kV Ferguson Pailin metal-clad switches serving the incoming grid supply, a local transformer, a Legacy feeder, a Dolgarrog feeder, and the Rhydymwyn R.O.F. feeder. In No. 2 switchhouse there are six 33-kV cellular-type switches controlling the C.E.B. incoming supply, a local transformer, a Legacy feeder, a Dolgarrog feeder, a Rhydymwyn R.O.F. feeder, and a Hawarden R.D.C. feeder. There is also a seven-panel 11-kV switchboard with truck-type oil circuit-breakers controlling local feeders. The control room houses 15 vertical remote control panels, in addition to the supervisory equipment, relays, instruments, telephones, etc.

The Power Company's Crewe substation, which is on the same site as the grid 2 × 30 MVA substation, comprises two switchhouses and a control room, together with the area operation engineers' offices. No. 1 switchhouse is equipped with eight 33-kV metal-clad Reyrolle switches controlling the incoming 33-kV C.E.B. supply, an L.M.S. Railway feeder, a Radway Green feeder, a Runcorn feeder, a Crewe Corporation feeder, an Oswestry feeder, a Legacy feeder, and a 33/11-kV local supply transformer, as well as a six-panel 11-kV board for local and secondary distribution. In No. 2 switchhouse there is a five-panel Reyrolle single bus-bar switchboard which serves for the incoming 33-kV supply, the Legacy,



The staff at the Crewe substation are to be congratulated on the preservation of the amenities

L.M.S. railway, Radway Green, and Crewe Corporation outgoing supplies. A 33-kV switch controls the bus-bar interconnector. The control room is equipped with vertical panels for remotely switching the 132-kV equipment in the grid substation and the Power Company's 33-kV switches.

The system loadings and telephonic channels are embodied in a high-frequency carrier wave system incorporated in one of the 33-kV overhead circuits between Crewe substation and the control room at Legacy. From Legacy the information is again relayed to the power stations.

Remote switching of the 132-kV equipment in the C.E.B. substation and the power company's 33-kV switches is effected at the Crewe control room

Lighting Education

E.L.M.A. Bureau's Activities

TWENTY-ONE years ago the Electric Lamp Manufacturers' Association took over the London Lighting Service Bureau and since that time, even during the war, the Bureau's services in the cause of better illumination have been steadily increased. At a press gathering last week Mr. E. B. Sawyer, acting manager of the Bureau, made reference to the past activities of the Bureau and its hopes for the future. He said that they had already been able to hold the first post-war Illumination Design Course and so great was the demand for it that they had been compelled to confine attendance to members of the E.L.M.A. concerns. A more general course was being arranged for February next. The Bureau intended not only to organise courses in the larger provincial centres but also in many smaller places. All the Bureau's "literature" was being revised, largely by Mr. A. D. S. Atkinson. Mr. Sawyer also referred with satisfaction to the fact that several members of their staff had returned from war service.

Mr. W. J. Jones, director of E.L.M.A., mentioned the recent reductions in the prices of lamps a trend which had been steadily pursued during the past twenty-five years. He touched upon the future of the fluorescent lamp and said that the 75-W gasfilled lamp was again available in both coiled-coil and single-coil patterns. With regard to industrial lighting, he expressed the hope that the standards considered essential for war factories would be applied to every kind of works, however small. It was a subject in which the Factory Inspectorate was taking a very close interest.

Among the recent publications of the Lighting Service Bureau is "Electric Illumination Handbook No. 2" dealing with interior lighting design. This briefly summarises the general principles of good lighting and explains the terms commonly used. Methods of light control are explained and the characteristics of various forms of lamps are set out in tabular form. There follow sections on lighting design, the choice of system, notes on general lighting and assistance in planning illumination. Appendices give information relating to reflection and transmission factors, methods of assessing illumination required, recommended values of illumination, spacing-mounting height and other factors involved.

"Light, the Sales Builder," is designed as a guide to the lighting of shop interiors—general, showcases and counters, highlighted displays and signs—with filament and fluorescent lamps. Plans Plans for future lighting design courses are set out in "Programme of Lighting Education, 1945-1946." This includes particulars of refresher courses, courses for architects and "rehabilitation" courses for returning members of the Forces. Future arrangements will provide for architectural students, primary and secondary schools and lighting specialists. Copies of these publications are obtainable from the Bureau, 2, Savoy Hill, London, W.C.2.

Railway Tool Exhibition

AN exhibition of power-operated hand tools, arranged by the L.N.E.R. is now being held at King's Cross Station, London, where numerous kinds of tools operated either electrically or by compressed air are displayed, and practical demonstrations given. . The catalogue contains a brief description, and approximate cost, of the various exhibits. The exhibition closes on December 15th.

Synchronous Induction Motors

Synchronous Impedance of the Non-salient Pole Type

By C. Y. Mang, B.Eng.

TAKING the general circle equation for non-salient pole synchronous induction machines, the rectangular co-ordinates of the point P in Fig. 1 measured from O′ (the centre of the circle) are: $\frac{a}{2} - I \sin \phi$ and $I \cos \phi - \frac{b}{2}$, $\therefore \left(\frac{a}{2} - I \sin \phi\right)^2 + \left(I \cos \phi - \frac{b}{2}\right)^2 = r^2$; *i.e.* $I^2 - aI \sin \phi - bI \cos \phi = r^2 - \left(\frac{a^2 + b^2}{4}\right)$ or $I^2 - aI \sin \phi - bI \cos \phi = c$ . . (1)

So, if the motor supply current can be expressed in the above form, the co-ordinates of the centre of the circle, measured from O the intersection of axes are given by: $x = \frac{a}{2}$ and $y = \frac{b}{2}$. In order to obtain the current locus for constant excitation and variable load, follow the usual analysis of the operation of motors of this type as shown in Fig. 2:—Let V = stator applied voltage per phase and E = back e.m.f. per phase due to DC excitation. From the triangle OCB, $E^2 = V^2 + OC^2 - 2V \cdot OC \cos \alpha$. $\therefore OC^2 - 2V \cdot OC \cos \alpha = E^2 - V^2$ . . . . . (2)

This is the polar equation of a circle of radius E whose centre lies on the Y axis and

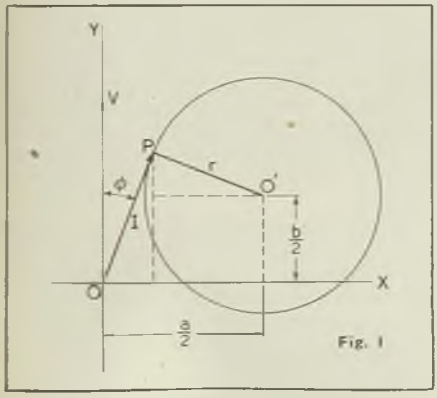


Fig. 1

is displaced from O by an amount + V. In connection with Fig. 3, which is derived from Fig. 2, ωL and R are phase values of the synchronous impedance. Since OC is the resultant e.m.f. driving the stator current I, if the synchronous impedance $Z = \sqrt{R^2 + \omega^2 L^2}$, then I lags on OC by an angle $\gamma = \tan^{-1}\left(\frac{\omega L}{R}\right)$; also the base line of the circle lags on V by the same angle $\tan^{-1}\left(\frac{\omega L}{R}\right)$. Now $I = OC/Z$ and $\alpha = \gamma - \phi$; therefore equation (2) may be written $I^2 - 2V \frac{\omega L}{Z^2} I \sin\phi - 2V \frac{R}{Z^2} I \cos \phi = \frac{E^2 - V^2}{Z^2}$ . . . . . (3)

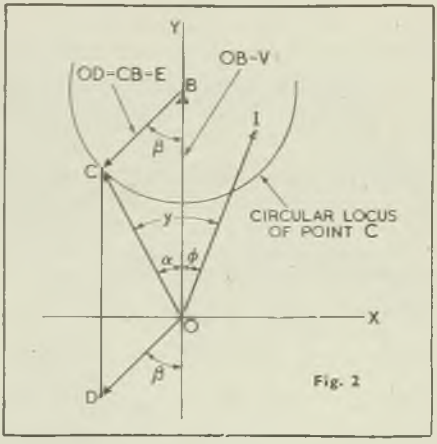


Fig. 2

Comparing (3) and (1), it is seen that the co-ordinates of the centre d of the current circle diagram (Fig. 3) are :—

$$x = \frac{a}{2} = V \cdot \frac{\omega L}{Z^2}$$
$$y = \frac{b}{2} = V \cdot \frac{R}{Z^2} \quad \text{. . . . . (4)}$$

and $r = \frac{E}{Z}$

Considering the xy co-ordinates of the centre of the circle diagram, in Fig. 3, as the DC excitation approaches zero, the battery remaining in circuit, the stator current I must approach Od, and become coincident with Od when the excitation becomes zero. This is so because E/Z becomes the radius of a circle with centre d and zero dimensions. When the DC excitation is zero, the motor must be operating as induction motor on no-load, so that Od must be the no-load current of the machine as an induction motor. In other words, the centre of the non-salient-

pole synchronous-induction motor circle is the extremity of the induction motor no-load current vector and is definitely fixed for any

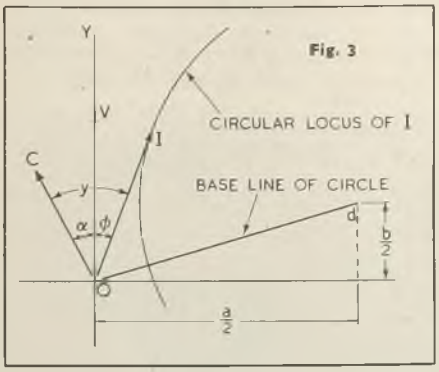


Fig. 3

given value of the stator supply voltage. The co-ordinates of the circle centre must therefore be given by $x = I_o \sin \phi_o$ and $y = I_o \cos \phi_o$ ..... (5) where I_o = the no-load current per phase of the induction motor and ϕ_o = the lag angle of the no-load current from the supply voltage.

The synchronous impedance of the motor can be derived from equations (4) and (5), it being evident that $I_o \sin \phi_o = \frac{V}{Z} \cdot \frac{\omega L}{Z}$ and $I_o \cos \phi_o = \frac{V}{Z} \cdot \frac{R}{Z}$, thus Z may be defined as $\frac{V}{I_o}$, ωL as $\frac{V}{I_o} . \sin \phi_o$, and R as $\frac{V}{I_o} . \cos \phi_o$. Using this definition of Z, instead of simply calling it synchronous impedance, ωL and R are apparently largely, if not mainly, due to the magnetic reluctance and resistance of the core plates of the motor.

TABLE I

Open Circuit Volts E	Short Circuit Amps Ist	DC Excitation Amps Idc.	Synchronous Impedance Z
126	3·4	8·0	37·0
150	4·1	9·6	36·6
177	5·1	12·0	34·7
200	6·1	14·4	32·8
211	6·8	16·0	31·0
222	7·6	18·0	29·2
232	8·45	20·0	27·4
240·5	9·3	22·0	25·9
250	10·3	24·4	24·3

The motor tested was a 200-V, 50-cycle, three-phase, 1,500-RPM induction motor. Fig. 4 shows the usual synchronous impedance line, that is, the value of the open-circuit terminal voltage divided by the short-circuit current at the same value of the DC excitation; also three points are shown for the line as defined by the quantity V/I_o, indicating the close agreement between the two lines. The values of $\frac{V}{I_o}$ are taken from Table II and plotted against the values of the DC excitation necessary to produce corresponding values of E., *i.e.*, 150, 200, and 250 V..

The open-circuit and short-circuit curves were taken from readings of induced e.m.f.,

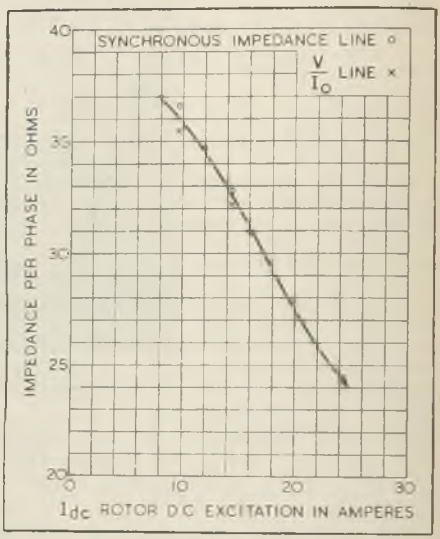


Fig. 4

E per phase and short circuit current, Ist per phase, corresponding to different values of rotor DC excitation when the machine was driven at 1,500 RPM. The results are shown in Table I. The phase values of the stator voltages and current for the no-load test are set out in Table II together with the corresponding values of the DC excitation amps taken from Table I.

It is not suggested that the original definition of synchronous impedance is either faulty or wrong and the present definition is put forward solely on the grounds that it may, in certain cases, lead to useful conceptions of what may be involved in the term synchronous impedance.

TABLE II—NO-LOAD TEST DATA

Phase Volts V	Phase Current I_o	$\frac{V}{I_o}$	DC excitation amps
150	4·23	35·5	9·6
200	6·20	32·2	14·4
250	10·20	24·5	24·4

Insulating Varnishes

Composition and Properties

FILM-FORMING substances used for insulation were discussed at a recent meeting of the Radio Section of the Institution of Electrical Engineers. MR. C. R. PYE described the fundamental chemical combinations involved and how properties could be varied by altering the ratio of the fluid contents. He outlined the basic difference between oil-based and synthetic varnishes, and commented on impregnation methods and specialised uses, remarking that solvent-less varnishes were the ideal variety, but there were still difficulties in the way of their full utilisation. Probably the type most likely to come into general use would be based on "Silicone" polymers, which resisted heat well and were suitable for high-frequency insulation.

In the discussion which followed several speakers pointed out the necessity for careful stove drying of coils before dipping and the advantage of rapid transfer to the bath while still hot. It was thought that the figures quoted for the degree of vacuum required were conservative and that in general a reduction of pressure to between 1 and 3 mm. of mercury was desirable. Complete extraction of any solvent at low pressure was important, and two pumps might be necessary to overcome the residual vapour pressure of solvent trapped in the pump oil.

Metallic catalysts should be used with caution as they were apt to initiate electrolysis; in general, driers with a lead base should be avoided as they tended to reduce the ductility of the copper and cause breakages. The formation of water as a by-product of curing some types of varnish should not be overlooked.

Moisture Penetration and Diffusion

Since the function of a varnish was to exclude moisture, it was important to realise that this was a matter of degree. The rate of penetration was governed by absorption by the material and diffusion through it. A substance with an intrinsically low water absorption factor might show widely differing degrees of penetrability depending on whether the molecular structure was ordered or random. In the process of evaporation solvents might leave intermolecular diffusion paths.

The properties of a varnish as a dielectric could not be predicted by applying Debye's theory, the general opinion being that calculations based on the rotation of polar groups were not profitable in the case of substances which were essentially mixtures. Many of the new wire coverings were more resistant to abrasion than oil-based bituminous enamels, but some were not so good from the point of view of resistance to moisture.

Some speakers thought that the advantages of solvent-less varnishes might be offset by loss from drainage resulting from their lower viscosity and the higher temperatures required for curing. When complete impregnation without voids was required it might be necessary to provide a permanent container for the component. All looked forward to the time when varnishes of the "Silicone" and vinyl carbazole types would be available in larger quantities for the treatment of high-frequency equipment.

Welding Research

USEFUL discussions on the applications of research to industry were a feature of the British Welding Research Association's symposium on the "Metallurgy of Steel Welding" held recently in London.

The president of the Association, Sir William J. Larke, said that only through enlightened interest could they hope to secure support, both personal and financial, from the industries concerned in the development and application of welding. Undoubtedly one of the most effective means of securing that objective was by the organisation of symposia at which those engaged in research could make authoritative statements on its results and receive in return comments and criticism which would stimulate further effort and, in many cases, suggest additional avenues for exploration.

Mr. A. Ramsay Moon, the director of research, outlined the Association's work in relation to the metallurgy of steel welding and Mr. J. G. Ball, secretary of the main Ferrous Metals (Metallurgical) Committee supplemented Mr. Moon's remarks with an analysis of the various papers submitted at the symposium.

The general conclusion from the discussion was that it was in the interest of research and industry to have a series of symposia and the Association is planning along these lines.

The papers and discussion were restricted to members, but they will be published in due course as a volume of proceedings.

Views on the News

Reflections on Current Topics

AS an ardent cinema-goer I eagerly accepted E.D.A.'s invitation to see its latest film, "Their Invisible Inheritance," and on the whole I was not disappointed with it, realising how hard it is to conceal large pills in jam without overdoing it. By its very nature the film has to compromise between entertainment and instruction; it is intended to be shown to housing authorities but it will also be seen by audiences of a more general character. I think the passages demonstrating how the kitchen should be arranged and the living rooms equipped are particularly good and so are the "shots" of the power supply arrangements. Incidentally, the dreadful example of an ill-wired room may lead some people to wonder how they can improve their situation without undue expense. Also incidentally, a well-known electrical trade-mark gets a good show in one part of the film.

* * *

The Heyworth Committee's report shows that one bugbear which the electrical industry has largely got rid of still haunts the gas industry. This is the black enamelled cooker, a depressing appliance which is difficult to keep clean. It is said that probably a third of the gas cookers now in use are out of date and inefficient and it seems to be implied that these are mainly black ones. Gas cookers seem to me to acquire an obsolete appearance much more rapidly than electric types. I have had an electric cooker in use for about sixteen years now and all who see it comment on its handsome appearance: and yet it is just a standard model by one of the well-known makers.

* * *

Whatever substance there may be in the allegations that the housing drive is making tardy progress, electricity supply authorities at least are pressing forward with their part of the work, judging by the mains extensions recorded for such purposes. The latest example I have noticed is that of the London and Home Counties J.E.A. which has sanctioned an expenditure of £49,816, largely on account of supplies to housing estates, both temporary and permanent.

* * *

In this connection an interesting point is raised. Under Section 24 of the Schedule to the Electric Lighting (Clauses) Act, 1899, a local authority which has the control and management of public lamps in any street may serve a requisition upon the electricity undertaking to lay distribution mains, for providing a supply to houses in that street. In this event the undertaking will lay the mains without any contribution towards the capital cost, or agreement as to guaranteed revenue. Where there is no agreement for electric street lighting, the J.E.A. would automatically (under Section 26 of the Act) require the Council to enter into one for a period of at least three years, applicable to the street (or part of it) in respect of which the requisition is made. With regard to temporary housing estates, local authorities will be called upon to meet any balance of capital expenditure when the estates are demolished, or the cost of any alterations where the houses are replaced by permanent ones.

* * *

An amusing proposal for getting over the plug and socket difficulty is reproduced in the December issue of the *Electrical Contractor*. It is related to a revised version of a *Sunday Express* cartoon re-drawn by Mrs. B. H. Sadler "under the skilful direction of Mr. J. Gaunt Craven, M.I.E.E." The solution is a "design for new 'Radar' universal socket. Guaranteed to take any make of 2, 5, 10 or 15 amp. B.S.I. or other standard two pin or three pin plug with round or flat pins. Pin centres and alignment controlled by 'radar' from the Mid England B.S.I. Plug and Socket Control Station by means of the new ripple frequency go gauge and pin diameter adjuster superimposed on the Grid." This seems to be as good a solution as some which have been propounded.

* * *

Also in the December *Electrical Contractor* I see a statement made at one of the provincial branches of the E.C.A. that a member was unable to obtain service at the counter of a certain wholesaler due to the assistants being engaged in serving non-contractor customers for cash, some of the purchasers being so ill-acquainted with the trade that they were seeking information on cable and switchgear sizes from a young boy assistant. In this connection I observe that the North-West Counties Sectional Board of the Association recently passed a resolution urging the E.C.A. Council to meet the Electrical Wholesalers' Federation for the purpose of "exploring every avenue" which may be available to stop supplies of electrical material to unauthorised contractors. I am not quite sure of the term "unauthorised" in this respect, but I think I see what they mean.—**REFLECTOR.**

CORRESPONDENCE

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

Single-Pole Fusing

MOST installation engineers will heartily endorse the views on single-pole fusing expressed by Mr. H. R. Mann, and it is certain that considerable misgiving prevails, especially in rural areas. The saving in installation costs is so small that the incurring of additional risks hardly seems worth it.

In his final paragraph Mr. Mann states that the use of earth-leakage circuit-breakers means that all installations would have to be metal-clad. This is certainly not the case, as experience at home and abroad has shown that for real leakage protection the protective conductor should be insulated from extraneous contacts, taking into account protection from fire as well as shock.

Selective protection for individual equipment or sub-circuits with earth-leakage circuit-breakers can only be secured with the adoption of an all-insulated wiring system, the protective circuit being insulated in addition to the working circuit. The policy of utilising one leakage circuit-breaker only in any installation is not at present in favour, but attempts to segregate sections of metal-clad installations have almost invariably resulted in failure.

Folkestone. T. C. GILBERT.

Situations and Salaries

AS a Service "user" of your "Situations Vacant" column, may I appeal to advertisers to help those looking for situations by stating what the position is worth rather than using the phrase "state salary required."

Surely advertisers know the type of man they require and the value of the position. Why leave us to estimate its value?

The phrase implies that the advertiser wants the cheapest man he can get, and I for one do not bother to answer such advertisements.

"R.E."

Contractors and Retail Sales

WHILE Mr. Alex. Milne is asking for compulsory registration, it is interesting to note that ironmongers and builders' merchants appear to be selling the bulk of the electrical supplies and accessories and soon the contractors will cease to exist except to install the fittings that are purchased through the ironmonger.

The time has come for the Electrical Wholesalers' Federation to make a clean up of the electrical business—goodness knows it is needed.

Chard. J. SCOTT.

Meter Testers' Status

FURTHER to "Meter Tester Class I's" letter published in your issue of November 16th, one may accept his remarks as being generally representative of feeling among meter staffs. It is hard to understand how and by what standards the recent N.J.I.C. rates for meter testers and mechanics were determined. To a meter tester, however, it is obvious that knowledge of the technical skill demanded by modern meter and instrument calibration cannot extend very far beyond the metering community otherwise such grossly unfair rates would not have been agreed.

It is also obvious that the normal testing station system of training and promotion is not widely known, inasmuch as a tester Class II is one who at some time has by reason of an adequate show of theoretical and mathematical ability graduated from repair to test and inspection duty. Further proficiency in advanced technology and test ability usually gains graduation to tester Class I.

The majority of these men have by necessity qualified in recognised courses of electrical technology, fulfilling years of hard study, generally part-time, in order that they may meet the requirements of their profession and therefore such men must surely be worthy of inclusion in an undertaking's technical staff.

Under present-day conditions, testing station trainees receive little encouragement when their renuneration following years of practical and technical effort is ½d. an hour more than that of the indoor labourer and much less than the electrician's rate. It is therefore urged that N.J.B. staff grading is long overdue, and a change of designation from "tester" to "meter technician" would be more appropriate to the duties performed.

Most testers visit consumers' premises in connection with account disputes and in addition to tests *in situ* they represent the

supply authority in discussions with the consumers in endeavours to settle the disputes and to execute such duties they must appear reasonably well clothed and not in overalls like their more fortunate higher-paid associates.

"DEPUTY METER SUPERINTENDENT."

Employees and Nationalisation

WHY does your correspondent, "Emancipated," in the *Electrical Review* of November 30th, assume that nationalisation of electricity will result in higher wages for the employees?

The article by "Borough Electrical Engineer," to which the writer refers, points out that salary scales for comparable technical workers in the nationally-owned Post Office appear to be only two-thirds of those paid in the electricity industry. In this industry the wages for technical workers are fixed by the National Joint Board of Employers and Members of Staff, which operates with satisfaction to employed and employers alike. It will be remembered that in the Conditions of Labour and National Arbitration Order made in 1940, all employers were required to observe terms and conditions not less favourable than the recognised terms and conditions settled by negotiating machinery of this kind.

Presumably "Emancipated" will agree that it is better for the workers if an industry, whoever owns it, is sufficiently prosperous to afford salaries which are a proper value for service.

*London, S.W.*16. FRANK D. LONG.

Staff Association Wanted

SOME time ago the Administrative Officers' Association was formed, the membership of which was, perhaps unfortunately, limited to higher executive heads of power and supply companies. With the prospect of nationalisation could not its membership be broadened, or a new association formed, for the purpose of representing the clerical and administrative staffs of the companies in discussions with the Government Department concerned with nationalisation?

The number of such workers in the industry must be at least 2,000 if not considerably more (excluding sales and publicity staffs) and they alone have no organisation to look after their interests at this critical time. All the other employees in the industry are catered for by N.A.L.G.O., E.P.E.A., E.T.U., etc., and these bodies will certainly consult, or be consulted by, the Minister concerned.

May we hope that clerical and administrative staffs (together with commercial staffs) in London or the Midlands will take some action? The matter is important and urgent.

"ACCOUNTANT."

Choice of Text Books

IN reply to Mr. J. C. Clarke's letter in your issue of November 30th, I should strongly recommend "Electrical Engineering Practice" by J. W. Meares and R. E. Meale, published by Chapman & Hall, Vol. 1, 28s., Vols. 2 & 3, 35s. each.

Coventry. W. M. BANATT,
Hard Metal Tools, Ltd.
(Pyrometry Laboratory).

TO help your correspondent may I suggest four volumes entitled "Principles of Electrical Engineering," with Sir Ambrose Fleming as the general editor? This should cover the subjects mentioned and the price at the time of purchase was well within the £5 stipulated.

Bath. KARL GILES.

New E.D.A. Film

LAST Thursday we saw the new film produced by the British Electrical Development Association—"Their Invisible Inheritance." This inheritance is the public supply of electricity which has become available practically everywhere during the past few years; the object of the film is to stress the need for ensuring that the inheritors—the modern generation—are enabled to make full and beneficial use of the service.

The film is primarily intended for the edification of housing authorities whose ideas of electrical service are sometimes sketchy and the parts dealing with the logical way of planning a kitchen and wiring living rooms are effectively done. But it is also necessary to include some "human interest" in a film that will also enjoy some public circulation and this takes the form of a comparison between conditions after the 1914-18 war and those now being experienced. In this part too the opportunity of urging the importance of adequate facilities is taken in a mildly humorous way.

Woman's influence in the matter is demonstrated by "shots" of a meeting at which views are expressed and conveyed to the local Housing Committee which is also shown in session. The "documentary" aspect of the film is good, there being a number of excellent views of power stations and of the grid.

PERSONAL and SOCIAL

News of Men and Women of the Industry

A DINNER is to be held by the West Wales (Swansea) Sub-Centre of the Institution of Electrical Engineers on Friday, January 25th, in honour of **Mr. A. Jarratt,** who has been in office continuously as treasurer, vice-chairman and chairman since the formation of the Sub-Centre. It is hoped to make a presentation to him and contributions should be sent to Mr. L. Benallick, Electricity Department, Guildhall, Swansea.

Mr. A. McVie, B.Sc., A.C.G.I., A.M.I.E.E., general manager and director of Kolster-Brandes, Ltd., has been elected chairman of the Council of the British Radio Manufacturers' Association. Mr. McVie joined Western Electric Co. (the predecessor of Standard Telephones & Cables, Ltd.), in 1921 as an engineer, and later became general manager for India and Malaya. In 1926, he was appointed assistant sales manager at the S.T.C. head office, where he was in charge of all telecommunication sales (excluding cables). In 1933 he was appointed foreign director in charge of S.T.C.'s export business, and later formed Stanelco Products. He was appointed to his present position in 1940. He is also manager of the S.T.C. receiving valve plant.

Mr. A. McVie

Lieut. Commander A. C. Hazell, R.N.V.R., who is at present serving in an aircraft carrier, informs us that he is on his way home and is due in the United Kingdom on January 14th. Letters will reach him at his temporary address, 214, Peverell Park Road, Plymouth.

Mr. W. G. Crawford, B.Sc., A.M.I.E.E., has been appointed chief electrical designer to the Harland Engineering Co., Ltd., and will take up his new position on January 1st. He spent some years with the company early in his career and he now returns to take the place of **Mr. L. Greenwood,** who is relinquishing his post.

Mr. J. D. H. Sheridan has been appointed chairman of the Strand Electric and Engineering Co., Ltd., and of the parent company, Strand Electric Holdings, Ltd., in succession to Mr. F. L. Blow, who recently resigned after nine years' service in that capacity. Mr. Sheridan previously held the position of managing director and will in future combine the duties of chairman and joint managing director. **Mr. S. E. Earnshaw,** for many years a director, now becomes joint managing director, remaining in charge of the company's theatre production lighting work. To fill the vacancy caused by Mr. Blow's resignation **Mr. L. G. Applebee** has been appointed to the board and will continue to be responsible for lighting sales to theatre and other "live" stages. The return to the company of another director, **Mr. H. M. Cotterill,** is also announced, after five and a half years' absence on active service. He will be in charge of cinema and general lighting sales.

Dr. John A. Fleming has been awarded the third (1945) Charles Chree medal and prize by the Physical Society of London. The presentation took place on December 6th. Dr. Fleming succeeded the initiator of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington as director and also president of the International Association of Terrestrial Magnetism and Atmospheric Electricity. Dr. Fleming's department is the only organisation in the world devoted to the study of terrestrial magnetism in all its aspects, including ionospheric investigations and experimental nuclear physics.

Mr. A. L. M. Bainton has joined Bull Motors (E. R. & F. Turner, Ltd.), Ipswich, as sales promotion manager.

Mr. A. G. Milne has been appointed technical superintendent to Blackburn Corporation electricity undertaking.

Blackpool Corporation Electricity Committee has appointed **Mr. K. C. Coope,** of Leeds, as deputy borough electrical engineer at a salary of £774 per annum.

Salford Light, Heat and Power Committee has approved the appointment of **Mr. J. B. Thomas,** B.Sc. A.M.I.E.E. assistant mains engineer, Central London Electricity Ltd., to the position of senior mains engineer.

Alderman S. C. Grimwade, J.P., deputy mayor of Ipswich, has been re-elected chairman of the Electric Supply and Transport Committee for the nineteenth year in succession.

Mr. L. A. Lee, district engineer at Market Harborough for the Kettering Electricity Department, for the past eleven years, has been appointed assistant consumers' engineer to the Mid-Lincolnshire Electric Supply Co., Ltd.

Mr. A. Abbott, A.M.I.E.E., has joined the staff of Merz & McLellan. He received his technical training at Manchester College of Technology, and served his apprenticeship in the Meter and Instrument Department of Ferranti, Ltd., and also on the outside erection staff of Ferguson, Pailin, Ltd. In 1930 he rejoined Ferranti, Ltd., being engaged in connection with the supply of metering equipments to the Central Electricity Board in South-East

England, after which, in 1932, he became assistant engineer with Landis & Gyr, Ltd., on similar work for the Board in North-West England. He joined the technical staff at the Polygon Testing Station of the Manchester Corporation Electricity Department in 1935, dealing chiefly with protective-gear engineering for the system. In 1939 he was appointed protective-gear engineer in the Switchgear Department of the General Electric Co., Ltd., Witton, being responsible for protective schemes on numerous large contracts.

Mr. Frank Clark is retiring on December 31st from the position of commercial assistant to the Eccles Corporation electricity undertaking after forty-five years' service. The Electricity Committee recently passed a resolution recording its appreciation of his services.

Speaking at a recent luncheon at the Waldorf Hotel, London, **Mr. W. Martin Hume,** chairman of the Watliff Co., Ltd., told the shareholders and guests present something of the part which the company's commutators had played in the war. He referred to the attack on the *Tirpitz*, made by midget submarines in the Alten Fiord on September 22nd, 1943, and said that the company had supplied special commutators for the main motors of the midget submarines, and these motors stood up so well to the strain of the arduous journey that a letter of commendation was later sent to the manufacturers by the Admiralty.

Mr. N. W. Jenson, F.C.I.S., has been appointed secretary of the Electro Medical Association, Ltd., to deal with administrative and other matters arising from the Association's post-war programme. Mr. Jenson's address is 55, Romney Street, S.W.1 (Abbey 3891-2).

Mr. H. D. Offer has been appointed meter superintendent to the Birkenhead Corporation Electricity Committee Department at a salary of £517 per annum.

The English Electric Co.'s annual presentation of indentures and merit awards to apprentices took place in the Association Hall of the Stafford Works on November 30th. During the afternoon the works were open to inspection by the parents of the apprentices. After welcoming the visitors, **Mr. F. Caunce,** superintendent of the company's Technical Education Department read a message from Sir George Nelson, the chairman and managing director, stressing the need for increasing the company's production and exports. Mr. Caunce pointed out that the regulations concerning the deferment of apprentices from military service were even more strict than during the war, and this was a matter of grave concern both to the apprentices whose careers were being interrupted and to the industry which would undoubtedly feel the repercussions of this policy in years to come.

Deputising for the Mayor, Councillor A. E. Hourd expressed the interest of the local government authorities in the activities of the company. Sir Hugh Chance congratulated the company on its pioneer work in the development of day continuation schools and elaborated the need for exports. While it was necessary to have up-to-date plant and equipment, he said that in the last analysis it was the initiative and energy of individuals who made up the organisation that ensured its success. Mr. J. W. C. Milligan, manager, Stafford Works, after distributing indentures and merit awards, handed the Milligan Shield for the best all-round apprentice of the year to Kenneth Jameson. A vote of thanks to the visitors, the speakers, and members of the management was proposed by Mr. R. C. Cook, chairman of the Apprentices' Association.

Mr. F. W. Cripps, until recently joint managing director of Dowsing Co. (Electrical Manufacturers), Ltd., with whom he has been for the last fifteen years, has joined Callinan, Giles & Co., Ltd., who are concerned with hair waving equipment, as managing director. He retains his seat on the board of Dowsings, leaving **Mr. A. J. Gunn** as managing director.

Professor J. D. Bernal, Professor of Physics at Birkbeck College, University of London, has been awarded a Royal Medal by the Royal Society in recognition of his distinguished contributions to the theory and applications of X-ray crystal analysis.

Appointments Vacant.—Among the positions advertised in this issue are the following :— Electrical engineer and manager for the Brighouse electricity undertaking (£650 plus £60 bonus); consumers' engineer for the Crewe undertaking (£459); engineers or physicists for transformer research with the E.R.A. (£450 to £650); and a chief maintenance engineer for a company operating a group of factories (£600-£700).

Recently the Shoolbred Electrical Co., Ltd., celebrated the seventy-fifth birthday of **Mr. H. G. Shoolbred,** A.M.I.E.E., and the jubilee year of the firm which he founded, and of which he is still a director. The celebration took the form of a luncheon at the Gleneagle Hotel, Harpenden, at which thirty old and new friends of Mr. Shoolbred and the company were entertained. Replying to a toast proposed by Sir Thomas Keens, Mr. Shoolbred said it was in 1895 that he started in the then very unusual business of electrical contracting, after completing his education under Professor Silvanus Thomson, who incidentally was his first customer. With a partner he founded the firm of Shoolbred & Connell at 146, Fleet Street, E.C. In 1901 the contract for wiring for lighting at the electricity works then being built in Luton was obtained by the firm, and Mr. Shoolbred, seeing the opportunities in the town, opened a branch office there. Soon the Luton branch became the major part of the firm's work, so that in 1907 the London office was closed.

In 1930, the undertaking was formed into a company, and Mr. Alec Plummer, who had been with Mr. Shoolbred for some years as assistant, became managing director. Other speakers included Mr. C. T. Melling, borough electrical engineer, and at the close an electric clock was presented to Mr. Shoolbred as a mark of appreciation by the company.

Obituary

The Rev. A. J. Stubbs.—The death is reported, on December 8th, at the age of eighty-four, of the Rev. Arthur James Stubbs, M.Inst.C.E., M.I.E.E. Mr. Stubbs began his career as an architect and then received an electrical engineering training with the late Sir William Preece. He entered the Post Office Engineering Department in 1880; in 1887 he became a technical officer and in 1902 superintending engineer. He was appointed assistant engineer-in-chief in 1907 and retired in 1921 to become a partner in the firm of Sir Charles Bright & Partners.

Mr. Stubbs entered the Church in 1931, when he was ordained deacon by the Bishop of Rochester; he became priest in the following year and assisted the Rev. Walter Bristow in the parish of Woodside, Croydon. He published jointly with Sir William Preece "The Manual of Telephony" and was author of many technical papers. He had served on the I.E.E. Council and as vice-chairman of the Decimal Association. For many years he was a member of the Croydon Borough Council.

Science and Industry

Liaison in Manchester

CLAIMING to be free and unprejudiced, the Manchester Joint Research Council was formed just over a year ago to establish liaison between the scientist engaged in research and the practical industrialist who applies its results. Half the members of the Council are nominated by the University and half by the Chamber of Commerce. It has a liaison officer whose duty it is to put those who have research problems to solve in touch with those who can help them, and *vice versa*. When matters concerning research need ventilating the Council will promote discussion by calling a conference, or by other means, and will also help, if required, by making representations to the Department of Scientific and Industrial Research. When the formation funds contributed by its promoters are exhausted, the Council will not have any source of income apart from donations.

Sir John Anderson (chairman of the Government Advisory Committee on Atomic Energy) addressed the Council in Manchester last week on "Science and Reconstruction," mentioning many instances from diverse industries as illustrations of their high technical efficiency and readiness to appreciate and develop new ideas formed in research laboratories. He then turned to what was still needed in respect of personnel, finance and organisation for this country to make the most of its resources and opportunities; he rejected the suggestion that a Ministry of Science was needed—which did not mean that he was satisfied with things as they were.

In his concluding remarks on the prospect of industrial use being made of atomic energy, Sir John said he was quite certain that nothing had been discovered to justify the expectation that the energy released by an atomic explosion could be used directly as a source of industrial power for many years. Meanwhile the devices utilised for the production of the new element "plutonium" were the ready means of procuring a vast range of new radio-active substances that might revolutionise medical science and be of equal importance in plant and animal physiology.

Ripple Control

Is Standardisation Desirable?

SO-CALLED "ripple control" of electrical apparatus by the injection of signal impulses into existing power networks has recently twice been discussed by the London Students' Section of the Institution of Electrical Engineers.

MR. T. R. RAYNER's informal re-introduction of the subject on the second occasion last month was an endeavour to ascertain whether it was possible, or desirable, to standardise the system. He expressed the view that if the method was to be used extensively, which seemed likely because of the economies it promised, then some form of specification would be necessary to protect the user and guide the designer, but without stifling further development. A little planning now would save costly modifications later on. But more information needed to be obtained about the behaviour of power mains serving a dual purpose for which they were not designed.

Several contrasting opinions were expressed in the subsequent general discussion. Some speakers wanted complete freedom for development and others maintained that standardisation was needed only in certain respects, for instance voltage of the signal. Another view was that standardisation now would be unwise in view of possible national reorganisation. Whereas it was contended that standardisation at present should not attempt to do more than prevent interference due to "spill-over," it was emphasised that a multiple-area distribution authority might wish deliberately to "spill-over" in order thus to control the network of a related undertaking.

Emphasis on the need for further information to be collected by measurement (tests had recently been made by the C.E.B.) was coupled with a proposal that a questionnaire be sent to all distributing undertakings in order to ensure that available data were recorded on a common basis.

Power Transformer Stresses

MECHANICAL stresses in power transformers due to short circuits, switching surges and thermal cycles are considered in detail in a paper prepared by DR. E. BILLIG (E.R.A.) for the Transmission Section of the Institution of Electrical Engineers. A rule is stated for the minimum clamping pressure that should be maintained within the windings to prevent their movement, even slight, under any circumstances, so avoiding insulation abrasion which might cause electrical breakdown. All methods of clamping so far employed are said to be compromises, none of them fully taking care of the effects of cumulative shrinkage during the whole useful life of the transformer.

High-voltage windings, from the mechanical point of view, should preferably be on the outside and tapping coils should be removed as far as possible from strong magnetic fields. More records of performance are needed and there is scope for more detailed investigation of the behaviour of the materials now used as inter-turn, inter-coil, and end insulation of transformer windings, and possibly for the development of a new material better suited to the purpose. The main property required of such a material, apart from the usual electrical and mechanical requirements, would be freedom from appreciable yield after extended operation over many years when immersed in oil at temperatures up to 100 deg. C. under a high continuous pressure of the order of 1 ton/in^2, on which is superposed a lower pressure pulsating at 100 c/s. Certain statements made in the paper on the merits of various forms of design represent the author's personal opinion; they are not necessarily official E.R.A. pronouncements.

Insulating Minerals

PROGRESS made in the use of powdered minerals for insulating conductors within metal sheaths is recorded by Messrs. F. W. TOMLINSON and H. M. WRIGHT (Pyrotenax, Ltd.) in a paper they have compiled for the Installations Section of the Institution of Electrical Engineers. Manufacturing methods are first described and then the use of heating tubes made in this way for a variety of commercial purposes, including radiant helical (arc welded stainless steel tubing) boiling plates, cooking range elements (welded "Inconel") for naval ships, cast-in hot-plates, electric pokers, pre-heating elements for brazing, tube furnaces, close-bent cartridge elements, roller element for calender, water heaters (copper sheath) and for warming bitumen, heavy oil, soil and concrete floors.

The ductility of heating tubes made in this way enables them to be bent into many shapes. For instance for tightening by expansion the fixing bolts of generators, an axial hole is drilled in each bolt to permit of the insertion of a D-section heater tube doubled back on itself.

The second half of the paper is concerned with cable and wiring for ordinary power distribution, the properties of this type enabling them to be utilised in situations where operating conditions have been too severe for normal types and where flameproofness is desirable. Current ratings and comparative weights and dimensions are tabulated while methods of terminating with gland seals or recessed ferrules are explained. There is some advantage in preparing cable lengths in advance of installation, under factory conditions, chiefly for housing schemes and similar repetition work.

Forthcoming Events

Saturday, December 15th.—*Manchester.*—At College of Technology, Sackville Street. Manchester Association of Engineers. Conversazione and dance.

Leeds.—Electricity Offices, Whitehall Road, 2.30 p.m. I.E.E. North Midland Students' Section. "Power Transformer Maintenance," by A. E. Shearer.

Monday, December 17th.—*London.*—Institution of Electrical Engineers, 6 p.m. Metropolitan Graduate and Student Society. "The Transport Policy of the L.P.T.B.," by H. A. Curnow.

Birmingham.—Grand Hotel, 6 p.m. Birmingham Electric Club. "Electrical Plant Breakdowns," by J. Ashmore.

Sheffield.—Royal Victoria Hotel, 6.15 p.m. Society of Engineers and Metallurgists. "Colour Television," by L. C. Jesty.

Bristol.—University (Royal Fort entrance), 6.30 p.m. I.E.E. Western Centre (Installations Group). "Some Factors affecting the Design of Electric Lighting Installations for Building Interiors," by R. O. Ackerley.

Newcastle-on-Tyne.—Mining Institute, 6 p.m. North-East Coast Institution of Engineers and Shipbuilders. "Electronics: Their Scope in Heavy Engineering," by Dr. W. G. Thompson.

Tuesday, December 18th.—*London.*—Lighting Service Bureau, Savoy Hill, 6.15 p.m. Association of Supervising Electrical Engineers. "The Electrical Engineer and his Library," by C. W. Marshall.

Institution of Electrical Engineers, 7 p.m. I.E.E. London Students' Section. "Atmospherics and their Location," by C. Clarke.

Glasgow.—Royal Technical College, 6.15 p.m. I.E.E. Scottish Centre. "The Design and Installation of Electrical Accessories for Domestic Purposes," by F. C. Fuke.

Leeds.—Metropole Hotel, King Street, 6 p.m. I.E.E. North Midland Centre. "Mineral-Insulated Metal Sheathed Conductors," by F. W. Tomlinson and H. M. Wright.

Manchester.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North Western Centre Measurements Group. "The Economic Utilisation of Modern Permanent Magnets," by D. J. Desmond.

Stockport.—Mersey Hotel, Mersey Square, 7.30 p.m. Association of Supervising Electrical Engineers (Manchester Branch). "Outdoor High-Voltage Switchgear," by F. H. Grundy.

Wednesday, December 19th.—*Liverpool.*—Municipal Annexe, Dale Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "High Frequency Heating," by L. Hartshorn and E. Rushton.

The Gas Report

Heyworth Committee's Nationalisation Proposals

IN June last year the then Minister of Fuel and Power, Major G. Lloyd George, set up a Committee under the chairmanship of Mr. G. Heyworth to review the structure and organisation of the gas industry and to advise on changes necessary in order to develop and cheapen gas supplies to all types of consumers. The Committee's report, the first to deal with the industry as a whole, is dated November 1st, 1945, and was presented to Parliament by the present Ministry on December 5th. Issued as a Command Paper (Cmd. 6699) of 57 pages with three maps, it is obtainable from the Stationery Office at 2s. net. Included among the 82 individuals and bodies who presented evidence were Sir Cyril Hurcomb and Sir John Kennedy, the chairman and deputy chairman of the Electricity Commission.

The Committee considers that while the gas industry is reasonably efficient within the limits of its existing structure, the latter does not suit present-day conditions and is even less likely to provide scope for the future. It recommends that all existing undertakings (including non-statutory) should be compulsorily purchased on fair terms to be arranged by an impartial body, since no voluntary process would be sufficiently speedy. The country would be divided into ten regions, the boundaries being those most suited to the industry and not based on local Government delineations and avoiding division of existing undertakings.

Regional Boards

It is proposed that administration should be by Regional Boards, each consisting of a full-time chairman, three functional directors (production, distribution and sales) and three part-time directors (resident within the region) appointed by the Minister of Fuel and Power, initially for five years and thereafter for three-year periods, after consultation with a gas personnel advisory panel. These posts would preferably be filled from within the industry and officers should be encouraged to move freely between the regions by gradations of remuneration on an adequate scale. Decentralisation, especially on the sales side, is regarded as desirable.

Capital, it is held, should be of the fixed-interest type, guaranteed by Government, the Boards paying ½ per cent. commission. All new capital issues would be approved by the Minister of Fuel and Power. The Boards' duties are to promote the maximum development of gas in accordance with the best commercial practice and to fix prices to recover under normal conditions all expenses, including interest on outstanding capital plus the commission. Boards should not accumulate reserves other than depreciation, but they should be ready to call upon the Government guarantee on occasion.

The scope of the Gas Research Board (formed in 1939) should be enlarged and funds for the purpose should be provided by a levy on sales. A first objective of £200,000 per annum is envisaged. Last year the revenue was £32,000 of which £18,000 was obtained by a levy on undertakings, £12,000 from the Department of Scientific and Industrial Research and the balance from plant and appliance manufacturers. The link between the director of research and the Boards should be at the level of the director in charge of production or of distribution. Several of the larger undertakings as well as manufacturers also have research and development departments dealing with both fundamental and applied research, involving an annual expenditure of upwards of £400,000.

Structure of the Industry

The Report opens with a history of the gas industry, starting from the lighting installation in the house of William Murdoch, the steam engineer, in 1792 and the first Act in 1812 granting powers to the London Gas Light & Coke Co. down to the present controls, including salient statistics onwards from the earliest Board of Trade returns obtained in 1882. The present industrial structure comprises 1,047 undertakings, of which 406 are owned by statutory companies, 367 by non-statutory companies and 274 by public authorities (including five joint boards). In addition nineteen railways and collieries supply gas to the public.

Sales of gas by statutory undertakings in 1944 amounted to 1,756 million therms (12·9 per cent. from coke oven plants and 10 per cent. from water gas) as against 1,494 million in 1938 and 1,177 million in 1920. Statutory companies were responsible for 61 per cent. of total sales, and public authorities 36·8 per cent., the "non-stats" providing the balance of 2·2 per cent. In England and Wales, companies with annual sales exceeding 30 million cu. ft. must become statutory; this rule does not apply to Scotland where only 68 concerns, out of 193, hold Parliamentary powers, although these account for 87·1 per cent. of the sales. Eleven holding companies control 161 and 103 statutory and non-statutory undertakings, which supply 11·2 per cent. About 30 companies also supply water or electricity. Local authority undertakings are mainly in the North of England the Midlands and Scotland.

More than 5 million therms per annum are made by 65 undertakings which provide some 70 per cent. of the total while fewer than 1·25 million therms are made by 762 undertakings which contribute 13 per cent. Cost to consumers is generally a function of size, operating

efficiencies tending to increase with size of works up to 10 million therms per annum. In 1937 the price per therm supplied by undertakings with outputs of over one million varied from 4·7d. to 12d. per therm averaging 9d.; for smaller undertakings it ranged between 6d. and 1s. 11d. Operating cost of manufacture usually represents rather more than one-third of the total cost, storage and distribution one-tenth and administration less than one-third; service of capital comes to between a quarter and one-fifth.

Carbonisation efficiency, varying from 65 to 79 per cent., showed a weighted average performance before the war of approximately 75 per cent. Improvements during the war should raise the figure by 2 per cent. and reorganisation should ultimately bring about a similar increase. With normal methods of carbonisation 8 to 10 cwt. of coke is available for sale for every ton of coal processed. Research into the complete gasification of coal, which would alter fundamentally the relationship between coke and gas upon which the present economics are based, is not likely to result in any commercial application for at least ten years.

A national gas grid is ruled out on technical and economic grounds, nor can selling prices be usefully determined on a national basis. Conditions in the Ruhr Valley and in Belgium are in no way comparable (chiefly in load density) with those in Great Britain. Reference is, however, made to the West Yorskhire Gas Distribution Co., which collects gas from coke ovens and supplies it in bulk to its constituent undertakings, resulting in substantial economies and increase in sales, especially to industry.

The effect of load factor is felt in distribution costs (20 per cent. of the total), of which about half goes to meet capital charges on mains, services, holders and governors. Amalgamation of undertakings in areas of high demand has been shown to be beneficial in reducing storage capacity and stand-by plant.

Domestic Consumption

Before the war the domestic load absorbed 65 per cent. (cooking 50 per cent.) of the total output, industry 20 per cent., commercial purposes 10 per cent. and street lighting 5 per cent. Approximately two-thirds of the 10·5 million domestic consumers are prepayment consumers, which makes the introduction of promotional tariffs difficult. There is ample evidence that the efforts of the gas industry to adapt its price policy (including forms of tariffs) to new conditions has been largely dictated by competition from electricity which has been the main incentive to increased efficiency.

In regard to the future, it is stated that electricity can offer competition to gas in every field and that a considerable proportion of the houses to be built will be served by electricity. The demand for higher standards of heating, labour saving, cleanliness and smoke abatement which favour gas against solid fuel also favour electricity. Increase in the gas cooking load is regarded as unlikely; on the other hand intermittent and summer water heating might equal the present cooking load. The net effect of the various factors should be an increase in total domestic sales of gas, but development in different areas would be uneven, and this has an important bearing on the type of organisation recommended. Any increase in total sales must come mainly from existing consumers and consequently very great importance is attached to an effective sales policy combining promotional tariffs with the supply of new appliances.

Industrial Heating

Recent technical developments in electric lighting and the high cost of maintaining street lamps are expected to result in a very substantial reduction in this load during the next decade. Gas is expected, however, to secure a good share of industrial heat requirements, enabling it, after an inevitable immediate decrease, to raise its sales within the next decade to the level reached during the war, which was more than 50 per cent. in excess of that in 1939. Some net expansion of commercial load is regarded as probable.

Certain assumptions are made regarding capital costs, though not as a basis for compulsory purchase. The total outstanding capital of companies, statutory and non-statutory, is approximately £165 million. The market value of quoted stocks of all classes (at par £125 million) is 10 per cent. above par; if this is applied to the whole the net current market value of the companies is £181·5 million. *Pro rata* the municipal undertakings are worth £90·75 million; their net outstanding debt is £22 million (gross borrowed £89 million). Total costs of acquisition would be £272·25 million on one basis and £203·5 on another.

The current yield of quoted gas company stocks is 4 per cent. and for Government and municipal stocks 3 per cent.; for quoted electricity undertakings, including the Central Electricity Board, it is 3½ per cent. The regional Boards should be able to obtain capital at 4 per cent. interest or, by relying on Government guarantee, 3 per cent. In addition to capital required by the Boards for acquisition, further amounts of from £30 million to £50 million are likely to be required over the next five years. These would be allocated to modernisation held up by the war, appliance replacements on a large scale, concentration of production units, integration of distribution systems, and expansion. The need for a uniform basis of accounts for the regional Boards is stressed.

Proposed Queensland Water Power Scheme.—A scheme for utilising the waters of the Tully River is recommended by a committee appointed by the Queensland Co-ordinator of Public Works. The plant would comprise four 7,300-kVA units operating under a net head of 1,600 ft. and the total estimated cost is £1,506,000, including £378,000 for the dam and £236,000 for transmission lines.

Rotor Deformation

Exchange of Experience at the I.E.E.

IN opening the discussion on December 6th on the paper by Messrs. R. H. COATES and B. C. PYLE on the deformation of rotor windings of large turbo-alternators at the Institution of Electrical Engineers (see our last issue, p. 825) MR. C. W. MARSHALL (C.E.B.), stressing the seriousness of the trouble, said that in July, 1943, 410 MW of plant was out of commission for this reason, representing about 4 per cent. of the total installed in stations connected to the grid. By December, 1944, the loss of capacity had dropped to 80 MW (0·8 per cent.) but at the present time 190 MW (1·9 per cent.) was out of commission. In addition, fourteen alternators of a total capacity of 275 MW were operating with single earth faults. Trouble had also been experienced with aluminium-wound rotors of Continental origin and it had also been reported on 1,500-RPM 100-MVA sets abroad. An important contributory factor appeared to be the high maximum temperature of 130 deg. C permitted. Unless the elastic properties of rotor conductors could be improved, that maximum temperature should be reduced by at least 10 deg. C, involving a reduction in the MVAR rating, which might be made up by the addition of power factor compensating apparatus. Pre-heating existing machines appeared to be more economical than this, although it involved some complication in operation.

Packing End Windings

MR. W. D. HORSLEY (C. A. Parsons & Co., Ltd.) said it appeared that the main controlling factor was the temperature gradient down the slot in a radial direction. The copper had been observed to move radially in the slot and the safest approach to the problem at the moment was rigidly to pack the end windings and reduce the temperature gradient down the slots. Pre-heating had been tried in South Africa, but had been found to give negative results. Hard copper had also been tried, but no definite improvement had been observed.

MR. W. N. KILNER (Metropolitan-Vickers) said that copper shortening in 3,000-RPM rotors had occurred in only two stations containing his company's machines. In one, in this country, the machines ran 29,796 hours and were started and stopped 467 times before a short circuit between coils developed. One machine was operated at too high a temperature due to inadequate ventilation owing to an error in the erection of the external ventilating ducts. Duplicate machines in the same station operated for longer periods without trouble. In a station in South Africa the machines were operated at overloads for long periods so that probably the average temperature was more than 130 deg. C. The first machine to fail had operated for 16,000 hours in two years and had been started and stopped only 86 times. This rotor was returned to England and re-wound with soft copper; the end turns were solidly blocked so that if the copper tended to contract it would have to cut through the packing blocks before it could short circuit the coils. That rotor was re-installed in 1938 and pre-heated each time it started up; everything had been satisfactory since.

Hard-drawn Copper Coils

Two rotors constructed with h.d. copper coils had been supplied to the same customer and there had been no trouble although there was no pre-heating. But there was evidence that other machines in the same station with hard drawn copper windings were showing signs of deformation. Rotors should be made which did not require pre-heating and the machines should not operate at higher field currents than they were designed for.

MR. A. J. GIBBONS (London Power Co.) said his company had been relatively fortunate in this matter owing to the fact that practically all its turbines were 1,500-RPM machines and were not run anywhere near their full rated field current. Most of their troubles had been due to earth faults, not short circuits, and therefore it was wise to have the rotor repaired when the first earth fault occurred. Rotors should be fitted with a continuous insulation resistance tester which would ring an alarm.

MR. K. R. HOPKIRK (B.T.H. Co.) said that two important factors in the distortion of copper were the maximum temperature during each run of the machine, compared with the initial temperature, and the blocking of the end windings. There was a limit to the

tension of the windings which was not dictated by the copper in the straight turns, but by its ability to withstand bending, and the authors had forgotten to take it into account. He was now using silver bearing hard drawn copper. The difference of temperature between the top and bottom conductors was a very large difference in the Sheffield case. Since 1939 his company had developed means for evening out that difference and, at the same time, reducing the temperature gradient between the copper in the slots and the iron of the rotor. That was a remedy for some of the older rotors and it also enabled a larger output to be obtained from the same frame size.

Long Service Without Trouble

MR. F. A. YOUNGMARK (English Electric Co.) said his company put in its first large machines in 1929 and early in 1930 with rotor lengths of 120-in. and 145-in., and neither of these rotors had broken down yet. Actually the first breakdown due to copper distortion occurred in 1942. At that time they had a considerable number of machines running all liable to the same trouble but fortunately a very strong packing had been put in the rear end windings which probably had minimised trouble. Since 1929, 15 per cent. of the failures on all the machines his firm had put in using soft copper had been due to copper distortion, which could be regarded as comparatively small. The use of semi-hard copper was becoming general and he favoured the strongest possible packings in the rotor end windings. Silver-bearing copper was the next move. His company had used temperature indicators 25 years ago but these gave misleading readings then and he recommended that the connections for the instruments should be made from the main brushes.

MR. C.W. PRIEST (Battersea Power Station) said that at Battersea the first 30,000-kW 3,000-RPM machine to be installed in this country went into service in 1931; it had run for 53,000 hours and had been started up between 4,500 and 5,000 times. No pre-heating was adopted nor any unusual practices and so far there had not been any rotor trouble. This machine was designed for a power factor of ·8, and although it seldom ran below ·9 it gave a good margin on the rotor current.

MR. J. W. HOWARD (G.E.C.) showed a slide illustrating rotor distortion in a 25,000-kVA 3,000-RPM Continental machine installed in this country and which had been sent to his company for repair. In this case there had been expansion and not contraction; it had occurred on the top of the slot, which was generally expected to be the coolest part of the winding. Quoting examples of trouble-free operation, Mr. Howard said that a 30,000-kW machine could be produced which would not be subject to distortion. In the near future there would be an increase to 50,000 kW, with longer rotors of larger diameter both of which points must necessarily lead to greater danger of distortion. In connection with such machines, the manufacturers would have to ask the supply industry to help formulate a technique involving pre-heating on the lines suggested by the authors.

MR. COATES in his reply said it was perhaps unfortunate that these troubles had occurred under C.E.B., operation and that the Board had been blamed unnecessarily. It was generally agreed that it was the range of temperature that caused the trouble and the authors had adopted pre-heating so that they could use the top range. The use of some form of ohmmeter whilst the machine was running did not appear to be practicable and the authors had used an electrostatic voltmeter to obtain the approximate position of the earth fault, should one occur whilst the machine was running. Perhaps leakage ammeters might be of some use.

MR. PYLE, who also made a short reply, asked if Mr. Marshall could give the MW outage due to copper deformation throughout the country during the last few years. Commenting on the fact that during the discussion representatives of makers had spoken of two years' operation before a machine blew up and the claim that this was due to the particular rotors being perfectly sound, he said the authors had had machines which operated nine years before blowing up.

Rural Undertaking's Progress

A REPORT on the development of the Hawarden electricity undertaking states that there are only nine Rural District Councils in England and Wales owning electricity undertakings, and of these the Hawarden undertaking is the second largest.

Figures and details show the extent of the growth of the undertaking and the vigorous policy of the Council in regard to rural electrification and industrial development. Considerable progress has been made in farm electrification and to-day 100 farms have had power facilities installed. The Council has under consideration further development and contemplates spending £81,000 in the next five years.

COMMERCE and INDUSTRY

Machinery Traders' Luncheon.

Merging of Ministries

THE Regional Organisations of the Ministries of Supply and of Aircraft Production which have hitherto been responsible for the interests of their respective Ministries, are to be merged under one Regional Controller in each Region. Arrangements for this merger are now proceeding and will be complete by the end of the year. Announcements of appointments of Regional Controllers will be made shortly.

Newcastle Contractors' Dinner

At the annual dinner of the Newcastle branch of the Electrical Contractors' Association on December 4th, Mr. W. F. T. Pinkney, who is retiring shortly from the position of assistant general manager of the North-Eastern Electric Supply Co., said he did not wish to see a repetition of what happened after the last war, when too many unqualified people started installation work. He thought probably the best way would be for reliable firms to absorb men of that type and give them a fair wage for a fair job, under supervision.

Mr. L. C. Penwill, director and secretary of the Association, said that every Service man who wished to do so would have the opportunity of entering the electrical industry in qualified form and through the proper channels.

The health of the guests was replied to by the Lord Mayor of Newcastle (Alderman J. A. Clydesdale).

The toast of "The Electrical Contractors' Association" was proposed by Mr. W. Horsfall, director of the G.E.C., and Mr. J. Douglas Green, vice-president, and Mr. Penwill replied.

Electrical Machinery Traders

Speaking at the Association's first annual luncheon last week, Mr. W. E. Lawton, chairman of the Electrical Machinery Traders' Association, said that although their organisation was barely a year old it had already noteworthy achievements to its credit. They claimed to represent 80 per cent. of their trade, and their position had already been recognised by the Government in giving them four representatives upon the panel advising the Ministry of Supply on the disposal of surplus Government industrial electrical equipment.

Mr. Lawton referring to a statement that there were between two and three thousand trade associations, maintained that this was very desirable provided that these associations served the national interest. The war had brought about many lasting changes and those who continued to shape their policies in conformity with out-dated views might suffer commercial extinction. They regretted to observe a tendency in the electrical industry, even in a section of its press, to cling stubbornly to the old order. He considered that full and frank co-operation of all sections of the electrical industry could do nothing but good for all concerned. In conclusion Mr. Lawton welcomed the Association's guests.

In acknowledging the welcome, Mr. A. L. Johnson (Richard Johnson, Clapham & Morris, Ltd.), who is chairman or a member of several trade associations, spoke of the functions of these associations and the way in which they could serve the public. After a brief historical review of the subject, Mr. Johnson showed that it was to the advantage of the manufacturer to dispose of his goods through the recognised distributor and retailer. He said that in the present sellers' market anyone with goods to offer could make money but exploitation of this situation would bring retribution as surely as commercial inefficiency.

In the matter of prices the speaker urged the importance of market research and of a sound system of costing which should be unified for each trade. Mr. Johnson also touched upon industrial education, the "rehabilitation" of ex-Service men, wages and export trade.

Other speakers were Mr. H. Weston Howard (chairman Eastern Regional Board for Industry) and Mr. H. Vernon (T. W. Ward, Ltd.).

Refrigerator Production Plans.

Non-ferrous Metals

After twenty-five years co-operative research service the British Non-ferrous Metals Research Association now has an annual income approximating to £50,000 and a membership exceeding 370 companies. A new booklet, illustrated with laboratory photographs, outlines the organisation and policy of the Association, reviews current research work and includes a list of recently published papers.

Ball and Roller Bearings

The Minister of Supply has made the Control of Ball and Roller Bearings (No. 4) (Revocation) Order, 1945 (S.R. & O. 1945 No. 1463, Stationery Office, 1d.). This annuls the sole remaining Order restricting the acquisition of ball and roller bearings.

Belgian Engineers' Visit

Ten young Belgian engineers, one of them a woman, who graduated this year at the Mining College at Mons and are now serving in the Belgian Forces or in civil posts, are visiting Britain under the auspices of the British Council to study mining and engineering practice, particularly developments since 1940. Their programme includes visits to the General Electric Co., Ltd., Witton; W. & T. Avery, Ltd., Birmingham; Hams Hall "B" Power Station, Birmingham; Mather & Platt, Ltd., Manchester; the National Gas & Oil Engine Co., Ashton-under-Lyne; and Metropolitan-Vickers, Manchester.

"Prestcold" Refrigerator Production

An annual output of 100,000 electrically-operated refrigerators will be produced at a factory which the Pressed Steel Co., Ltd., is just converting from shell manufacture at Cowley, near Oxford. Mr. E. A. Lever, manager of the "Prestcold" Refrigeration Department, tells us that the last few machine tools are now being installed and that production is due to

commence on January 1st. Owing to the need for training labour and running in the plant full output will not be attained in 1946, but is expected that about 70,000 refrigerators will be produced. Although the first models are for the Government's prefabricated houses, by the middle of next year there should be six types in production for the general market and for export. The refrigeration unit of the new apparatus, which is self-lubricating, is sealed in a steel cylinder only 8 in. high by 8 in. in diameter, thus making the maximum storage space available.

"Dynamos" Visit Electrical Works

The Moscow "Dynamo" football team recently paid a visit to the St. Mary Cray works of Morphy-Richards, Ltd. The company has shipped considerable quantities of its "auto-control" electric irons to Russia and a sample of these seen at the offices of the Russian Trade Delegation led members of the team to ask to see the irons made. Each man purchased one to take back with him. Morphy-Richards also inform us that they have received instructions to send many of these irons to the United States where they are popular with some of the large departmental stores.

New Cable Factory

The Rolls-Royce factory at Newcastle-under-Lyme has been allocated by the Board of Trade to Rist's Wires & Cables, Ltd. The company informs us that this has a covered area of nearly 400,000 sq. ft. and a site area of 31 acres. During the war the company has been engaged in making motor and aircraft cables and p.v.c. cables for communication purposes and it claims to have produced over 1,000,000 yd. a week of the former types and 3,000,000 yd. of plastic-covered cables. It is anticipated that the new works will employ 2,000 people.

Aircraft Control

The art of flying becomes steadily more complex as the controls and instruments in the pilot's cockpit become more elaborate and numerous. In a service aircraft such as the Beaufighter, for instance, the cockpit contains some fifty controls, indicators and gauges, to all of which the pilot must at some time attend.

It is agreed that the actual positions of the controls cannot be standardised. *Flight* (the official organ of the Royal Aero Club), therefore, suggests that the first step should be the definite grouping of the controls according to their purpose, and the subsequent location of these groups within specified cockpit areas. The main logical groups are flying, control, engine and auxiliary, and there are two subsidiary sections operational and radio. Immediate identification of the "areas" would be achieved by the use of a distinctively coloured border enclosing each area. The system is described in the December 13th issue of *Flight*.

Television in the United States

United States manufacturers have revised the time-table for the appearance of post-war television-radio sets on the American market. Whereas some months ago it had been expected that the first television sets would be ready for sale this Christmas, producers now indicate that new television sets will not be available before late 1946 or early 1947. Television sets have not yet been manufactured on a mass production basis, and it is expected that a good many problems will yet have to be solved in this connection. There are at present six available "telecasting" stations and new ones are not expected to go into operation before 1948 to 1949. The prediction that probably only twenty cities will have television is made by the Emerson Radio & Phonograph Corporation. Delay on the part of the Federal Communications Commission in considering and acting upon the 160 applications for commercial television licences received, is cited as another factor hampering the industry.—*Reuter.*

Electric Vehicle Production

The "Q" Vehicle Co., Ltd., has completed arrangements for the large-scale manufacture of electric vehicles to be started early in 1946 at Sunderland by Steels Engineering Products, Ltd., Crown Works, Sunderland. The vehicles will include several alternative models of 20-cwt. vans and two alternative models of 2½-ton lorries. The "Q" Vehicle Co., Ltd., will be responsible for the selling, distribution and servicing of the vehicles under the "Q" short-haulage plan, which includes the provision of servicing stations in selected centres.

Dissolution of Partnership

A. N. Edwardes and **T. D. Edwardes,** carrying on business as electrical factors and shippers at 20, Blackfriars Road, London, S.E.1, as Edwardes Bros., have dissolved partnership. Mr. T. D. Edwardes will attend to debts and carry on the business.

Accident at Gasworks

Wigan Corporation was fined £10 with £1 15s. 6d. costs at the local magistrates' court recently for a contravention of the Factories Act in that the metalwork of a portable oxide breaker at the gasworks was not efficiently earthed. While pushing the machine three men received an electric shock, one of them being killed. Mr. D. Picken, Home Office inspector, said he found that the wire of the earth conductor was broken within the cable itself. The corrosion showed that the defect had existed for some time. Mr. J. Leather, maintenance electrician, said he had tested the motor, starter and earth wire a month before and the earth wire was intact. He tested them after the accident with a "Megger" instrument which indicated to him that they were in order. It was an intermittent defect.

Tower Clocks

Three new clocks which have been installed by Gillett & Johnston, Ltd., of Croydon, are all of the synchronous type. One is on the new surgical ward of the Queen Victoria Hospital, East Grinstead, Sussex, and has dials made up of Roman numerals applied to the tower instead of being cast integrally with supporting rings in the usual way. There are four dials, each of 5 ft. diameter, and the copper hands are mounted on coned centre discs, fitted to the structure of the tower at the dial centres. The mechanism is a single synchronous timepiece, coupled to

the dial-work by shafts and bevel gearing, and also arranged to release a motor-driven bell-striking mechanism at the hours.

All Saints' Church, South Merstham, Surrey, is the site of the second clock, which has a 3-ft. skeleton dial, cast in bronze. The mechanism is close behind the dial centre, without a striker, but with clocks of the synchronous type it is a simple matter to add a striking mechanism at any subsequent time, should the need arise.

The third clock replaces the old weight-driven clock in the tower of Coddenham Church, near Ipswich, Suffolk. There the synchronous time-piece operates the hands of the existing dial through a new motion-work and also releases the hour-striking mechanism, which is motor-driven and raises the existing hammer to strike the hours; so the clock represents a change over and is a good example of the way in which time-controlled AC mains can bring accurate time to quiet villages which are well away from large centres of population.

Large New Chemical Works

The President of the Board of Trade stated on Monday that Imperial Chemical Industries, Ltd., intended to erect a large new works on a 3,500-acre estate three miles from Middlesbrough at a cost of about £10,000,000. The works was expected eventually to employ 10,000 people; besides the production of heavy organic chemicals there would be installations for the manufacture of sulphuric acid, an electrolytic chlorine caustic soda plant and a vacuum salt plant.

Northern Ireland D.J.B.

Representatives of Belfast Corporation, Londonderry Corporation, and the Electricity Board for Northern Ireland met in Belfast last week to inaugurate a District Joint Board for Northern Ireland to operate in conjunction with the National Joint Board of Employers and Staff of the Electricity Supply Industry.

New Zealand Import Licensing

The *Board of Trade Journal* for December 8th gives full details of the import licensing arrangements made by the New Zealand Government for next year. They include many classes of electrical goods ranging from irons to generators, motors and transformers.

Calendars

Six excellent photographic views of old Chester adorn the two-monthly sheet calendar received from Brookhirst Switchgear, Ltd. Copies are available on request at the nominal charge of 2½d.

An attractive wall calendar, illustrated by a colourful bird life study, has been sent to us by Milne & Longbottom, Ltd., Rochdale.

Well-known beauty spots and historical buildings in Lincolnshire illustrate the 1946 calendar of Ruston & Hornsby, Ltd.

Trade Announcements

Mr. H. V. Henniker, M.I.E.E., and Mr. O. Thewsey have formed Henniker, Thewsey, Ltd., engineers, Edinburgh and Manchester. Mr. T. A. Long, M.I.E.E., managing director of Bonar, Long & Co., Ltd., Dundee, will be chairman, but the active direction will be in the hands of Messrs. Henniker and Thewsey. The company holds the agency for Bonar, Long & Co., Ltd., for the North of England, Scotland and North Wales, and other agencies are pending. The company will continue in Scotland agencies previously held by Mr. Henniker; Mr. Thewsey will be primarily responsible for the greater part of the North of England and North Wales.

The address of Thermolectrics, Ltd., has been changed to Chapel Works, Church Street, Hampton-on-Thames, Middlesex.

Trade Publications

W. T. Henley's Telegraph Works Co., Ltd., 52, Hatton Garden, London, E.C.1.—Catalogue (C) containing technical particulars of paper-insulated (metal sheathed) cables of various classes and sizes for from 660 to 22,000 V.

Londex, Ltd., 207, Anerley Road, London, S.E. 20.—Illustrated leaflets (No. 105) dealing with high-speed multiple contactors with ball bearings, AC 10 A up to 400 V and DC 5 A up to 250 V, for welding, motor control and signalling; (No. 104) remote master control for street lighting.

Higgs Motors, Ltd., Witton, Birmingham, 6.—Abridged pocket size price list of numerous types and sizes of motors.

Newage (Manchester), Ltd., 282, Bury New Road, Manchester, 7.—Brochure illustrating a comprehensive range of stationary and mobile engine driven AC and DC generators, welding sets, battery charging plant and compressors.

Applicants for copies of these publications should write on their firms' business notepaper.

Equipment of Burnley College

Equipment costing £3,895 is to be installed in the new electrical laboratory at Burnley Municipal College.

American Factory for China

The Westinghouse Electric Corporation is to set up a $40 million electrical equipment factory in China.—*Reuter.*

London J.E.A. Estimates

SUBMITTING estimates for the operation of the London & Home Counties Joint Electricity Authority for 1946, Mr. T. H. Jones, chairman of the Finance Committee, stated last week that while most costs had risen substantially it was not considered necessary at present to make any general increase in charges to consumers who would still receive their supplies in 1946 at approximately the same average price per kWh as in 1936. The new grid tariff, would lead to increased expenditure which could not be precisely estimated. Capital expenditure was estimated at £197,000, and income from the sale of electricity, etc., at £1,722,000. Expenditure for the year was estimated at:—Cost of energy, £811,000, distribution, management, etc., £432,000, interest and redemption of capital, £385,000, and income tax, £81,000, making in all £1,709,000. The estimated surplus was £13,000, making an accumulated surplus at the end of 1946 of £184,000.

PARLIAMENTARY NEWS

By our Special Reporter

Electrical Workers in the Forces

IN the course of his speech in moving the vote of censure on the Government last week, Mr. Oliver Lyttelton said that in the heavy engineering industry the labour force was falling week by week although the industry was supposed to be making a great contribution towards the restoration of export trade. He happened to be connected with Associated Electrical Industries, Ltd. This concern had received back from the armed forces 850 of its workers; it still had 9,335 in the forces. The English Electric Co., Ltd., had 40 per cent. of its capacity unused. Although the President of the Board of Trade had recently made eulogistic comments about orders for electrical plant taken in Brazil, this was not accompanied by any action by the Government to secure that the present needs of the heavy engineering industry for labour should be met.

Ministry of Works Electricians

Sir Harold Webbe asked the Minister of Works on what grounds assistant electrical wiremen employed by his Department were barred from qualifying for employment as full craftsmen.

Mr. Tomlinson said that the Departmental Joint Industrial Council had been able to formulate a satisfactory scheme to enable assistant electrical wiremen to qualify for employment as full craftsmen in his Ministry. The problem was a complicated one; the difficulties included such matters as seniority in relation to discharge and certain rules with regard to the qualifications for full membership of the trade union. He was, however, arranging for the matter to be re-examined by the Council.

Supply in Merioneth

Replying to Squadron-Leader Roberts, the Minister of Fuel and Power (Mr. E. Shinwell) said that the amount of energy generated by authorised undertakers by water power in the County of Merioneth in the year 1944 was 34·5 million kWh. Of this, about 8 million kWh was sold in Merioneth, the remainder being sent to other parts of North Wales. No figures were available of units generated or sold by non-statutory undertakers.

Water Power in East Africa

Squadron Leader Donner asked the Secretary of State for the Colonies whether the terms of reference of the committee of experts on electrical development in East Africa included the examination of projects for development of electric power in combination with irrigation where possible.

Mr. George Hall replied that the immediate purpose of the inquiry was to investigate the potential demands for electric power and the resources, including water power, for its production. The possibility of combining hydro-electric schemes with irrigation would not be overlooked.

Cable & Wireless Foreign Properties

Captain Gammans asked the Foreign Secretary whether any negotiations had yet been opened with the Governments of Egypt, Portugal and other countries at present served by Cable & Wireless, Ltd., as to the terms under which these countries were prepared to transfer the company's stations to the jurisdiction of H.M. Government. Mr. Bevin replied in the negative.

Industrial Controls

Mr. Bower asked the President of the Board of Trade if he would consider setting up some central authority for the purpose of bringing about some immediate improvement in the operation of the industrial controls system in the interests of more rapid expansion.

Mr. Ellis Smith answered that the Government was satisfied that the existing arrangements for keeping industrial controls under review and adapting them to the requirements of the transition were adequate for the purpose.

Power Plug Shortage

Major J. White asked the President of the Board of Trade if he was aware that there was a shortage of electric power plugs in East Kent; that this shortage was holding up the completion of housing construction and repairs, while causing hardship to householders without alternative means of cooking and heating; and if he would take steps to make supplies available.

Mr. Ellis Smith said that he was informed that the production of electric power plugs was sufficient to meet present demands. If he were given particulars of any specific case of shortage he would have it inquired into.

Purchase Tax on Electric Kettles

On the report stage of the Finance Bill Sir Arnold Gridley moved an amendment to include electric kettles among the articles of household equipment which were to be freed from purchase tax.

The Chancellor of the Exchequer (Mr. Dalton) said that he was sympathetic to the amendment because he hoped that electrical equipment would be widely installed in houses all over the country. He could not, however, take the tax off the more expensive electric kettle and continue to impose it on the ordinary tin kettle. Without anticipating his next Budget statement he could say that he was hopeful that he would be able to extend freedom from purchase tax in respect of a number of articles of household necessity. The amendment was by leave withdrawn.

Fluorescent Bus-Lighting

C.A.V.-Siemens Systems

THERE is no inherent reason why fluorescent tubes, if they can be suitably energised, should not be employed for illuminating the interiors of public service passenger vehicles. Short tubes may be fitted in trough reflectors inset horizontally in place of the usual bulb lamps. The luminous tubes of DC installations are "started" in the ordinary manner by means of an automatic thermal switch for heating the electrode filaments in conjunction with a choke for inducing the voltage surge that initiates the discharge which causes fluorescence inside the tube.

For deriving energy from the battery of accumulators normally carried by all passenger vehicles in a form suitable for the luminous tubes, furnished by Siemens Electric Lamps & Supplies, Ltd., four circuit arrangements have been developed co-operatively by C.A.V., Ltd., for either DC or AC at high frequency.

Trolley-buses carry a 60-V battery arranged in two banks, which are connected in series for vehicle manœuvring and in parallel for lighting. Thus with DC at 60 V available (Fig. 1 full lines) fluorescent tubes can be employed which are 15 in. long and 1½ in. in diameter, rated at 14 W, the lamp voltage approximating to 41. Full voltage can be made available for lighting by the inclusion of a booster (motor-generator) which obviates battery paralleling and also serves to augment the voltage (Fig. 1 dotted lines) in the case of vehicles fitted with 24 V batteries.

The lamp circuit efficiency approximates to 55 per cent., which is said to be reduced by about 5 per cent. by the inclusion of the motor generator. To stabilise DC circuit voltage a ballast resistance is provided in the form of a small bulb lamp (tungsten filament) operated as a "barreter." It involves a system loss of the order of 45 per cent. by comparison with the 10 to 25 per cent. choke loss in AC systems, which is unavoidable because the system voltage must be higher than the lamp voltage.

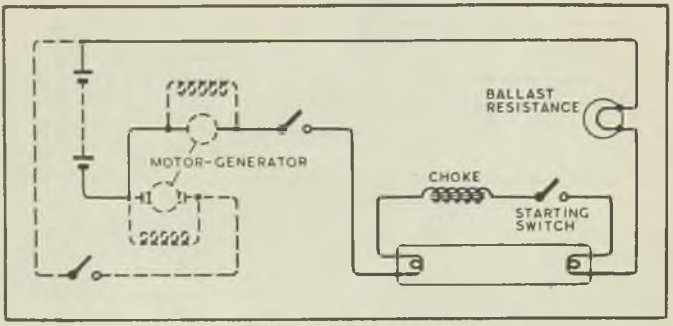


Fig. 1.—Battery-fed 60 V lighting circuit

For vehicles carrying 12- or 24-V batteries a motor-alternator is provided (Fig. 2) to deliver AC at 400 c/s and 110 V to 18 in. lighting tubes rated at 15 W. In this circuit the thermal starting switch is replaced by a condenser arranged to be in resonance with the choke before tube discharge commences, the voltage across the condenser sufficing to start the discharge before the electrode filaments are correctly heated. The resonance of the circuit ceases when the discharge takes place.

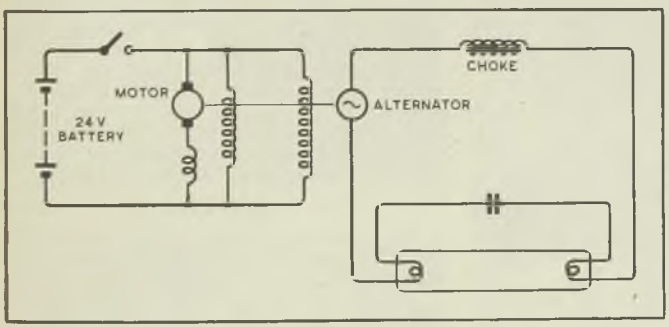


Fig. 2. Most favoured AC 400 c/s system

The efficiency of the lamp circuit is 75 per cent. in this system, being reduced to 50 per cent. overall by the need for the rotary machine, which is of conventional type operating at 3,000 RPM; it weighs about 100 lb. for a double-deck bus. The weight of choke and condenser amounts to 2 lb. per lamp installed.

The frequency of 400 c/s has been chosen because it is the standard already adopted for aircraft AC equipment ; it also minimises any stroboscopic effect the lamps might cause, simplifies their " starting " and reduces the size of control accessories.

Lastly a system that is still in the experimental stage utilises a 24-V battery to actuate a vibrator with two contacts for alternately energising the split primary of a " transformer " whose secondary (Fig. 3) output is of 100 c/s at 110 V. Because of the lower frequency of this system, resonance starting cannot be utilised ; a thermal switch has to be associated with the condenser and choke.

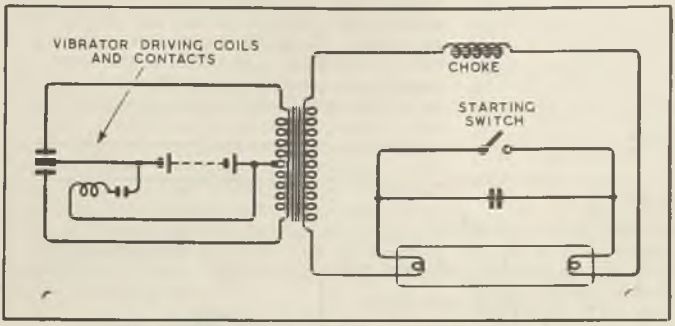


Fig. 3. Experimental vibrator-convertor method

Municipal Reports

Bradford

THE greatest load so far experienced at the Valley station of the Bradford Corporation (82,190 kWh) was sustained on December 7th, 1944. Recording this in his report for 1944-45 Mr. T. H. Carr, the electrical engineer and manager, mentions some of the operating difficulties encountered. Thus when an earth was found to have developed on the alternator rotor windings of a 20,000-kW set (which had earlier been recommissioned after being under repair) it was necessary to keep the machine in service owing to the heavy loads being carried. Later the set had to be shut down when mechanical troubles occurred on couplings and thrust block. The engineer also refers to difficulties experienced with the latest 180,000 lb. per hr. boilers fitted with retort-type stokers due to the inability of the stokers to deal satisfactory with Yorkshire coals.

A total of 280 million kWh was generated last year compared with 305·5 million in the previous year, the reduction being due to considerable outage of plant (two 30,000-kW sets as well as that already mentioned). Sales amounted to 216·5 million kWh (against 215 million); industrial supplies were lower while those under special domestic rates rose from 64·2 million to 72·7 million kWh.

Income from the sale of electricity amounted to £1,013,200 (£974,378), equal to 1·123d. (1·087d.) per kWh. Total income was £1,097,178 (£1,057,902) and working expenses £862,003 (£823,360). After deduction of debt charges and income tax there was a deficiency of £8,731 (£29,486). This, with £3,567 contributed to capital outlay, has been charged against the reserve and renewals account.

Details are given in the report of the extension schemes in hand at the power station. The 1946 programme includes a 22,500-kW turbo-alternator and two 180,000 lb. per hr. boilers, while the 1948 extensions comprise a similar set and one boiler.

Norwich

The bombing of Norwich in 1942 is recalled in the annual report of the Electricity Committee (city electrical engineer Mr. J. A. Sumner) for the year ended March 31st last. Figures given show that in the city area, where a number of factories as well as many houses were completely destroyed, the sales of electricity have fallen from 71·6 million kWh in 1938-39 to 62 million last year. On the other hand in the county and fringe areas supplies have very substantially increased—from 19·6 million to 35·5 million kWh, apart from 18·8 million kWh to aerodromes. This rate of growth is likely to be accelerated by the large county development scheme approved by the Council.

Total sales last year are given as 115·5 million kWh compared with 96·2 million in 1943-44, income being £757,059 (£649,184) and working expenses £561,441 (£495,537). Loan charges amounted to £164,703 (£149,030), leaving a net profit of £30.915 (£4,617). A sum of £41,036 was spent on capital works and the balance carried forward was reduced from £152,890 to £142,769. The original cost of assets totally destroyed by enemy action was £25,000 and the cost of repair work carried out has reached £26,200, making a total claim of £51,200.

Huddersfield

The latest accounts of the Huddersfield Electricity Department (electrical engineer and manager, Mr. F. A. Ellis) cover fifteen months to March 31st last. A total of 195·0 million kWh was sold, revenue received amounting to £608,522, equivalent to 0·75d. per kWh sold (0·71d. in 1943). Working costs were £478,847, or 0·59d. per kWh sold (against 0·54d.). After meeting loan charges, income tax, etc., applying £3,212 to capital expenditure and contributing £9,300 to the rates the balance carried forward is increased from £29,171 to £32,121.

Aircraft Electrical Equipment

Six Years' Advance Demonstrated

LAST week we visited an exhibition of aircraft electrical equipment at the Royal Aircraft Establishment, Farnborough. The exhibition was organised by the Electrical Engineering Department, of which Dr. Bairsto is the head, and it covered all branches of electrical engineering. This Department investigates, designs, tests and develops electrical equipment and installations for use in aircraft. It examines and approves proprietary electrical equipment for aircraft and exercises technical supervision over development contracts placed with the industry. The display covered developments during the past six years and comprised over 250 exhibits. Accordingly we are able only to select typical items for attention.

Left : " Type P " 6-kW aircraft generator. Below : Carbon-pile regulator (" Type 23 ") for 6-kW generator

Aircraft power supply equipment is in striking contrast to commercial types for greater effort has been made to obtain a high output with low weight. This has been achieved partly by design considerations and partly by the use of light alloy metals, higher running temperature with forced-air cooling direct on to the commutator and " Class B " insulation. The " Type P " generator, which is used on the Lincoln, will give its rated output of 6 kW at a minimum speed of 3,300 RPM, but it requires 100 cu. ft. of cooling air per minute. The power/weight factor of this generator is 105 W per lb.

The "Type O2" generator, also shunt wound with interpoles, is a 3-kW machine of similar construction but with an output of 85 W per lb. For smaller aircraft the 1,500-W " Type HX " generator was produced. It is of simple shunt-wound construction and gives 72·5 W per lb. All these generators have a nominal output voltage of 29 V DC, which, apart from recent developments at 210 V, 3-phase, 400 c/s, is the standard voltage for all modern aircraft equipment.

For the purpose of supplying current at frequencies of between 1,200 and 2,400 c/s to special radio equipment, inductor type alternators are used. The original models " Types R " and " U " were of the homopolar type. Later types, the " U2 " for example are hetrapolar and have increased efficiency. In this case the coils of the AC winding are concentrated in single slots in the centre of each DC pole piece, each coil spanning one pole pitch. The AC voltage is regulated at 80 or 115. The " U2 " generator employing this construction has a power/weight ratio of 19·75 W per lb., but the larger and more recently developed " Type Y " gives 53·6 W per lb.

At the high speeds at which airborne generators are driven, usually between 4,000 and 6,000 RPM, efficient lubrication has presented a difficult problem. Originally grease packed bearings were used but now a system has been devised whereby oil is carried in a felt reservoir and transferred to the shaft by felt wiping washers on either side of the bearing and then passed to the bearing by the combined action of centrifugal force and surface tension.

Accurate regulation of generator output voltage is vital. In early days Tirrel vibrating reed regulators, similar to those used in the automobile industry, were employed. Field currents in excess of 1·5 A cause arcing, and, mainly for this reason, the carbon pile system was substituted. The usual type is a Newton design in which carbon pile discs or washers are held in a ceramic tube and the pressure exerted on the pile (and hence its resistance) is varied by the movement of an armature controlled by a

solenoid connected across the generator output. The armature operates against a calibrated star-shaped spring which maintains the pile under compression. By careful setting of the regulator solenoid core and pile plug the generator can be made to provide a steady output voltage over a speed range of from 3,000 to 6,000 RPM.

On modern four-engined aircraft using four 6-kW generators, a master regulator, "Type 32" is employed to maintain the line voltage despite the steep falling volt/load characteristics of the individual "Type 23" regulators.

This was shown in a "mock up" of the Lincoln aircraft power supplies installation. The regulator dissipates 125 W in its pile which has a resistance range of from 1·5 to 9·0 ohms. It has a steeply falling volts/load characteristic—27 per cent. from no load to full load—to ensure stable operation. This regulator weighs 7 lb. 7 oz. The Stones master regulator with an external carbon pile dissipates 37 W and has a pile resistance range of between 1·5 and 10 ohms. It weighs 5 lb. 5 oz. There are many other models for various applications, including series types which serve to provide a constant voltage

Generator test set (12-kW) with one "Type P" and one American 6-kW generators.

output from a widely varying input when used in conjunction with motor generators and rotary transformers. Of special interest is a lightweight version, "Type 40," weighing only 10 oz. and dissipating 12 to 15 W with a pile resistance of from 2·5 to 11 ohms.

Power for radio equipment is usually obtained from rotary transformers operating from the aircraft general services supply which may vary between 24 and 29 V, according to whether or not the engines are running and the generators are charging the accumulators. This again entails the use of a carbon pile regulator. For a given output wattage (say 300) a weight of 88 per cent. of the 1939 value has been achieved. The efficiency of the machines has risen to 65 per cent. Two other interesting exhibits were the motor-generator, "Type 88" which has alternative separately excited motor field coils for clockwise and anti-clockwise rotation, and a range of oil impregnated bronze sleeve bearings which were developed when a bearing shortage seemed inevitable. When used with radio equipment the rotary machine is assembled with its regulator and suppressor and called a power unit. The "Type 16" is typical—it will operate over an input range of from 21·6 to 29 V and gives an output of 300 V 260 mA, 150 V 10 mA and 13 V 3·9A. The weight is 35 lb. As an alternative power for radio may be obtained from a vibrator type convertor.

There was an interesting range of short-time rated DC motors, typical of which is the "MF/S19," a Croydon motor rated at 2·8 HP with a torque of 2·5 lb.-ft. at 5,900 RPM.

Accumulator Developments

Research on accumulators to improve their durability has led to the introduction of plates of 0·62 in. thickness with a stronger acid solution. Good terminals and copper inserts in the pillars and links have been introduced because of the heavy currents and wet wood separators have replaced porous rubber owing to their ease of manufacture. They do not, however, withstand storage in an unused condition for so long. It is shown, however, that the maximum performance is obtained from plates 0·031 in. thick with separators of porous rubber or porous polyvinyl chloride. Sulphuric acid is still considered to be the best electrolyte for accumulators.

The Far East war gave great impetus to the development of light transportable generating sets and examples shown included an Enfield 80-watt petrol-electric pack set, a 6-kW DC petrol-electric set using a Triumph engine and a modified "Type P" generator and a lightweight 5·6-kVA Diesel-electric set. In contrast there was a 20-kVA, 230-V Met-Vick set and a Ford "V-8" engined mobile set driving two 6-kW "Type D" generators. Both metal and mercury rectifiers were in evidence.

Heating equipment included flying clothing, blanket, camera muff and casualty bag. Another exhibit showed the development of automatic timing and switching control gear and demonstrated the complexity of the switchgear needed for operating the bombgear on a modern British bomber.

Wiring Details

The electrical accessories exhibit contained all manner of switches and wiring fittings including micro-switches which enable actuation of a circuit to be made or broken by a movement of the actuating mechanism of the order upwards from a few thousandths of an inch. Heavy duty thermal circuit-breakers are now being employed on modern aircraft power supply systems. They carry current up to 200A and among other uses is its employment in the power supplies circuit of the Lincoln where it operates in conjunction with the cut-out. Various systems of wiring were exhibited in-

cluding those developed by the G.E.C., Crabtree, Lucas, Plessey, the Society of British Aircraft Constructors and M.A.P.

Aircraft are apt to suffer severely from magnetisation caused by static electricity and various kinds of demagnetisers have been developed. In one type the wiper magnet is passed over the surface of the machine to demagnetise it. A demonstration model showed the increase in arcing at contact points at high altitudes. The materials section provided some interesting and colourful exhibits showing the method adopted to proof equipment against tropical conditions and Arctic cold ; examples of corrosion are shown.

A section devoted to the operation of flying controls showed such equipment as photo-flash bulbs, towed-target controls and cowl-gills ; the latter are actuated by a high-speed series-wound split-field motor with a four-stage epicyclic reduction gear with a ration of 625 : 1. A further stage of gearing carries a cam which operates the reversing switch. There has been a recent move to introduce electronic control of some rotary machines instead of mechanical regulation. This was shown by the electronic regulators for generator, "Type UKX" and motor generator, "Type 8." In both cases the output is fed to a bridge which is balanced at a predetermined voltage. A variation in output causes a current to flow from the bridge through two stages of amplification and varies the field of the motor or, in the case of the "UKX" generator which has a common field for both AC and DC, varies the current flowing in one of the windings of a double-wound saturable choke.

A section of the exhibition is devoted to the development of interference suppressors. Another exhibit deals with ignition research and high speed cathode ray oscillographs.

Lighting equipment on show included the various lamps used on and in aircraft and also beacons, floodlights, flare paths and runway lighting for aerodromes.

French Diesel-electric Locomotives

ON the Paris-Dijon railway there are now two new Diesel-electric traction locomotives fitted with 4,000-HP motors. They have an average speed of 100 km.p.h. and a top speed of 130 km.p.h. The first (262 ADI) was built by Fives-Lille and the second (262 BDI) by the Compagnie des Forges et Acieries de la Marine et d'Homecourt. Both are similarly constructed, being divided into two permanently coupled sections with a maximum weight per axle of 18 tons. Each section comprises thre driving axles and two bogies. The centre part of each section carries the Diesel group while auxiliary plant is arranged from one end to the other with all the electrical equipment at the driving end. Most of the accessories are interchangeable between the two locomotives. Each motor drives a shaft which is provided with a toothed crown and the transmission between the motor and axle is of the Sécheron-Mayfarth type. Each section carries two main supercharge four-stroke airless injection Diesel engines built by the Société Général de Constructions Mécaniques, capable of developing 1,050 BHP for the first hour and 950 HP afterwards for the rest of the run. Normal running speeds of the engines are 700, 630 and 500 RPM. Each Diesel engine is furnished with two Rateau cylinder turbo-blowers (one at each end) driven by exhaust gases. The locomotives may be considered as consisting of two separate parts electrically, comprising two generators, three double armature driving motors, two exciters and an auxiliary generator, etc. The auxiliary 150-V circuits are fed by a Diesel Saurer 150-HP engine driving a DC generator, with a group of parallel accumulators of 218 Ah capacity. The traction motors are suspended from the chassis and power transmission is regulated automatically so that the Diesel engine cannot be overloaded. A Cuenod exciter type regulator is employed so that with each step-up of the driving handle constant "injection" is maintained. The driving handle has 18 different positions. The two locomotives were ready for use in September, 1939, but were kept in storage during the war and not put into service until this year.

New French Diesel-electric locomotive

ELECTRICITY SUPPLY

Northmet Power Station Scheme. Sheffield Estimates.

Birkenhead.—LOAN.—The Corporation Electricity Committee is seeking sanction to borrow £20,000 for mains, services and change-over.

SUBSTATIONS.—Six substations are to be erected at Rock Ferry, Irby Village, Pensby, Little Sutton and Bromborough.

Bucklow.—SUPPLY TO HOUSES.—The R.D.C. proposes to install electricity in twenty-two council houses already erected at Ackers Lane, Carrington.

Cardiff.—SERVICE UNITS.—At a meeting of the Electricity Committee the city electrical engineer submitted a sample of a new standard service unit for small dwellings. He was authorised to install units of this kind in all new houses where suitable and use them as replacements.

SUPPLY TO HOUSING SITES.—The Electricity Committee is to provide a supply to housing sites at Sweldon farm at a cost of £1,733 and Caerau Farm (£3,086).

Cheltenham.—RESUMPTION OF HIRE SCHEMES.—The Electricity Committee recommends the resumption of hire and hire-purchase schemes and a vote of £10,000 for the purchase of apparatus.

Fulham.—GRID TARIFF REVISION.—The Electricity Committee reports that the revised grid tariff will result in an increase in cost, but that this should not be more than 2 per cent. of the total cost of electricity purchased from the Central Electricity Board.

POWER STATION EXTENSION.—The tender of Sir Robert McAlpine & Sons of £16,369 has been accepted for the foundations and superstructure of the power station extension.

ACCIDENT TO COLLIERS' CREW.—Two members of the crews of the Electricity Department's colliers, Fulham II and Fulham VII, J. R. Redshaw and W. Foster, were drowned when a boat in which they were returning aboard capsized.

Hertfordshire.—NEW POWER STATION.—The Northmet Power Co. is to promote a Bill in Parliament for the purpose of enabling the company to lease from the North Metropolitan Power Station Co., Ltd., a power station to be erected at Rye House, Hoddesdon. Work on the construction of the station, the first section of which will have a capacity of 64,000 kW, will commence shortly.

Ilkeston.—TENANTS' REQUEST GRANTED.—The Housing Committee has granted an application from the Council House Tenants' Association for permission to install electricity in Council houses.

Inverness.—JOINT SCHEME REJECTED.—The Town Council, which is promoting a Provisional Order to obtain a supply of water for domestic purposes from Loch Duntelchaig, has decided not to agree to a proposal by the North of Scotland Hydro-Electric Board for a joint scheme between the burgh and the Board.

Llangollen.—PURCHASE PROPOSAL.—The Urban District Council has approved a recommendation that sanction be obtained to the purchase of the assets of the Llangollen and District Electric Lighting Co. The Council is also to ask the company to reduce its charges.

Luton.—"ALL-ELECTRIC" HOUSES.—All future Council houses apart from those for which contracts have already been let are to be "all-electric." A recommendation to this effect by the Highways, Town Planning and Estates Committee was approved by the Town Council after discussion at its last meeting.

Manchester.—STREET LIGHTING.—The Electricity Department estimates that an additional expenditure of £29,304 will be necessary to restore a normal standard of street lighting. Of this sum £20,255 will be for electricity, £6,744 for repairs and maintenance and £2,305 for the conversion of installations. Many of the 15- and 25-W lamps are to be charged to 100 W and upwards.

Salford.—LOAN APPLICATIONS.—The Electricity Committee is seeking sanction to borrow £4,017,026 for extensions at the Agecroft power station and £5,000 for domestic electrical appliances.

Sheffield.—ELECTRICITY ESTIMATES.—The estimated income of the Sheffield Corporation Electricity Department for the year ended March next is £2,139,040, and for the following year, £2,157,600, total expenditure being £2,333,330 and £2,343,060 respectively. There is thus an estimated debit balance for 1945-46 of £194,290 and for 1946-47 a deficit of £185,460.

Southwark.—DOMESTIC APPARATUS PURCHASES.—The Borough Council Electricity Committee is to buy cookers (£500), water heaters (£600) and washboilers (£200).

EXTENSIONS.—Mains are to be extended to the Brandon Street estate at a cost of £250 and an AC supply is to be provided in Walworth Road at a cost of £2,000.

Walsall.—OFFER TO BUY CHASETOWN UNDERTAKING.—The Town Council has approved a recommendation of the Electric Supply Committee regarding the proposed purchase of the undertaking of the Chasetown and District Electricity Co., Ltd. The recommendation was that the Council should make an offer of £140,000 for the undertaking.

Warrington.—COUNCIL HOUSE INSTALLATIONS.—Having received applications from tenants for the installation of electricity, the Housing Committee has called for a report on the number of Council houses not yet wired.

SUPPLY EXTENSIONS.—The Electricity Committee is to provide mains for supplying the Capesthorne Road estate and a factory and dairy, the cost of £4,463 to be met out of surplus revenue.

York.—COOKERS FOR HIRE.—The Electricity Committee is seeking sanction to borrow £10,000 for electric cookers. The Committee proposes to supply these cookers at a rental of 15s. per quarter, consumers to guarantee to pay the rental for a minimum of five years.

LOANS.—Application is being made to borrow £58,577 for the augmentation of feeder cables. Sanction has been received to loans of £7,734 for mains, £4,050 for transformers and switchgear and £5,595 for supply to temporary bungalows.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Johnson & Phillips, Ltd.—It is proposed to increase the company's borrowing powers from £1,000,000 to £1,600,000. The company originally planned to issue to shareholders the remaining 200,000 £1 ordinary shares by way of rights in the ratio of one for four at £3 a share, these terms being considered to avoid the element of bonus which a Treasury direction prohibits. These terms were, however, unacceptable to the Capital Issues Committee, which also would not agree to an amended proposal with the issue price raised to 65s.

The Perak River Hydro-Electric Power Co., Ltd.—A debit balance of £35,253 for the year ended July 31st last increases the total deficit on net revenue account to £70,935. The sinking fund instalment on the guaranteed debenture stock, due February 1st, 1945, together with the interest for the year under review, was advanced by H.M. Treasury in the terms of the guarantee. The company's total liability in this connection is now £165,531. Unofficial information from various sources indicates that the physical damage sustained to the plant, etc., is not so serious as might have been anticipated.

Tube Investments, Ltd.—Group trading profits for the year ended October 31st amounted to £2,254,723 (£2,354,038), and the net balance available for appropriation is £808,195 (£824,048). As already reported, the ordinary dividend is being maintained at 22½ per cent. In addition there is a special distribution of 10 per cent., and £300,000 (£100,000) is placed to general reserve; this is effected by transferring £400,000 from contingencies reserve. A sum of £250,000 is applied to dividend stabilisation reserve and the carry-forward is increased from £274,166 to £290,145. The report states that in connection with development plans the group has entered into substantial capital commitments.

The Sun Electrical Co., Ltd., records a trading profit for the year to April 30th last of £21,179 (against £19,151), and a net profit of £18,916 (£17,857). Deductions are as follows:—Preference dividend £9,375 (same), fees £1,500 (same), lease redemption £1,500 (same) and income tax reserve £4,000 (£3,000), and after payment of an ordinary dividend of 2½ per cent. (unchanged), £2,112 (£1,905) is carried forward.

Johnson, Matthey & Co., Ltd., have declared an interim ordinary dividend of 3 per cent., the same as last year.

The Notting Hill Electric Lighting Co., Ltd., is paying two years' dividend to December 31st, 1945, on the 6 per cent. cumulative preference shares. The dividend for 1943 was paid last June.

Dictograph Telephones, Ltd.—The accounts show a trading profit for the year to August 31st last of £35,148, compared with £35,313 in the preceding year, the net profit being £15,930 (£15,477). The total dividend distribution is maintained at 11 per cent., £5,000 (same) is placed to general reserve and £250 (same) to employees' fund, leaving £10,689 (£11,009) to be carried forward.

The Victoria Falls & Transvaal Power Co., Ltd., is paying an interim ordinary dividend of 4 per cent. (same) less tax at 5s. 8d. in the £.

Lisbon Electric Tramways, Ltd.—The interim dividend is again 2½ per cent., tax free.

Silentbloc, Ltd., has declared an interim dividend of 12½ per cent. (same).

New Companies

Standard Telecommunication Laboratories, Ltd.—Private company. Registered December 1st. Capital, £100,000. Objects: To promote and carry on research work in connection with telecommunication, electronics, chemistry, physics, etc. Subscribers: T. G. Spencer and A. W. Montgomery, both of 63, Aldwych, W.C.2. Solicitors: Slaughter & May, 18, Austin Friars, E.C.

Kenwright Electrical Co., Ltd.—Private company. Registered December 3rd. Capital, £5,000. Objects: To carry on the business of manufacturers and repairers of, and dealers in, dynamos, motors, armatures, magnetos, batteries, etc. Directors: J. F. E. Kenwright, 69, Brodrick Road, Wandsworth Common, S.W.18, and two others. Registered office: 113, Parchmore Road, Thornton Heath, Surrey.

Northern Wholesalers, Ltd.—Private company. Registered November 22nd. Capital, £10,000. Objects: To carry on the business of manufacturers of, and dealers in, radio, television, electrical goods, etc. Subscribers: C. H. Mellon and E. B. Hilton, both of 327, Corn Exchange Buildings, Manchester, 4. Secretary: H. Mellor. Registered office: 337, Corn Exchange Buildings, Manchester, 4.

Woodruff's Electric, Ltd.—Private company. Registered November 22nd. Capital, £1,000. Objects: To acquire the business of an electrical engineer heretofore carried on by Henry Woodruff at 41, Duckworth Street, Darwen. First directors: H. Woodruff, 49, Blackburn Road, Darwen, and two others. Secretary: E. Giller. Registered office: 41, Duckworth Street, Darwen.

John Trapp (Electrical), Ltd.—Private company. Registered November 28th. Capital, £500. Objects: To carry on the business of electrical engineers and general electrical installation contractors, wireless engineers, etc. Directors: J. L. Trapp, 9, Broadway Parade, Crouch End, N.8, and B. Raynor, 40, Ruth Road, High Wycombe, Bucks. Registered office: 15, The Broadway, Crouch End, N.8.

Zero Electric, Ltd.—Private company. Registered November 30th. Capital, £2,000. Objects: To carry on the business of manufacturers of, and wholesale and retail dealers in, all types of plant, machinery and accessories, including civil engineering, agricultural, aeronautical, mechanical, electrical and other

engines and vehicles generally, etc. Subscribers: C. H. Knowles, 19, Oaklands Avenue, Harborne, Birmingham, and E. C. Fielding, 49, Lonsdale Road, Walsall. Solicitor: Henry G. Hazelgrove, 26, Stanhope Road, Highgate, N.6.

Allander Industries, Ltd.—Private company. Registered in Edinburgh November 27th. Capital, £10,000. Objects: To acquire that portion of the business of the Ellangowan Paper Co., Ltd., relating to radio and electrical engineering, etc. Directors: A. I. McNaughton, Skara Brae, Briarwell Road, Milngavie, and V. S. W. Smyth, 11, Cheyne Court, Flood Street, Chelsea, S.W.3. Registered office: Allander Mills, Milngavie.

Huckett & Brazier, Ltd.—Private company. Registered November 27th. Capital, £1,000. Objects: To carry on the business of manufacturers and repairers of, and dealers in, dynamos, motors, armatures, magnetos, batteries, etc. First directors: L. H. Huckett, 88, Kenilworth Road, Edgware, and W. R. Brazier, 6, Hillfield Close, Kingsbury, N.W.9. Registered office: 784, Finchley Road, Temple Fortune, N.W.11.

Induction Heaters, Ltd.—Private company. Registered November 29th. Capital: £1,000. Objects: To carry on the business of manufacturers of, and dealers in, induction or resistance heaters, etc. Directors: F. H. Rogers, Elmhurst, Kenley, Surrey, and B. Heastie, 59, Bassett Road, W.10. Registered office: 181, Queen Victoria Street, E.C.4.

South Wales Electrical Engineers, Ltd.—Private company. Registered November 24th. Capital, £600. Objects: To carry on the business of electrical equipment specialists, etc. Directors: F. J. Shimmans, 33, Gower View, Llanelly, and Mrs. A. Thomas, 23, New Zealand Street, Llanelly. Registered office: 77 Station Road, Llanelly.

Super Power, Ltd.—Private company. Registered November 24th. Capital, £500. Objects: To carry on the business of electricians, electrical or mechanical engineers, suppliers of electricity, etc. Directors: R. C. Watkins, 156, Poplar Road, South Wimbledon, S.W.19, and two others. Registered office: 81, North Side, Clapham Common, S.W.

Kirkdale Electrical Co., Ltd.—Private company. Registered November 29th. Capital, £2,000. Objects: To carry on the business of electricians, electrical and mechanical engineers, radio dealers, etc. Directors: H. A. Yates and Edith E. M. Yates, both of 1, Highfield Drive, W. Wickham. Registered office: 95, Dartmouth Road, S.E.23.

Increases of Capital

Sydney S. Bird & Sons, Ltd.—The nominal capital has been increased by the addition of £15,000 in 150,000 shares of 2s. each beyond the registered capital of £50,000.

Diploma Electrical Products, Ltd.—The nominal capital has been increased by the addition of £5,900 in £1 ordinary shares beyond the registered capital of £100.

Electrical & Radiological Instrument Co., Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 ordinary shares beyond the registered capital of £2,000.

Walsall Electrical Co., Ltd.—The nominal capital has been increased by the addition of £2,500 in £1 ordinary shares beyond the registered capital of £7,500.

Funditor, Ltd.—The nominal capital has been increased by the addition of £10,000 in £1 shares beyond the registered capital of £5,000.

Mortgages and Charges

North-Eastern Electric Supply Co., Ltd.—Satisfaction (1) to the further extent of £69,757 on November 12th, 1945, of trust deed dated December 30th, 1933, originally securing £2,500,000 3½ per cent. consolidated debenture stock, and (2) to the further extent of £28,726 on November 14th, 1945, of trust deed dated April 22nd and registered May 6th, 1942, originally securing £2,202,039 .3½ per cent. consolidated debenture stock.

Petters, Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated October 23rd, 1945, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd. and Hambros Bank, Ltd.

Devon Electric & General Services, Ltd.—Satisfaction in full on October 29th, 1945, of charge dated March 19th, and registered April 1st, 1937, securing all moneys due or to become due from the company to Barclays Bank, Ltd.

Banner Electric Co., Ltd.—Charge on Burford House, Burford Street, Hoddesdon, Herts, dated November 14th, 1945, to secure £3,600 and further advances. Holders: Cheltenham and Gloucester Building Society.

Electrical & Radiological Instrument Co., Ltd.—Satisfaction in full on October 23rd, of mortgage dated April 7th, and registered April 26th, 1945, securing £500.

Receiver Appointed

Combi Electric Co., Ltd.—R. Stephens, Timewells, Oatlands Close, Weybridge, was appointed receiver and manager on November 13th, under powers contained in debenture dated September 6th, 1944.

Bankruptcies

F. O. Tosswill, electrical engineer, lately carrying on business at 15, Portsmouth Road, Guildford.—Last day for receiving proofs for dividend December 14th. Trustee, Mr. A. H. Ward, London (Suburbs) and Southern District, 42, Tavistock Square, London, W.C.1, Official Receiver.

B. J. Wainwright, electrician, lately carrying on business at "The Wells Road Garage," 197-202, Wells Road, Shepherd's Bush, W.12, and as "Wainwright Neon Displays" at 197, Wells Road, Shepherd's Bush, previously at 14, St. Thomas' Road, Harlesden, London N.W.10.—Trustee, Mr. P. Phillips, 76, New Cavendish Street, London, W.1, released November 19th.

M. Skulnick, 83, Wellesley Court, Maida Vale, N.W., battery manufacturer.—Public examination, adjourned *sine die*, to be proceeded with on December 18th, at Bankruptcy Buildings, Carey Street, W.C.2.

STOCKS AND SHARES

THE volume of Stock Exchange business is fairly well maintained, having regard to the season of the year and the various cross-currents which operate in the markets shortly before January 1st. The success of the negotiations with the United States has had a strengthening effect upon the ordinary shares of companies likely to benefit from the expanded trade which it is thought will result from the new agreement. Cinema shares are to the fore. Electricity supply issues are dull, on nationalisation possibilities, Cable and Wireless stocks have relapsed into inactivity. Amongst dollar stocks, Brazilian Traction stand out with a point improvement.

Nationalisation

Prices of Home electricity supply shares remain on the down grade. Investment continues cautious of embarking money in the industry at a time when the outlook is as uncertain as ever. Interest has been aroused by the publication of the recommendations of the Committee, set up last year, to inquire into the working of the gas industry. The main plank of these recommendations is that the gas industry shall be nationalised under Regional Boards. The question naturally arises as to whether similar treatment will be proposed for the electricity supply undertakings.

Extensive Expansion

Last week, reference was made to the intention of the Central Electricity Board to spend, over the next five years, £450,000,000 in expansion. To begin with, £150,000,000 is earmarked for putting work in hand as soon as possible On top of this, the London Power Company contemplates an expenditure of £3,372,000 in order to increase the available generating capacity for the grid supply.

Such schemes as these would, in times more normal than the present, exercise a stimulating effect upon the prices of ordinary shares in companies which stand to obtain orders, arising out of the expenditure mentioned above. British Insulated Callender's, Henley's, Crompton Parkinson, Telegraph Construction, Johnson & Phillips, Siemens and various others cannot fail to benefit substantially from the programmes which are being thought out in connection with post-war developments. Yet, where changed, prices have mostly gone a little lower since these plans were made public.

Equipment Shares Decline

Falls predominate in the group of equipment and manufacturing shares. Westinghouse Brakes at 74s. 6d. have fallen 3s. Automatic Telephones, 67s. 3d., Murex, 91s. 3d., Mather & Platt, 52s. 3d., Ransome & Marles, 91s. 3d., are a florin to half-a-crown lower. Other declines have left Henley's at 26s. 9d., General Electrics at 95s., Walsall Conduits at 55s., Associated Electrical at 55s., Christy Brothers at 80s. and British Vacuum Cleaner at 56s. Telegraph Constructions at 61s. have resisted the general tendency, being 6d. to the good. The most considerable movement in this group is in De La Rue, which at 10⅜ have gone back 7s. 6d., of which 1s. is due to deduction of the dividend. Falk Stadelmann put on ⅛, rising to 41s. 3d.

Crompton Parkinson Results

As expected, Crompton Parkinsons have brought up the distribution for 1944-1945 to the previous year's total of 22½ per cent., including a bonus of 7½ per cent. The preliminary profit statement shows that earnings are little different from last year's; therefore they cover the distribution with the usual comfortable margin. They work out, in fact, to the equivalent of about 40 per cent. on the ordinary capital, and this is the best result since the latter was increased by 50 per cent. in 1938. The price of the 5s. shares has eased off to 29s. 6d. The modest yield of £3 16s. per cent. is evidence of the high place which Crompton Parkinson shares hold amongst industrial investments of a firmly progressive character.

Radio Shares

Buying, said to be again on behalf of American interests, lifted Electric & Musical Industries 2s. to 36s. 3d., at which price the sellers came in, and it eased off to 35s. 8d. A. C. Cossors are a lively market. The price rose to 46s. 3d. before going back to 45s., leaving it unchanged on the week. E. K. Cole at 36s. 3d. are a few pence easier, but Pye deferred at the same price, hold their recent gain.

Miscellaneous Movements

Cable & Wireless ordinary has gone back 2½ points to 103, the preference being rather higher at 100. Public interest is lacking, for the moment, in either stock; other matters attract more active notice. Oriental Telephones, again reactionary, are 1s. 9d. lower at 55s. 6d. At 33s. Marconi Marines have lost 9d. Dollar stocks show improvement: International "Tel. & Tel." are 3½ better at 39, and Brazilian Tractions strengthened to 30. Candian Marconi at 23s. are 3s. up. Home Railway stocks are better as a whole, but Transport "C" at 61 is a point down. Thomas Tilling shares remain at 50s., British Electric Traction deferred has lost 20, receding to the level £1,000.

Great Northern (Denmark)

The Great Northern Telegraph Co., Ltd., of Denmark, will hold its annual meeting in Copenhagen on Thursday in this week when a dividend of £2 per share (20 per cent.) will be recommended. The company's report, an extremely interesting document, starts by saying that more than six years have passed since the last report was presented by the board to British shareholders. A dividend of £2 per share has been declared, but in spite of this the price is 4½ lower at 32½.

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.

BIRMINGHAM Electric Furnaces, Ltd., A. G. E. Robiette and P. F. Hancock.—"Heat treatment of austenitic white cast iron alloys." 17313. October 20th, 1943. (573521.)

British Thomson-Houston Co., Ltd.—"Safety systems for electrical control of machinery." 1366/42. January 29th, 1942. (573469.)

British Thomson-Houston Co., Ltd., and D. F. Welch.—"High frequency electrical ignition systems." 9487. June 11th, 1943. (573483.)

Callender's Cable & Construction Co., Ltd., Callender-Suchy Developments, Ltd., A. B. F. G. Richardson and C. T. Suchy.—"Electrodeposition of metals." 19618/43. December 27th, 1944. (573422.)

Coleman & Appleby, Ltd., C. B. Appleby and J. L. Hermolle.—"Electroplating apparatus." 1175. June 28th, 1944. (573488.)

Compagnie pour la Fabrication des Compteurs et Matériel d'Usines á Gaz.—"Electric shunts." 15023/41. December 19th, 1940. (573497.)

County of London Electric Supply Co., Ltd., and L. E. W. Humphries.—"Cable laying plough." 20244. December 3rd, 1943. (573444.)

F. Dean (legal representative of R. Dean).—"Air-break isolating switches of the heavy current type." 20757. December 11th, 1943. (573448.)

Enfield Rolling Mills, Ltd., and O. J. Metzger.—"Manufacture of castings." 10954. August 5th, 1942. (573433.)

General Electric Co., Ltd., and R. J. Clayton.—"Directional short-wave aerials." 11695. August 19th, 1942. (573436.)

General Electric Co., Ltd. I. Jenkins and S. V. Williams.—"Processes for surface-carburising steel." 5604. April 30th, 1941. (573466.)

General Electric Co., Ltd., H. C. Turner and W. H. Fisher.—"Electrical measuring bridges." 15695. September 24th, 1943. (573418.)

E. R. Gilbert.—"Electrical hot-plates." 7185. April 18th, 1944. (573523.)

W. T. Henley's Telegraph Works Co., Ltd., and E. Moor.—"Clamping device." 11079. July 8th, 1943. (573502.)

T. E. Ivall.—"Electrical circuits for the generation of pulses or oscillations." 13559. August 19th, 1943. (573508.)

R. E. Jennings and Foster Transformers & Switchgear, Ltd.—"Electrical regulating apparatus." 17521. October 25th, 1943. (573438.)

F. R. Mason and Metropolitan-Vickers Electrical Co., Ltd.—"Loading apparatus." 14401. September 20th, 1940. (573526.)

A. E. Morrison and A. C. Morrison.—"Electrically propelled vehicles." 5139/45. February 1st, 1944. (Divided out of 1844/44.) (573426.)

Philips Lamps, Ltd.—"Frequency modulated radio transmission." 11313/43. July 11th, 1942. (573406.)

Plessey Co., Ltd., and H. V. G. Stubbs.—"High frequency ignition systems." 11703. July 19th, 1943. (573504.)

Radio Corporation of America.—"Method of and apparatus for bonding materials electrically." 16972/43. February 27th, 1943. (573518.)

Standard Telephones & Cables, Ltd.—"Electrical control system." 10767/43. September 14th, 1942. (573405.) "Electric attenuators." 20930/43. August 17th, 1942. (573451.)

Standard Telephones & Cables, Ltd. (trading as Stanelco Products), and J. Handley.—"Electric soldering irons." 20237. December 3rd, 1943. (573443.)

Standard Telephones & Cables, Ltd., V. J. Terry and E. A. Foulkes.—"Electrical devices for the detection or measurement of mechanical vibrations." 18161. November 2nd, 1943. 573420.)

Westinghouse Electric International Co.—"Vapour electric discharge devices." 19124/43. May 7th, 1942. (573550.)

TRADE MARKS

THE following applications have been received for the registration of trade marks. Objections may be entered within a month from December 5th:—

DURATHREAD. No. 636,221, Class 1; and 636,221, Class 17. Thermoplastic mouldable threads (not of the nature of rubber) in the form of threads, for industrial purposes other than textile purposes. — Duratube & Wire, Ltd., 16, Hanworth Road, Feltham, Middlesex.

SATCHWELL. No. 635,598, Class 7. Steam, oil and water valves, all being parts of machines; and electric motors for operating such valves. Also No. 635,599, Class 9. Automatic temperature regulators, switches and contactors.—Rheostatic Co., Ltd., 94, Farnham Road, Slough.

ANTARA. No. 635,570, Class 9. Electrical apparatus and instruments not included in other classes; talking machines, etc., and parts of such goods.—General Aniline & Film Cpn., 230, Park Avenue, New York. Address for service: c/o McKenna & Co., 14, Waterloo Place, Pall Mall, London, S.W.1.

VIBRAPOWER. No. 635,775, Class 9. Electrical vibrators and rectifiers.—Wright & Weaire, Ltd., 740, High Road, Tottenham, N.17.

CHEERIWAKE. No. 636,209, Class 9. Electric apparatus for heating water and making tea at any pre-set time.—British Vacuum Cleaner & Engineering Co., Ltd., Goblin Works, Ermyn Way, Leatherhead, Surrey.

VOLTIP. No. 636,306, Class 9. Loudspeakers, parts thereof and fittings therefor not included in other classes; and transformers.—Doris E. Briggs, trading as Wharfedale Wireless Works, Hutchinson Lane, Brighouse, Yorks.

VENAIR. No. 636,259, Class 11. Extractor ventilators for the roofs of buildings.—Froggatt & Prior, Ltd., 4, Bingley Hall Buildings, King Alfred's Place, Broad Street, Birmingham, 1.

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.

Ashton-under-Lyne.—December 17th. Town Council. Electrical wiring of fifty houses, Reyner Lane. Particulars from the chief engineer, Electricity Works, Wellington Road.

Blackpool.—January 3rd. Electricity Committee. Batteries, charging equipment and associated switch and fuse gear. (See this issue.)

Edinburgh.—February 15th. City Council. 33-kV switchgear and accessories for Portobello power station. (See this issue.)

Kettering.—January 4th. Electricity Department. Six transformers, switchgear and sheet steel kiosks. (See this issue.)

Maesteg.—January 1st. Electricity Department. L.v. mains, services and public lighting. (December 7th.)

Manchester.—December 31st. Electricity Committee. 6·6-kV switchgear and one 20-ton road weighbridge and frame. (December 7th.)

Tredegar.—December 29th. Urban District Council. Two 250-kVA and one 500-kVA transformers. (December 7th.)

Wrexham.—December 18th. Rural District Council. Wiring of 106 houses. Particulars from Mr. D. E. Edwards, engineer, Imperial Buildings.

Orders Placed

Cheltenham.—Electricity Committee. Accepted. Mains extensions to Montpelier (£139).—Power Lines, Ltd.

Hull.—Telephones Committee. Accepted. Cable (£425).—British Insulated Callender's Cables.

Manchester.—Generation Sub-Committee. Accepted. 400-V switchgear for Stuart Street power station.—English Electric Co. and Metropolitan Vickers. Gas duct, Stuart Street.—Simon Carves. Low-pressure pipework.—Brightside Foundry & Engineering Co.

Distribution Sub-Committee.—6,600-V switchgear.—A. Reyrolle.

Newcastle (Staffs).—Electricity Committee. Accepted. Laying cable for supply of electricity to works.—Callender's Cable & Construction Co.

South Shields.—Corporation. Accepted. Electric vehicle battery (£245). — Crompton, Parkinson. Trolley-buses.—Northern Coachbuilders (three bodies at £1,465 each) and Charles Roe (two bodies at £1,403 each).

Southwark. — Electricity Committee. Accepted. Cables for twelve months.—Scottish Cables.

Wallasey.—Electricity Committee. Accepted. Distribution pillars (£67 13s. 6d. each).—Henley's. Substation distribution boards (£120 19s. each) and underground boxes (£7 6s. each).—British Insulated Callender's Cables. Transformers for three years.—British Electric Transformer Co.

Warrington.—Electricity Committee. Accepted. Spare exciter armature (£450).—English Electric Co. Two single-phase truck-type meter testing equipments (£525).—Metropolitan Vickers.

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.

Barnard Castle.—Houses, Middleton, Toft Hill and Evenwood; R.D.C. surveyor.

Birkenhead.—Police hostel, Bidston Road; borough engineer.

Bootle.—Factory, near Ford station; Walmsley & Co., Bolton.

Bournemouth.—Extensions, Lowther Road school (£8,600); borough engineer.

Cardiff.—Factory and houses, Western Avenue; Walker Building Co.

Cheltenham.—Factory, Maida Vale estate; Metal Details, Ltd.

Factory, Newtown; Bernard Myers & Co., Ltd., Oxford.

Buildings, Market (£20,000); Gloucestershire Marketing Society.

Houses (62), Lynmouth estate (£74,184); Wheeler & Mansell.

Houses (46), Brooklyn estate; Western Estates (Lawes Cherry), Ltd.

Chilton (Co. Durham).—Houses (20); R. M. Chamberlain, builder, Belle Vue Bank, Gateshead.

Coventry.—Houses (32), Council estates (£35,574); city engineer.

Conversion of Cheylesmote Hostel to flats (£28,500); city engineer.

Cromarty.—Houses (24); D. Matheson & Sons, architects and civil engineers, Dingwall.

Darlington.—Houses (15), Hurworth, for the R.D.C.; Parvin & Sons, builders, Horsemarket.

Doncaster.—Houses (152), Wheatley Park estate, for T.C.; F. Haslam, Ltd., builders, Hall Cross.

Durham.—Houses (100) for the City Council; city engineer.

Fulham. — Dwellings, Henderson site (£104,645); Perrys (Ealing), Ltd.

Gloucester.—Houses (24), for R.D.C.; C. D. Carus-Wilson, architect, Hardwicke.

Hastings.—Offices and flats, 9, Wellington Square; C. Cornell & Co., Ltd.

Hexham.—Houses (150); U.D.C. surveyor.

Isle of Axholme.—Permanent houses (98), for R.D.C.; S. W. Chester, clerk, The Gables, Epworth, nr. Doncaster.

Lanarkshire.—Ice rink (£100,000); Peter Coia, promoter, Bellshill.

Liverpool.—Houses (136), Brook House estate; director of housing, Blackburn Chambers, Dale Street, Kingsway.

Llandilo.—Permanent houses (28), Llandebie, for R.D.C.; R. P. Walters, surveyor, council offices, Crescent Road.

Macduff.—Houses; burgh surveyor, Buchan Street.

Maghull.—Extensions, junior school, Moorhey Road, for T.C.; county architect, County Offices, Preston.

Manchester.—Waterworks (£7,417,000); water engineer.

Houses (£195,800), Wythenshawe; city architect.

Works extensions, Trafford Park, for Geigy Colour Co., Ltd.; R. Carlyle & Co., Ltd., builders, Elsinore Road.

Merthyr Tydfil.—Permanent houses (54), Quakers Yard; borough engineer.

Middlesbrough.—Development plan for the River Tees (£6,000,000); Tees Conservancy Commission.

Middleton.—Works extensions, Spring Vale Mills, for Yorkshire Dyeing & Proofing Co., Ltd.; P. Cummings, architect, 16, Oxford Street, Manchester, 1.

Millom.—Houses (28), Town Head, Haverigg, for R.D.C.; J. Hankey, surveyor, council offices, Market Square.

Newburn.—Houses (£47,950), Claremont estate, Lennington, for U.D.C.; William Leech (Builders), Ltd., Clayton Street, Newcastle-on-Tyne.

Newcastle-on-Tyne.—Houses (60), Blakelaw estate, for the city council; W. D. & R. Allison, builders, Whitburn.

Houses (73), Longbenton estate; Hadden & Hillman, builders.

Newcastle (Staffs).—Houses (110), Beasley Farm estate, for T.C.; G. & G. Seddon, Ltd., builders, 55, Duke Street, Fenton, Stoke-on-Trent.

Primary school, Blackfriars site, for Education Committee; A. Cotton, borough surveyor and schools architect, Municipal Buildings, Lancaster House.

Northumberland.—Schools, Ulgham Stobswood, Lynemouth and Bothal, and additions, Ashington Mining School; county architect, county hall, Newcastle-on-Tyne.

Ponders End.—Factory, Alexandra Road; H. A. Shipman.

Prescot.—Houses (28), Shaw Lane estate, for U.D.C.; J. Jones (Woolton), Ltd., builders, Elm House, Liverpool, 16.

Redcar.—Houses (36), for T.C.; borough engineer.

Saffron Walden.—Houses (£83,630), Ashton Road; J. L. Glasscock & Son's Successors, The Causeway, Bishop's Stortford.

Scarborough.—Houses (£35,564), Barrowcliffe estate; Mollekin Bros., contractors, Lowdale Avenue.

Shoreditch.—Flats, Stonebridge estate (£102,000); borough engineer.

Sidmouth.—Permanent houses (66), for U.D.C.; surveyor.

Southend - on - Sea.—Houses (44), Prince Avenue; borough engineer.

South Shields.—Houses (134), Marsden Road, G. Bailey, Ltd., builders, King Street.

Southport.—Houses (92), Russell Road; borough engineer.

Southwark.—Engineering works extension and reconstruction, Gt. Dover Street; Dewrance & Co., Ltd.

Tynemouth.—Factory, Tynemouth trading estate, for Ronson's Products, Ltd.; H. D. Hastie, Ltd.; King Street, North Shields.

Upton-on-Severn.—Houses (30) for R.D.C.; Pemberton & Bateman, 29, High Street, Evesham.

Wallasey.—Extensions, Riverside Restaurant (£4,750); and school, Gorsey Lane; borough engineer.

Wallsend.—Houses (189), Station Road site; W. Leech, builder, 2, Clayton Street, Newcastle.

Wantage.—Permanent houses (42); R.D.C. surveyor.

Warlingham.—Houses (29), Tythe Lane; R. J. Clarke & Co., Ltd.

Warrington.—Houses (176), Council estates; borough engineer.

West Silloth.—Houses (35); North-Eastern Housing Association, Curzon Street, Maryport.

Weymouth and Melcombe Regis.—Houses (28), Fleet View, Westhill Road, Wyke Regis; borough surveyor, 6, Pulteney Buildings.

Whiston.—Houses (62), for R.D.C.; surveyor, council offices, Prescot, nr. Liverpool.

Woolwich.—Houses (£80,863), Woodlands estate; borough engineer.

Workington.—Houses (22), High Harrington; Dunn Bros.

York.—Technical college, secondary school and county college at Dringhouses for the City Council; city architect.

Export Inquiries

WE have received the undermentioned inquiries from firms and individuals overseas who wish to secure agencies for British electrical equipment and appliances or to import them into their territories. We shall be glad to pass on to them replies received from readers which should be addressed to the Editors, quoting the number given in parentheses. We cannot vouch for the standing of inquirers and manufacturers replying to them will no doubt require the usual references :—

Belgium.—Agencies wanted for manufacturers of switches, especially protective switches for AC motors. This inquirer also requires a metal planer with a 1-metre bed. (X. 134.)

India.—A Bombay firm asks for catalogues, samples and prices of electrical installation accessories; wires, cables and flexibles; heating and cooking appliances; and electric lamps. (X. 135.)

Iran.—Catalogues and prices of electrical equipment required by a Teheran firm. (X.136.)

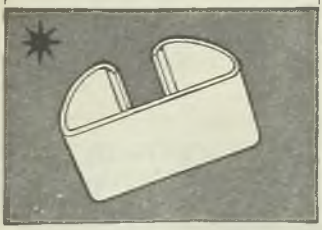
Nigeria.—Lists wanted of laundry machines, electrical fittings, and grinding machines for coffee, corn, etc. (X. 137.)

Every time a designer or production engineer decides to use some form of Spire fixing, he puts a few thousand (or a few million) nuts and washers out of a job. No more fumbling and holding the bits together with one hand while you get to work with the other. Spire fixing can tackle and simplify most light assembly jobs. The best thing is to send us the job — or the drawings. If a Spire fixing will improve the job we'll design it for you and show it to you in a week or two. Then you can judge for yourself.

THAT'S Fixed THAT!

Type CA 725

Fixing knobs to shafts. Sounds simple but if you're a radio manufacturer you know what a headache it can be. The Spire fixing was designed to solve that particular problem. The CA 725 is made to measure for shafts of various diameters. Then it is snapped into position in the hub of the knob and the knob pushed straight on to the shaft. Don't think of Spire as a 'kind of nut.' It is a great deal more than any nut. It is a simplified and sure method of fixing. Especially awkward fixings !



Spire

✳ **A BETTER way of fixing**

Simmonds Aerocessories Limited · Great West Road · London · A Company of the Simmonds Group

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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. *(See notice below for Christmas.)*

THE CHARGE for advertisements in this section is 2/- per line (approx. 7 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 this counts as six words and 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.

CHRISTMAS SCHEDULE

CLASSIFIED ADVERTISEMENTS

Latest time for receiving copy

DEC. 21 issue, closed for press on FRIDAY, DEC 14	DEC. 28 issue, First post on THURS., DEC. 20

OFFICIAL NOTICES, TENDERS, ETC.

BOROUGH OF KETTERING

Electricity Department

TENDERS are invited from British manufacturers for:

SPECIFICATION No. 101.
Two 300-kVA. ratio 6,600/420-volts Transformers.
Two 300-kVA. ratio 11,000/420-volts Transformers.
Two 400-kVA. ratio 11,000/420-volts Transformers.
SPECIFICATION No. 102.
11,000-volt Switchgear.
6,600-volt Switchgear.
Sheet Steel Kiosks.

Specifications and Forms of Tender, in duplicate, may be obtained from the Borough Electrical Engineer, Rockingham Road, Kettering, upon receipt of one guinea for each specification, which will be refunded upon receipt of a bona-fide tender and the return of the specification. Extra copies of the specification may be purchased at a cost of 5s. each.

Tenders must be submitted in a plain sealed envelope supplied by the Corporation, endorsed " Tender for Specification No. 101 " or " Tender for Specification No. 102," and must be received by me not later than FRIDAY, 4th JANUARY, 1946.

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

JOHN CHASTON,
Town Clerk.

Town Clerk's Office,
High Street, Kettering.
4th December, 1945. 3657

MAESTEG URBAN DISTRICT COUNCIL

Caerau Housing Site

TENDERS are invited for the SUPPLYING and LAYING OF L.T. MAINS, SERVICES AND PUBLIC LIGHTING at the above site.

Copies of Specification, Conditions of Contract and Form of Tender may be obtained upon application to the Engineer and Manager, Maesteg Urban District Council, Electricity Department, 35, Commercial Street, Maesteg, Glam.

The completed tender should be forwarded in a plain sealed envelope, marked " L.T. Mains, Caerau," and should reach THE UNDERSIGNED NOT LATER THAN TUESDAY, 1st JANUARY, 1946.

A. KING DAVIES,
Clerk of the Council.

Lloyds Bank Chambers,
Maesteg, Glam.
November 26th, 1945. 3572

CITY OF EDINBURGH

THE Lord Provost, Magistrates and Council of the City of Edinburgh invite tenders for the following works at Portobello Power Station:—

33-kV SWITCHGEAR AND ACCESSORIES TO SPECIFICATION No. ED-GS. 190.

The Specification, Form of Tender, General Conditions and Drawings can be obtained from the Corporation's Consulting Engineers, Messrs. Kennedy & Donkin, Alliance House, 12, Caxton Street, Westminster, London, S.W.1, on and after Tuesday, 18th December, 1945, on payment of a deposit of £2 2s. for each copy, which will be refunded on receipt of a bona fide tender and on the return of the Specification, General Conditions and Drawings.

Tenders, on the prescribed form, endorsed on the outside with the title of the Specification, must be delivered at the office of the undersigned not later than 12 noon on Friday, 15th February, 1946.

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

J. STORRAR, S.S.C.,
Town Clerk.

City Chambers, Edinburgh.
December, 1945. 3674

COUNTY BOROUGH OF BLACKPOOL

Electricity Department

THE Electricity Committee invites tenders for the supply and delivery of:—

One Control Battery
One Circuit Breaker Closing Battery
One Circuit Breaker Tripping Battery
High and Low Rate Charging Equipment and associated switch and fuse gear.

Specification and Form of Tender may be obtained from the Borough Electrical Engineer and Manager, Shannon Street, Blackpool. Tenders enclosed in a plain envelope and endorsed " Tender for Batteries " must be delivered to the undersigned not later than 3rd January, 1946.

TREVOR T. JONES,
Town Clerk.

Town Hall,
Blackpool. 3687

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 and 40 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.

H.T. CABLE JOINTER

APPLICATIONS are invited for above position from fully qualified plumber jointers. Wages and working conditions not less favourable than J.I.C. Scottish District No. 13, Zone C, present rate being 25d. per hour.

Applications, stating age and experience, should be addressed to the undersigned.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

W. S. SAWTELL, M.I.E.E.,
General Manager.

Scottish Southern Electric Supply Company Limited,
High St., Galashiels, Selkirkshire. 3690

AN Electricity Supply Authority in the Home Counties invites applications for the following vacancies:—

(a) 6 Electricians for the maintenance and repair of domestic electrical apparatus on consumers' premises.
(b) 1 Assistant Electrician for Works Maintenance—D.C. and overhead experience essential.
(c) 4 Wiremen.
(d) 2 Overhead Linesmen for H.T. line construction and maintenance.
(e) 1 Plumber Jointer for 11-kV jointing.
(f) 1 Electrician for Cooker Repair Shops and Factory maintenance.
(g) 1 Tracer or Junior Draughtsman for Mains Records, etc.
(h) 2 Meter Testers and Repairers.

District rates will be paid. Applicants to indicate clearly the particular vacancy for which they are applying, and include the following information in their reply:—

Age.
Whether married or single.
Training and experience.
Last civilian employment and nature of work.

At present the Control of Engagement Order limits the age of male applicants to men under 18 years or over 51 years of age. Applicants who are thereby prevented from changing their employer may make an application, which will be retained for consideration when the restriction is removed.

Class A men on leave, just discharged from the Forces, may apply, irrespective of age, provided their period of leave has not expired.

Women under 18 years or over 41 years of age may apply for vacancies (a), (g) and (h).

This advertisement is published by permission of the Ministry of Labour and National Service.

Replies to—Box 3524, c/o The Electrical Review.

ALDERLEY EDGE AND WILMSLOW ELECTRICITY BOARD

Appointment of Deputy Distribution Assistant

APPLICATIONS are invited for the above appointment to the Board's permanent staff. Candidates should have attained a technical standard equivalent to Graduateship of the I.E.E. and have had practical experience of the design, operation and maintenance of a modern three-phase E.H.T. and L.T. system, particularly substation work. The salary will be in accordance with Grade 8, Class C, at present £329 per annum for the first two years, £338 for the third and fourth year, and £347 thereafter. There is no war bonus attached to this position.

Applications, on forms to be obtained from the undersigned, together with copies of two recent testimonials, to reach the undersigned not later than Friday, 28th December, 1945.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and subject to medical examination.

The Ministry of Labour and National Service (Technical and Scientific Register) has given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

C. CAMERON KIRBY.
Engineer and Manager.

13, Water Lane,
Wilmslow, Cheshire. 3574

BOROUGH OF HASLINGDEN

Electricity Department

Plumber Jointer

THIS advertisement is published by permission of the Ministry of Labour and National Service. Applications are invited for the position of Plumber Jointer. Applicants must be experienced in jointing both E.H.T. (6,600 volts) and L.T. cables.

Rate of pay in accordance with the Schedule of the District Council, No. 3, North-Western Area, Electricity Supply Industry, B Zone, at present 25.43d. per hour.

Applications, giving age, whether married or single, and details of experience, and accompanied by copy testimonials, to be received by the Borough Electrical Engineer, Electricity Offices, Haslingden, Rossendale, not later than the 22nd December, 1945. 3693

COUNTY BOROUGH OF HASTINGS

Electricity Department

Demonstrator (Female)

APPLICATIONS are invited for the appointment of Demonstrator (Female) at a salary in accordance with Grade II of the Corporation's salary schedule, commencing at £170, rising to £210 by four annual increments, plus war bonus, at present £48 per annum.

Candidates must have a good general education and hold a recognised diploma in Domestic Science, and possess a thorough knowledge of the use of electrical domestic appliances. Possession of the E.A.W. Electrical Housecraft Diploma will be an advantage. They must be competent to arrange and conduct Lecture Demonstrations on cooking and all forms of domestic apparatus, advise consumers on kitchen planning, and assist in the showrooms when required.

In accordance with a Council resolution the appointment will be a temporary one.

Applicants should state age, whether single, married or widow, give details of education, technical training, experience and diplomas.

The Ministry of Labour and National Service agree that the post may be advertised unrestricted.

Applications should be addressed to the undersigned and delivered not later than the 3rd January, 1946.

J. SAVAGE.
Engineer and Manager.

Electric House,
12 and 13, York Buildings,
Hastings. 3655

COUNTY BOROUGH OF BLACKPOOL

Electricity Department

Appointment of Two Charge Engineers

APPLICATIONS are invited from suitable applicants for the position of Charge Engineer for shift duties in the Blackpool Generating Station, the plant capacity of which is 15,500 kilowatts, supplemented by bulk supply at 33 kV. Applicants must have had experience of the control, operation and maintenance of water tube boilers, turbo-alternators and 33-kV switchgear and transformers, with "on load" tap changing gear and induction regulators. Experience of the operation and maintenance of supervisory control will be considered an advantage.

The salary for each of the positions will be in accordance with the National Joint Board Schedule, Class G, Grade 8, at present £420. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidates will be required to pass a medical examination.

Applications, giving full details of age, training and experience, together with copies of not more than three recent testimonials, must reach the Borough Electrical Engineer, Shannon Street, Blackpool, by 31st December, 1945, and must be endorsed "Charge Engineer."

The Ministry of Labour and National Service has given permission under the Control of Engagements Order, 1945, for the advertisement of these vacancies.

TREVOR T. JONES, Town Clerk.

Town Hall, Blackpool. 3658

SPALDING URBAN DISTRICT COUNCIL

Electricity Department

Junior Mains Assistant

APPLICATIONS are invited for the appointment of a Junior Mains Assistant. Candidates must have had technical training and experience in the operation and maintenance of high and low pressure A.C. distribution systems.

Salary and conditions will be in accordance with N.J.B. Schedule, Grade 8b, Class B.

Applications, stating age, with particulars of training and experience, and endorsed "Junior Mains Assistant," to be received by the undersigned not later than Monday, December 31st, 1945.

House may be available in due course if required.

This advertisement is published by permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1945.

FRANK C. ROBERTS,
Engineer and Manager.

Electricity Dept.,
Spalding, Lincs. 3695

BOROUGH OF CREWE

Electricity Undertaking

Appointment of Consumers' Engineer

ENGINEERS with sound qualifications and ability for the following work are invited to apply for the above appointment:—

Preparation of specifications and estimates for all types of electrical installations, and supervision of installation and maintenance work, including appliances.
Inspection and testing of consumers' installations in accordance with appropriate regulations.
Showroom organisation, including consumers' enquiries, sales, publicity and load development.
Street lighting design, installation and maintenance.
(Three assistants cover the above work under the control of the Consumers' Engineer.)

Corporate membership of the I.E.E. will be a recommendation. Salary will be in accordance with the N.J.B. Schedule, Grade 6, at present commencing at £459. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and successful medical examination.

Applications, stating age, qualifications, training and experience, must reach the undersigned in an endorsed envelope by Saturday noon, 29th December, 1945.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

K. B. EDWARDS,
Town Clerk.

Municipal Buildings,
Earle Street, Crewe. 3694

BOROUGH OF BASINGSTOKE

Electricity Department

Commercial and Clerical Assistant

APPLICATIONS are invited for the above appointment. Applicants must have a thorough training and experience in the commercial and clerical side of a Municipal Electricity Undertaking, and must be competent to supervise and control office staff.

The salary will be at the rate of £285 per annum, plus temporary war bonus (at present £59 16s.), rising, subject to satisfactory service, by annual increments of £15 to £330 per annum.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the conditions of the Council's Sick Pay Scheme.

The successful candidate will be required to pass satisfactorily a medical examination by the Council's Medical Officer.

Applications, endorsed "Commercial and Clerical Assistant," stating age, full particulars of qualifications, training and experience, from those exempt from the provisions of the Control of Engagement Order, 1945, only, and accompanied by copies of not more than three recent testimonials, should be forwarded to reach the undersigned not later than Friday, 21st December, 1945.

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

MEIRION O. JONES,
Town Clerk.

Municipal Buildings,
Basingstoke.
6th December, 1945. 3696

LONDON POWER COMPANY LTD.

ASSISTANT Boiler House Maintenance Engineer required. Applicants should be capable of assisting in the organisation and direction of large staff in all classes of work associated with repairs and maintenance of large H.P. and E.H.P. water tube boiler plant and auxiliary equipment, and should have previous experience in this category.

Applicants should also have a sound technical and practical training in mechanical engineering, with general knowledge of power station operation.

Commencing salary in accordance with N.J.B. Schedule, Class M, Grade 8a, £569 per annum.

The Ministry of Labour and National Service, Technical and Scientific Register, have given permission under the Control of Engagement Order, 1945, for advertisement of this vacancy.

Applications in writing to the Superintending Engineer, London Power Co. Ltd., Battersea Generating Station, Kirtling Street, Nine Elms Lane, Battersea, S.W.8. 3697

BOROUGH OF BRIGHOUSE

Appointment of Electrical Engineer and Manager

APPLICATIONS are invited for the position of Electrical Engineer and Manager of the Corporation's Electricity Undertaking at a salary of £650 per annum, rising by two annual increments of £25 to £700, plus cost of living bonus (at present £59 16s.). An allowance in accordance with the scale adopted by the Council will be paid to the Engineer if he uses his private car in connection with the business of the Council.

Candidates must be Corporate Members of the Institution of Electrical Engineers or hold an equivalent qualification, must be experienced in the management and administration of an electricity undertaking, and must not be more than 45 years of age. The appointment will be subject to the Corporation's conditions of service; to the Local Government Superannuation Act, 1937; to the passing of a medical examination, and to three months' notice on either side. No testimonials will be required in the first instance.

Canvassing, either directly or indirectly, is prohibited, and candidates should state in their applications whether to their knowledge they are related to any member of, or the holder of any senior office under, the Council.

Copies of the conditions, etc., relating to the appointment may be obtained from the undersigned. Applications, endorsed "Electrical Engineer and Manager," must be delivered to the undersigned not later than the first post on Wednesday, 16th January, 1946.

ERNEST H. CLEGG, Town Clerk.

Town Hall, Brighouse. 3663

CITY OF PLYMOUTH

Electricity Department

Appointment of Junior Shift Charge Engineer

APPLICATIONS are invited for the position of Junior Charge Engineer to carry out the normal duties of assisting the Shift Engineer in the Generating Station.

Applicants must be between the ages of 25 and 40 and should have experience in a modern Power Station. Preference will be given to those who have passed the graduateship examination of the Institution of Electrical Engineers, or an approved equivalent. The salary will be in accordance with Grade 8b, Class H, of the National Joint Board Schedule, at present £385 per annum.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, 1937, and the successful candidate willl be required to pass a medical examination.

Applications must be made on special forms to be obtained from the undersigned, to whom they must be returned not later than noon on the 31st December, 1945.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

H. MIDGLEY,
City Electrical Engineer.

Armada St., Plymouth.
December, 1945. 3681

CAMPBELTOWN & MID-ARGYLL ELECTRIC SUPPLY CO. LTD.

Engineering Assistant

APPLICATIONS are invited for the appointment of an Engineering Assistant at a salary of £300 per annum, plus a temporary war bonus, at present £62 8s. per annum.

Applicants must have had experience in installation work on consumers' premises, including the preparation of estimates, and must also have had general experience in the installation and operation of E.H.T. and L.T. underground and overhead mains and substations. Experience of Diesel Power Station operations will also be an advantage.

The successful candidate will be required to participate in the Company's Superannuation Scheme.

Applications in writing, giving details of training and experience, accompanied by copies of recent testimonials, endorsed "Engineering Assistant," should be addressed to the undersigned not later than the 28th December, 1945.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

N. F. MARSH, M.A., M.I.E.E.,

North House,
Grantham, Lincs. 3691

BEDFORD CORPORATION ELECTRICITY UNDERTAKING

Appointment of Mains Assistant

APPLICATIONS are invited for the position of Mains Assistant. Candidates, whose ages must not exceed 40 years, must be Graduates or Corporate Members of the Institution of Electrical Engineers or other acceptable equivalent qualification, with practical experience in the laying and maintenance of single and three-phase cables, overhead lines and transformer substations.

The commencing salary will be in accordance with Class 7, Grade G, of the National Joint Board Schedule (at present £445 per annum).

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Canvassing, either directly or indirectly, will disqualify the candidate.

Applications must be made on special forms to be obtained from the undersigned, to whom they must be returned not later than 12 noon on Tuesday, January 1st, 1946.

The Ministry of Labour and National Service, Technical and Scientific Register, have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

P. G. CAMPLING,
Chief Engineer and General Manager.

Electricity Offices,
Prebend Street, Bedford.
December, 1945. 3654

COUNTY BOROUGH OF SOUTHPORT

Appointment of Shift Charge Engineer

APPLICATIONS are invited for the position of Shift Charge Engineer at the Corporation's "Selected" Generating Station. Candidates at present serving with H.M. Forces will receive every consideration.

Candidates must have received a good technical training and have had experience in the operation of Central Station plant, including Turbo-Alternators, Water Tube Boilers and E.H.T. Switchgear.

Salary will be in accordance with the N.J.B. Schedule, Class F, Grade 8. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1922; medical examination necessary.

Candidates should give particulars of their qualifications, experience and age, together with copies of two recent testimonials.

Applications, endorsed "Shift Charge Engineer," should be addressed to the Borough Electrical Engineer, 188, Lord Street, Southport, and must be received by Monday, 7th January, 1946.

This advertisement inserted with the permission of the Ministry of Labour and National Service.

R. EDGAR PERRINS,
Town Clerk.

Southport.
5th December, 1945. 3665

WELWYN GARDEN CITY ELECTRICITY SUPPLY COMPANY LIMITED

Appointment of Junior Mains Assistant

APPLICATIONS are invited for the above appointment from Electrical Engineers who are Graduate Members of the Institution of Electrical Engineers or possess equivalent qualifications.

Experience in general operation of E.H.T., H.T. and L.T. distribution systems necessary.

Salary in accordance with N.J.B. Schedule, Class F, Grade 8b, rising to Grade 8a at the end of the first year and to Grade 8 after 2 years' satisfactory service.

Applications, stating age and giving full particulars of training and experience, together with copies of testimonials, to be forwarded to the undersigned not later than December 28th, 1945.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

A. T. BULLEN, M.I.E.E.,
Electrical Engineer and Manager.

40, Howardsgate,
Welwyn Garden City,
Herts. 3689

BOROUGH OF MANSFIELD

Electricity Department

Appointment of Meter Engineer

APPLICATIONS are invited for the position of Meter Engineer from qualified engineers with experience in testing and repairing all types of direct current, single and polyphase meters, etc., together with standardisation of instruments, etc., and general meter department routine.

The conditions of the appointment are in accordance with the National Joint Board Schedule, Class E, Grade 8, commencing at £371 per annum

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

Applications, with copies of three recent testimonials, and giving particulars of qualifications, experience and age, should be addressed to the Borough Electrical Engineer, Lime Tree Place, Mansfield, not later than January 5th, 1946.

Permission by the Ministry of Labour and National Service to publish this advertisement has been obtained.

A. C. SHEPHERD,
Town Clerk.

Carr Bank, Mansfield.
6th December, 1945. 3678

BOROUGH OF CHEPPING WYCOMBE (High Wycombe)

Electricity Undertaking

Appointment of Assistant Demonstrator (Female)

APPLICATIONS are invited from suitably qualified persons to instruct consumers in the use of cookers and other electrical appliances, to give practical demonstrations, and to assist in the showroom.

The salary will be in accordance with the Southern Provincial Whitley Council Scale, namely £155 to £240, plus war bonus of £48 2s., with commencing salary according to age. The appointment will be subject to the Council's Conditions of Service and to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications, giving full particulars of age, training, qualifications and experience, together with testimonials, should be forwarded to the undersigned not later than Friday, December 21st, 1945.

HENRY ROBSON,
Borough Electrical Engineer.

Electricity Offices,
Frogmoor,
High Wycombe, Bucks. 3645

APPLICATIONS are invited from Engineers or Physicists to undertake research on problems associated mainly with Transformer Design, Manufacture and Operation. Previous experience of transformer design is desirable but not essential. Starting salary would depend on qualifications and experience, and would probably be from £450 to £650 per annum, exclusive of cost of living bonus, in accordance with the Whitley scale, and superannuation under the F.S.S.U.

Applications to be sent by 4th January, 1946, to the Secretary, The British Electrical and Allied Industries Research Association, 15, Savoy Street, London, W.C.2.

The Ministry of Labour and National Service, Technical and Scientific Register, have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy. 3664

OPERATING STAFF REQUIRED FOR SELECTED POWER STATION

APPLICATIONS are invited from men exempt from the Control of Engagement Order for service as:—

TURBINE DRIVERS, with experience on large turbo-alternators operating at high pressure and temperatures.

BOILER OPERATORS, with experience on pulverised fuel boiler units equipped with automatic combustion control.

Write, stating age and details of experience, to The Resident Engineer, Little Barford Power Station, near St. Neots, Bedfordshire. 3639

BOROUGH OF ECCLES

Appointment of Showroom Assistant (Female)

APPLICATIONS are invited for the position of Showroom Assistant (Female) in the Corporation's Electricity Showrooms.

Applicants must have a thorough knowledge of the practical use of electricity to all kinds of domestic appliances, and preference will be given to candidates having a knowledge of Cookery demonstration.

Commencing salary £172 10s. per annum, rising, subject to satisfactory service, to a maximum of £206 per annum, plus war bonus, at present £48 5s. per annum.

The appointment will be subject to the approval of the Ministry of Labour and National Service, and the successful applicant will be required to contribute to the Corporation's Superannuation Fund, and to undergo a medical examination to the satisfaction of the Council's Medical Officer of Health.

Applications, stating age and full particulars of qualifications and experience, accompanied by copies of two recent testimonials, to be forwarded to the Borough Electrical Engineer, Electricity Offices, 1, King Street, Eccles, Lancs., not later than Friday, 21st December, 1945.

G. O. JONES,
Town Clerk.

Town Hall, Eccles.
4th December, 1945. 3652

BOROUGH OF CHESTERFIELD

Electricity Department

Technical Assistant

APPLICATIONS are invited for the above appointment from candidates of good technical knowledge and sound practical experience in the general work of a Distribution Department, including the preparation of specifications, the commissioning of plant and the estimating of the cost of extensions to the H.V. and M.V.A.C. systems, both underground and overhead.

The salary will be in accordance with Grade 8, Class F, of the N.J.B. Schedule, at present £397 per annum.

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

Applications, endorsed "Technical Assistant," giving details of training and subsequent experience, should be delivered to the undersigned not later than 31st December, 1945.

The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

RICHARD CLEGG,
Town Clerk.

Town Hall, Chesterfield.
14th December, 1945. 3653

PRINCIPAL WELFARE, SAFETY AND PERSONNEL OFFICER

REQUIRED by a large electricity supply undertaking in the London area, a Principal Welfare, Safety and Personnel Officer. Applicants should preferably have had an engineering training, be experienced in industrial legislative requirements, be familiar with up-to-date welfare organisation, and have intimate knowledge of the handling of personnel matters. Replies should state: (1) age, (2) previous experience, (3) salary required; to—Box No. 463, c/o Dawsons, 31, Craven St., London, W.C.2. 3698

ARMATURE Winder for repair work, A.C. and D.C. Permanent position, good prospects, small growing business. Class A. ex-Serviceman or exempt from M.O.L. control. Lancaster area. Write giving full details of experience, etc.—Box 3596, c/o The Electrical Review.

ARMATURE Winder required, over 51 or Class A ex-Serviceman. Reply details experience and wages required.—Box 8107, c/o The Electrical Review.

ARMATURE Winder required to take charge and to act as Foreman in fractional h.p. repair dept. Good prospects for right man. Applications from those over 51 or Class A ex-Servicemen only. Write—Box 3680 c/o The Electrical Review.

CENTRAL London Contractors require experienced Storekeeper; permanency to right man. Class A ex-Serviceman or otherwise free. Full particulars to—Box 3700, c/o The Electrical Review

CHARGEHAND Engineer required for shift work by industrial undertaking in West Midlands. Lancashire boilers and reciprocating engines generating A.C. Permanent post with pension. Salary £300 to £350. State age and experience. Only Class A ex-Servicemen or Servicemen due for early release should apply.—Box 3675, c/o The Electrical Review.

CHIEF Draughtsman, experienced in radio and electrical engineering. Class A ex-Servicemen or men exempt M.O.L. control. Write giving experience and salary required.—Box 3641, c/o The Electrical Review.

CHIEF Draughtsman, London. Well established manufacturers of electricity meters. Experience in precision large scale production essential. Applications from Class A ex-Servicemen or others exempt from M.O.L. control only. Age, experience, and salary required.—Box 3618, c/o The Electrical Review.

CHIEF Engineer for factory maintenance in South Wales, qualified mechanical and electrical. House will be available. Apply with particulars of age, experience and salary to—Box 3646, c/o The Electrical Review.

CHIEF Maintenance Engineer required by Company operating group factories in North and North-East London undertaking manufacture light engineering products, to control electrical and mechanical maintenance of all plant and equipment, including general repair and extension of buildings. Applicants must have previously successfully held similar position and be corporate members of one or more of the senior professional Institutes. Possession of a Board of Trade first-class Engineer's Certificate and experience as Chief Engineer aboard large ocean-going vessels will be considered advantageous. The position carries a salary of £600-£700 per year, according to qualification, and is pensionable after a period of satisfactory service. Write with full details, age, education, training and subsequent experience to—"C.M.E.", Box 7967, A.K. Advg 212a, Shaftesbury Avenue, W.C.2. 3577

CLERICAL Assistant, Class A ex-Serviceman, for Stores Office. Must have thorough knowledge of all electrical material. Apply—London Electrical Company, 92, Blackfriars Road, S.E.1. 24

CLERICAL Assistant required by manufacturers of electric light fittings, London district. One with previous knowledge of the trade, and who is adaptable, preferred. Class A ex-Servicemen and others exempt from M.O.L. control only.—Box 3570 c/o The Electrical Review.

COSTING and Estimating Clerk required by electrical contractors. Over 51 or Class A ex-Servicemen only. Write, stating age, experience and salary required, to—Southern & Redfern Ltd., Woodhead Rd., Bradford. 3629

DIE-Maker required, able to take charge of die-casting shop. Staff. Urgently required in N.W. London area. Must be exempt from M.O.L. control. Please reply to—Box No. 148, Phillips Advertising Ltd., 15, Wilton Road, London, S.W.1. 3650

DRAUGHTSMAN, assistant, preferably having some experience with electronic equipment, London, progressive opportunity. Applications invited from Class A ex-Servicemen and others exempt from M.O.L. control. Write stating age, experience and salary required.—Box 3533, c/o The Electrical Review.

DRAUGHTSMAN-Designer for electric design of polyphase electric motors. Applicants must have had extensive experience in work of this type. Class A ex-Servicemen or otherwise free from M.O.L. control. Please state salary required. North London area.—Box 3673, c/o The Electrical Review.

DRAUGHTSMAN with experience in design of domestic electric light fittings required for London office. Class A ex-Servicemen and others exempt from M.O.L. control only. Write giving details of experience, age, and salary to—Box 3571, c/o The Electrical Review.

DRAUGHTSMEN (2) required immediately, London. Good opening in important medium-size company with U.S.A. connections specialising in light electro-mechanical equipment. Applicants should have electrical or telecommunications experience and good general knowledge of workshop practice. Permanent. Class A ex-Servicemen or otherwise free. Write stating age, experience, salary required.—Box 3651, c/o The Electrical Review.

DRAUGHTSMEN required, also Improvers and Learners, male or female for design work on electric light fittings by manufacturers in Leeds area. Experience in similar work or in other sheet metal work an advantage. Applicants free of Ministry of Labour Control please write with detailed particulars of experience, salary required etc., to—Box 3684, c/o The Electrical Review.

ELECTRICAL Measuring Instruments. Small but progressive London company has vacancy for Technical Supervisor to manage Experimental Department, with thorough knowledge of instrument design, experimental and development work. Man with production and supervisory experience preferable. Write stating age, experience and salary required.—Box 3644, c/o The Electrical Review.

ELECTRICAL Research Engineer required by firm manufacturing small electric motors and electro-mechanical appliances. Please write giving full details of experience, education and salary required. Over 51 or from Class A ex-Servicemen only.—Box 3527, c/o The Electrical Review.

ELECTRICIAN-Wireman urgently required for electro-agricultural work on farms and estates. Class A ex-Servicemen or otherwise exempt from M.O.L. control. Permanent situation with good pay and prospects to suitable applicant not afraid of working under farm conditions. Apply in writing in first instance, with details of previous experience, to—The Electrical Engineer, Taskers of Andover (1932) Ltd., Andover, Hants. 3643

ELECTRICIANS and Assistants wanted, Class A ex-Servicemen or over 51. Permanency to right men.—J. H. Plant Ltd., 99, St. Martin's Lane, Charing Cross, W.C.2. 8073

ELECTRICIANS and Mates (exempt from M.O.L. control) wanted Central London, for general installation and repair work. Every consideration and permanent job to reliable and conscientious workers.—Waddington & Goodwell Ltd., 34/35, Hatton Garden, E.C.1. 8091

ELECTRICIANS and Wiremen wanted urgently for A.C. and D.C. installations of lighting and power in Central London area. Class A men or men exempt from Ministry of Labour control. Apply—Arco Electrical Ltd., 55, Hatton Garden, E.C.1. Holborn 3179. 3637

ELECTRICIANS for installation work required in London, Manchester, Birmingham, Bournemouth, Southampton, Hull and Sheffield. Class A ex-Servicemen or otherwise exempt from M.O.L. Write full particulars to head office—Messrs. F. H. Wheeler & Co. Ltd., 39, Victoria Street, S.W.1. 3586

ELECTRO-Mechanical Designer with experience in detail design is required by development dept. of large S. London engineering firm. Applicants outside Restriction of Engagement Order only should apply, in writing, giving full details of experience and sal. required, to—Box 3677, c/o The Electrical Review.

ENGINEERS and Draughtsmen, becoming available for civil employment under Class A demobilisation, are invited to apply for positions in the heavy electrical plant departments (comprising electrical machines and transformers of all kinds) of a large electrical engineering manufacturer in the Midlands. Applications, stating age, appropriate technical qualifications and industrial experience, and order of salary required, to—Box 71, c/o The Electrical Review.

ENGINEERS and Draughtsmen, becoming available for civil employment, under Class A demobilisation, are invited to apply for positions in the Switchgear Department of a large electrical engineering manufacturer in the Midlands. Applications stating age, appropriate technical qualifications and industrial experience, and salary required, to—Box 69, c/o The Electrical Review.

ESTIMATING Engineer required by a firm of manufacturing electrical engineers in the South of England to deal with enquiries and technical correspondence for house service meters and indicating instruments. Applicants who have specialised in either product may apply, but preference will be given to those with a knowledge of both. Salary £450/£525 according to qualifications. The Ministry of Labour and National Service have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy. Applications, which must be in writing, stating date of birth, full details of previous experience (including a list in chronological order of posts held), should be addressed to—Box 3439, c/o The Electrical Review.

ESTIMATOR wanted, capable of preparing own schemes in addition to quoting on consultants' specifications, etc. Sound knowledge of electrical contracting business essential; able to organise and operate own contracts; permanency to right man. Class A ex-Servicemen or men otherwise free. State salary required, experience and when available to—Box 3581, c/o The Electrical Review.

EXPORT Estimator required. Should have knowledge and experience of electrical engineering and administration, and have had service abroad. Ex-Serviceman, Class A. Reply stating age, experience, and salary required to—Box 3567, c/o The Electrical Review.

FOREMAN Electrical Engineer required for large industrial concern in South Lancashire. Applicants should have practical experience in the operation and maintenance of A.C. and D.C. factory distribution systems, motors and automatic control gear, and will be required to control a staff of electricians. Duties include requisitioning of equipment and material and its installation. Applicants should be exempt from Ministry of Labour control, or Class A ex-Servicemen. State full particulars of education, technical training, experience and salary required. Position carries superannuation, and house is available.—Box 3640, c/o The Electrical Review.

FULLY experienced Foreman required for transformer shops, must be conversant with all manufacturing processes, including winding, assembly and impregnating, able to control personnel (150). Knowledge of rate-fixing and piece-work. Permanent progressive position. Factory in North-West London. Applicants must be free from restrictions of the Control of Engagement Order. Write, stating age, experience and salary required, to—Box 3495, c/o The Electrical Review.

LABORATORY Assistant required in S.W. London area with knowledge of electrolytic condenser manufacture, able to assist in development and process control Permanency with good prospects for keen person. Applications from Class A ex-Servicemen only. Write giving all essential details.—Box 3548, c/o The Electrical Review.

LABORATORY Assistant with some knowledge of physics and electrical training required in S.W. London area. Applications from Class A ex-Servicemen only. Write giving details of age experience, etc.—Box 3549, c/o The Electrical Review.

LABORATORY Manager required. Applicant should already hold similar position, such as chief engineer or assistant to same, and have first-class electrical and scientific training and experience. Excellent opportunity with well-known London manufacturing company.—Box 3601, c/o The Electrical Review.

LADY Shorthand Typist with knowledge book-keeping required by electrical contractor's office. Write, stating age, salary required and experience, to—Box 3634, c/o The Electrical Review.

LIGHTING Technician required for preparation of schemes and estimates for stage and colour lighting, preferably with drawing office experience. Applications from Class A ex-Servicemen and others free from M.O.L. control only. State age, experience fully, salary.—W. J. Furse & Co. Limited, Traffic Street, Nottingham. 3668

MANAGER required for electrical contractors, London. Must have thorough knowledge of trade, estimating and supervision of labour. Excellent prospects for live man. Write, stating age, salary required and experience, to—Box 3633, c/o The Electrical Review.

METER Mechanic. Applications are invited for the position of Meter Mechanic from craftsmen having suitable experience in repairing and recalibrating all types of watt-hour meters, summation equipment and time switches. Conditions of employment and wages are in accordance with No. 9 area, J.I.C., the present wage being £5 1s. 10d. per week of 47 hours, including war bonus. The appointment in the first instance will be temporary. Applications, with copies of three recent testimonials, should be addressed to the Borough Electrical Engineer, Town Hall, Tunbridge Wells, by 28th December, 1945. The Ministry of Labour and National Service, Technical and Scientific Register, have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy. 3671

PHILIPS Lamps Limited have vacancies for young Mechanical Engineers with degrees, or the equivalent, in mechanical engineering. Applicants with previous experience of mass production in light engineering industry, and who are Class A ex-Servicemen or over 51, should write fully, stating age, previous experience and salary required, to—The Secretary, Philips Lamps Limited, New Road, Mitcham Junction, Surrey. 3662

REQUIRED, the services of a young energetic qualified Chemical Engineer prepared to ultimately take up responsible position in Australia. Applicants must be exempt M.O.L. control. Write fully, stating qualifications and experience.—Box 8093, c/o The Electrical Review.

REQUIRED 2 or 3 men for construction, assembly, and wiring of electronic equipment, amplifiers and test gear. Sound film equipment company, London. Applications invited from Class A ex-Servicemen with suitable experience, also from others not subject to M.O.L. control. State age, experience and wages required.—Box 3623, c/o The Electrical Review.

SALES Engineer Representative required for London area for switchgear and power transformers. Switchgear engineering knowledge essential. Reply to—Box 3682, c/o The Electrical Review.

SALES Engineer required by prominent London instrument company, to take charge of sales office and to handle all correspondence and contracts (home and export). Must have sound knowledge of industrial and laboratory indicating instruments. Our staff have been notified of this vacancy.—Box 3685, c/o The Electrical Review.

SCOTTISH Cables Ltd., Renfrew, invite applications from Estimators with first-class experience in paper and rubber insulated cables, for executive charge of a department. Excellent prospects for applicants possessing the requisite qualifications and initiative. Applications, which will be treated in the strictest confidence, to state age, experience and salary required. 3679

SWITCHGEAR manufacturers in the Manchester area have vacancies for Draughtsmen experienced in layouts, detailing and dingram work. Applications are invited from men who are free from restriction and particularly men under Class A release. Full details should be quoted, in the first place, to—Box 3496, c/o The Electrical Review.

TECHNICAL Sales Representative with knowledge of radio and electronics required by established cable company in the London area. Details of age, qualifications and experience and salary required to—Box 3632, c/o The Electrical Review.

TELEVISION and Radio. Assistant Buyer and Progress Chaser required, experience of radio and electrical trade essential. Applicants should be free of the Control of Engagement Order. Write, giving age, full details of experience, salary required, to—Personnel Officer, R.F. Equipment Ltd., Plantation Rd., Amersham, Bucks. 3672

TRACTION Control Designer, technically trained and with good shop experience, required for the handling of contracts and designing of schemes and apparatus. Any design engineer with D.C. experience would be considered. Applicants must be exempt from the Control of Engagement Order. Apply—Box 3630, c/o The Electrical Review.

VACANCIES are available for men released in Class A who have had experience on Instrument Work. Preference will be given to those who possess some theoretical knowledge. Apply, stating experience, training, age and wages required, to—Cambridge Instrument Company Ltd., Sydney Road, Muswell Hill, N.10. 46

WANTED Assistant Electrical Engineer to take charge of electrical work connected with production of machine tools, factory maintenance and installation work. Commencing salary £400-£500 per annum, according to experience and qualifications. Over 51 or from Class A ex-Servicemen only. Write, giving age, qualifications and experience details to—The Newall Engineering Co. Ltd., Old Fletton, Peterborough. 3543

WANTED. Clerk-Book-keeper, knowledge of typing. Experience electrical engineering plant. Applications from those exempt from M.O.L. control only. Write stating age, wage and references, giving full particulars, to—Phillips & Sons (Electrical) Ltd., 40 & 42, Waterford Road, Walham Green, S.W.6. 3699

WANTED, experienced Tracers (Female), also juniors with some experience (not learners). Apply, stating age, experience and salary required, to—Box 3631, c/o The Electrical Review.

WORKS Manager required for radio valve and cathode ray tube factory employing approximately 1,200 people in London area. Salary in region of £1,000 per annum. Applicants must have sound mechanical and electrical qualifications and be fully experienced in modern methods of works organisation, mass production methods and labour management. Write, stating age and full experience, to—Box 3499, 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.

BOROUGH of Ealing—Junior Mains Assistant; Central Electricity Board—Assistant Control Engineer. All applicants are thanked.

SITUATIONS WANTED

A capable and energetic Engineer, with sound electrical and mechanical experience on the widest range of equipment of all makes and types, desires a responsible position in an established firm. Class A released Flight Lieutenant, twice mentioned in despatches for successful development work and organizing ability.—Box 8088, c/o The Electrical Review.

COMMERCIAL AND/OR SALES MANAGER

ADVERTISER, aged 43, of proved ability to handle a wide range of products, desires change to progressive manufacturer. Fourteen years' all-round managerial experience, organizing and controlling sales, publicity, estimating, costing, buying, labour and staff. Good technical background, some works experience and d.o. training. Reasonable salary. Midlands preferred but not essential.—Box 8012, c/o The Electrical Review.

A qualified man (38), just demobbed, seeks a job. 9 years with municipal undertaking, advising consumers on lighting, heating, cookers, w/heaters, and supervising wiring installations for same. General knowledge office routine, management, showroom experience. Excellent references.—Box 8123, c/o The Electrical Review.

ABOUT to be de-mobbed, young man, 32, keen and conscientious. Comprehensive experience, 10 years with three leading electro-mechanical instrument firms. Including 5 year apprenticeship in all shops and latterly in test room, experimental and inspection departments, desires permanent post offering good prospects.—Box 8127, c/o The Electrical Review.

ADVERTISER, anticipating early release from a Govt. Dept., desires a post as Representative of an electrical manufacturer in Norway or Denmark; 20 years' experience planning, costing and installing, all classes electrical installations, including hydro-electric stations.—Box 8009, c/o The Electrical Review.

ADVERTISER, desiring change, seeks Managerial Post. Over 25 years' experience with manufacturers, contractors and wholesalers. Energetic worker. Excellent references.—Box 8094, c/o The Electrical Review.

ADVERTISER (age 35), recently demobilised (major, R.E.M.E.), is desirous of obtaining post as executive (Sales Manager or Works Manager) in light or medium engineering or electrical firm. Requires position where enterprising initiative and organising ability are desirable, leading to rapid advancement and permanency. 15 years' experience in electrical and general engineering practice. Excellent personality. Scotland area preferred, but would go anywhere. Would require to give present employers one month's notice, but could probably arrange less. Associate of the Electrical and Mechanical Institutions. Replies to—BM/MMK, London, W.C.1. 8110

ADVERTISER seeks position. Branch Manager or Salesman with electrical manufacturer, wholesaler or contractor. Fully experienced, including accounts and administration.—Box 8115, c/o The Electrical Review.

ADVERTISER (34), Demobilised Technical Officer, keen and enthusiastic, with good organising ability, seeks responsible progressive position as Sales Engineer abroad. Knowledge of Far East and lighter side of the electrical industry. Would also consider exclusive agencies in South Africa or India/Burma.—Box 8126, c/o The Electrical Review.

A.I.E.E., 38, free, extensive experience, adaptable, seeks post, London.—Box 8089, c/o The Electrical Review.

A.M.I.E.E., English (32), now in N. Ireland (no labour control), experience cable firm, supply co., internal and external construction, tech., admin., sales, high Govt. war post, requires job with much constructive work, anywhere.—Box 8106, c/o The Electrical Review.

A.M.I.E.E. (51), desires appointment as Sales Engineer, London and South, with Electric Heating Manufacturers. Technically qualified. Good connections. Car. Telephone. Available December.—Box 8058, c/o The Electrical Review.

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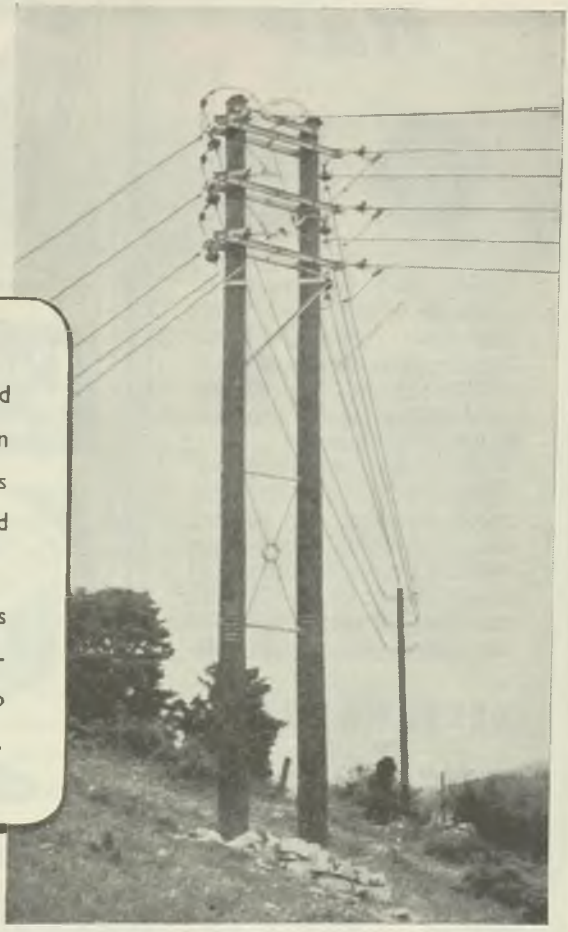

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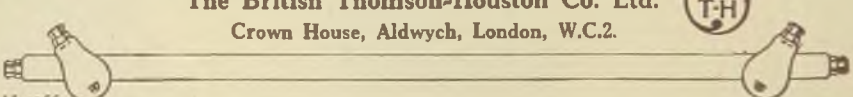

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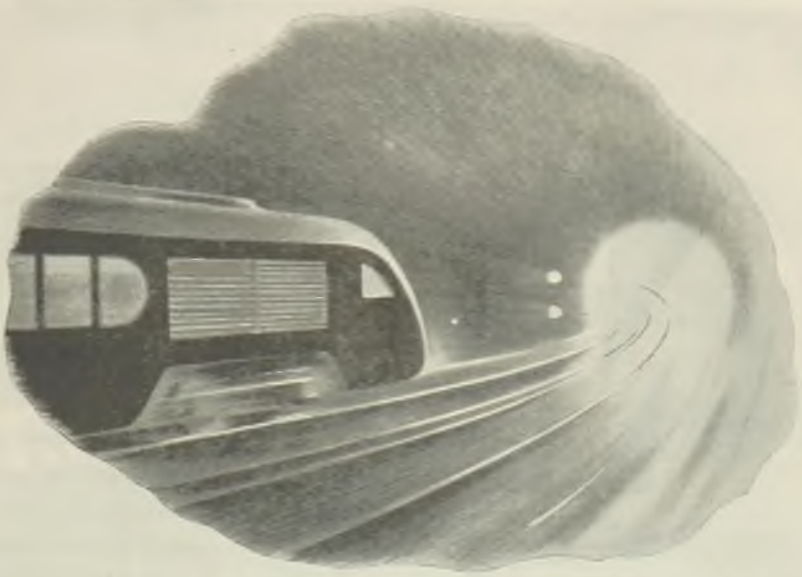

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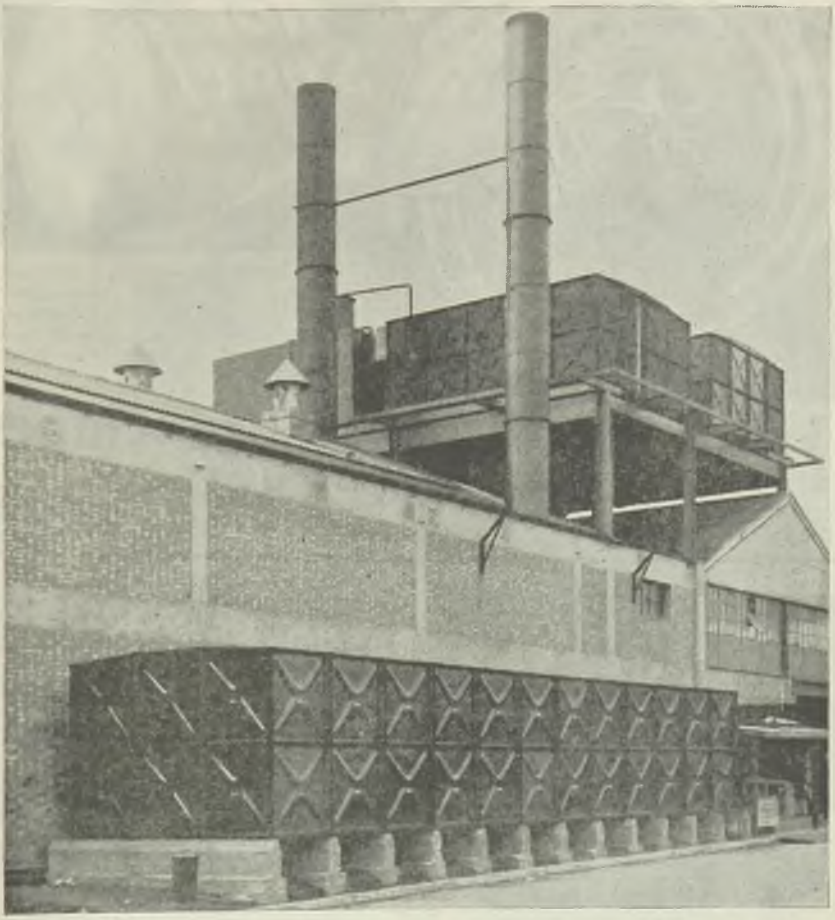

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