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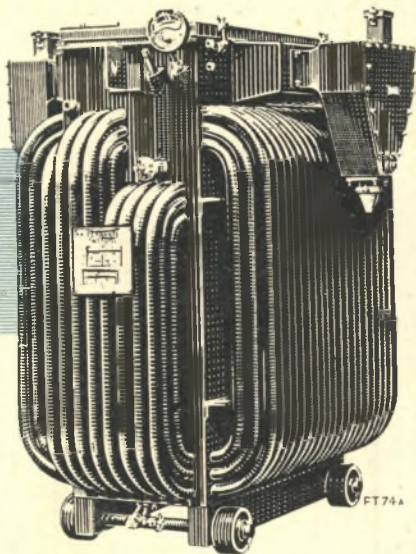
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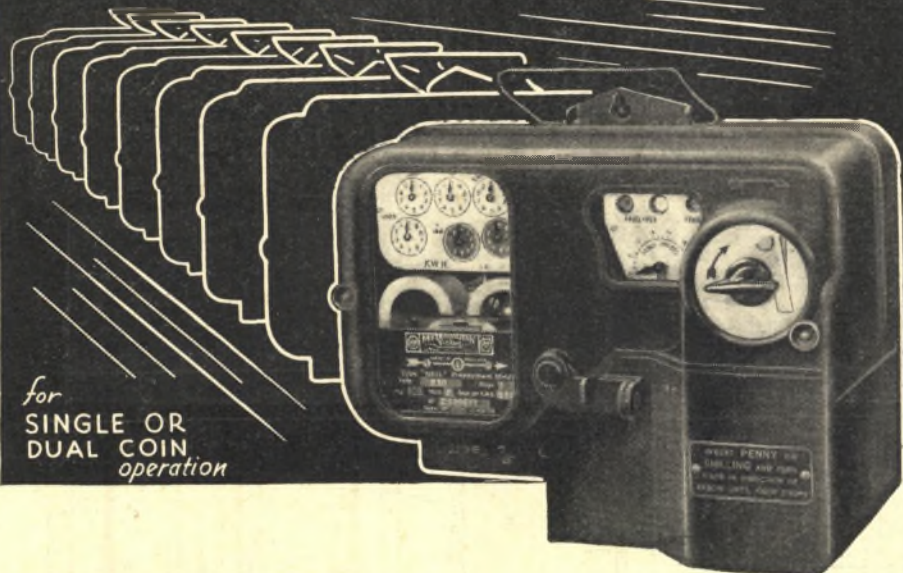


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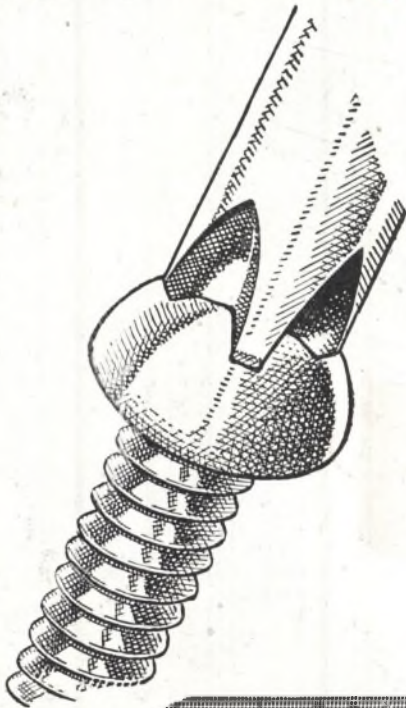


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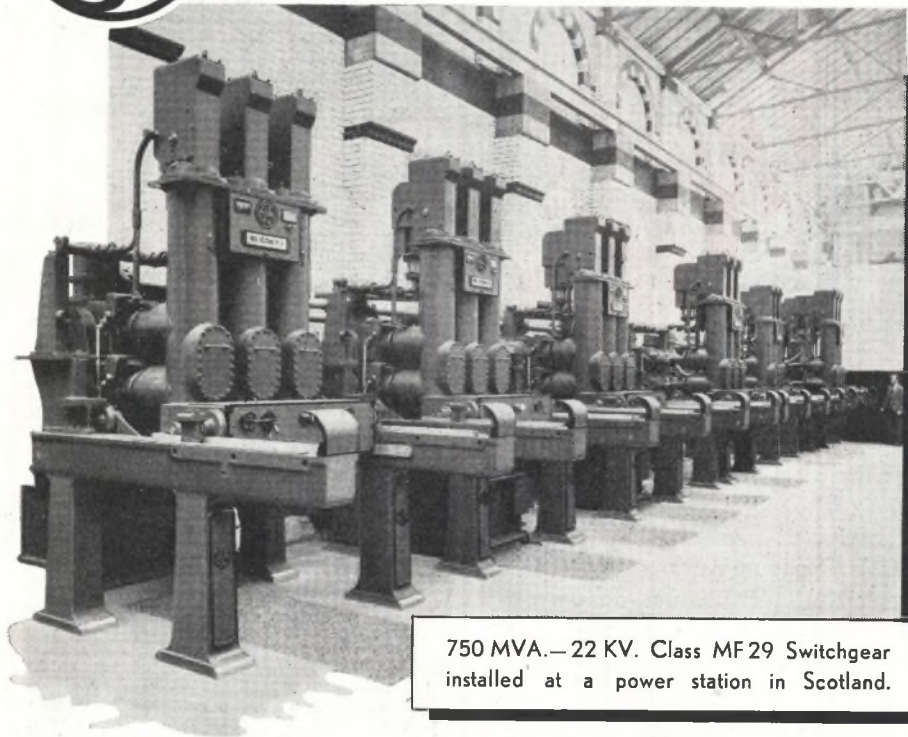
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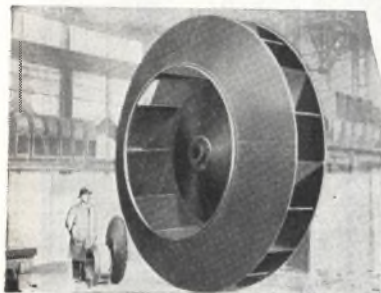
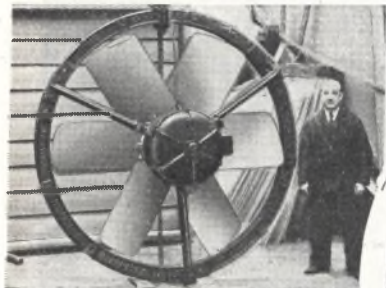
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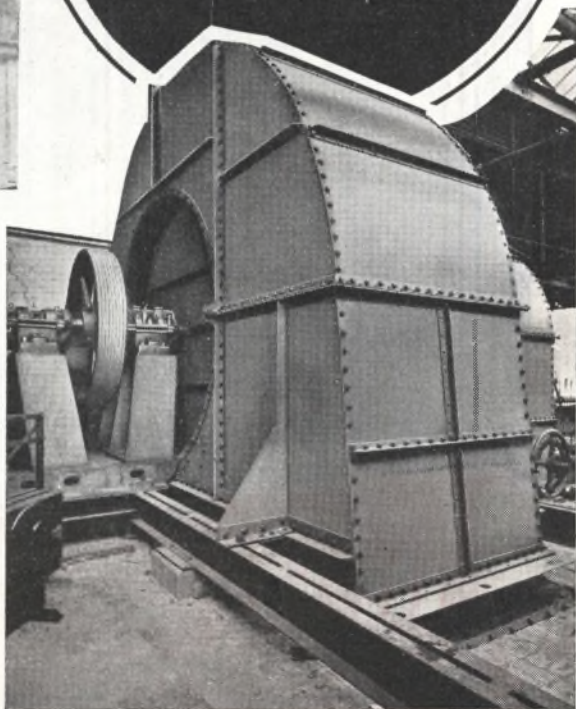


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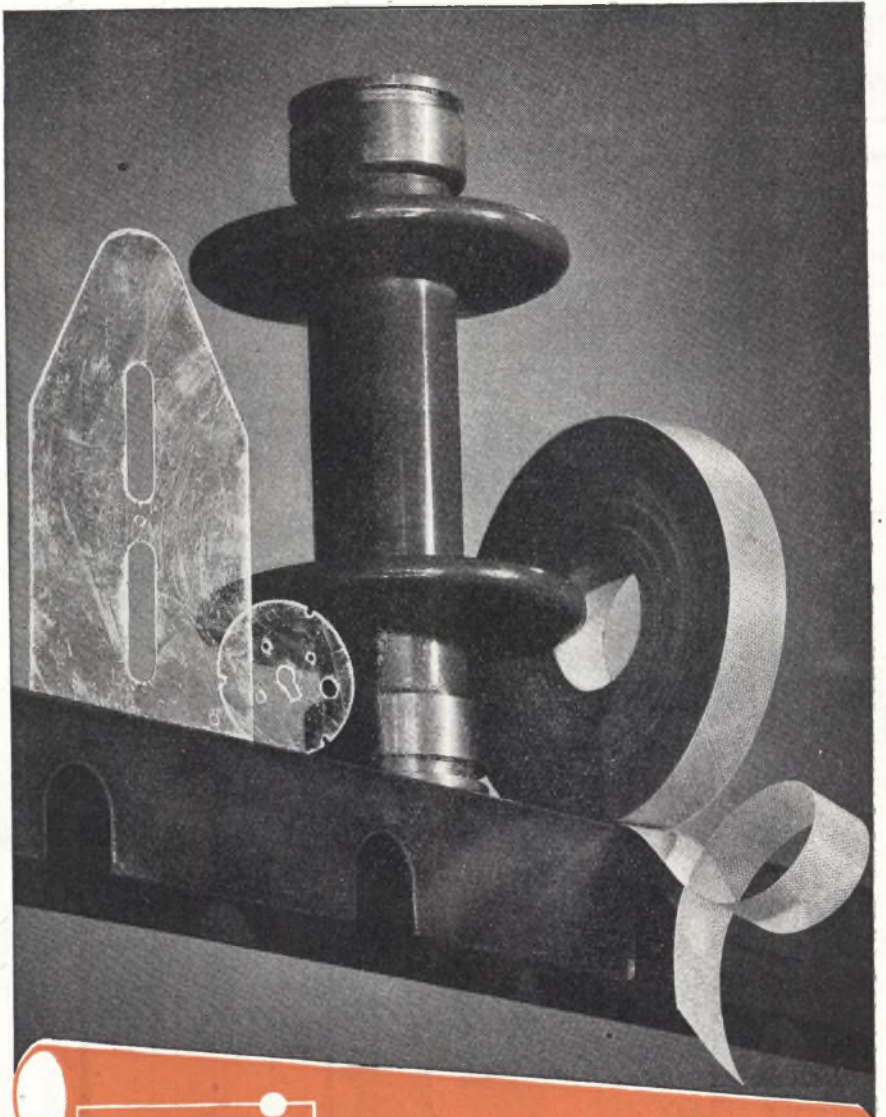


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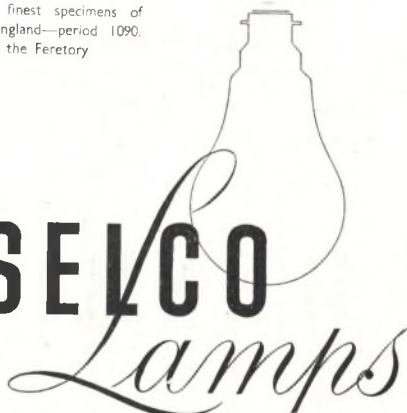


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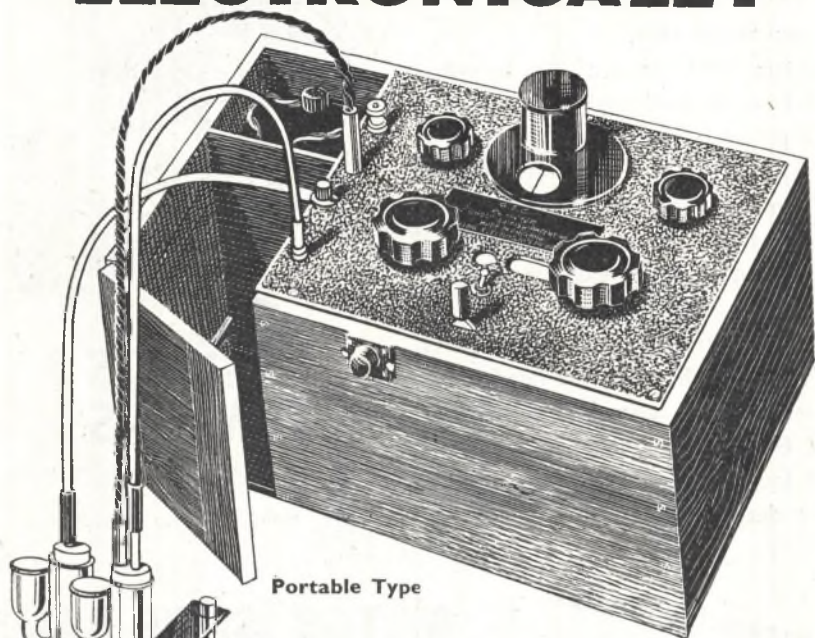
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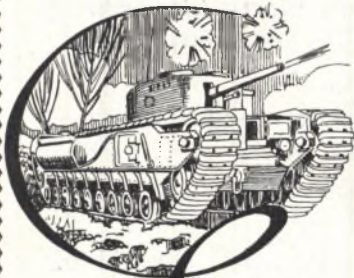
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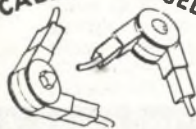
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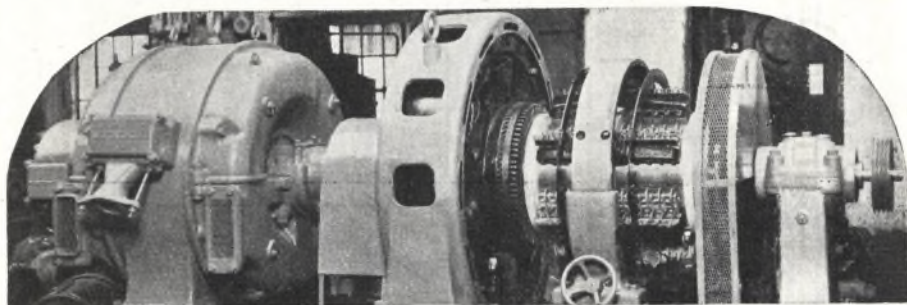
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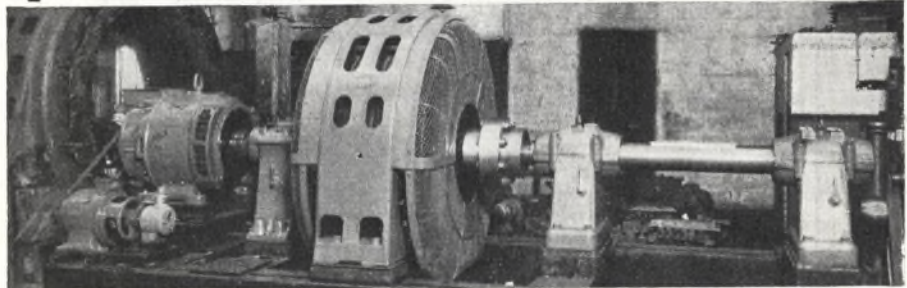


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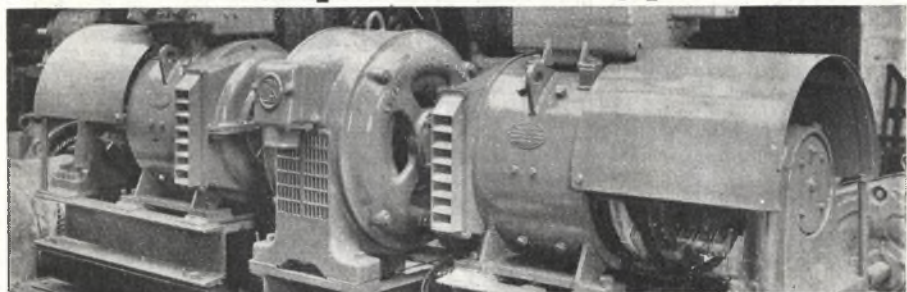




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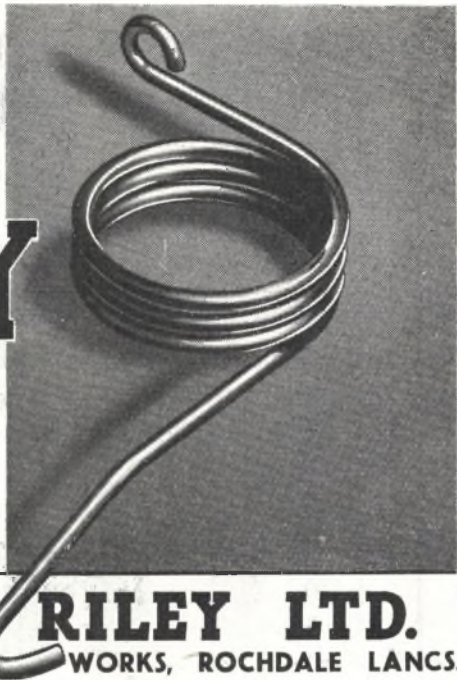
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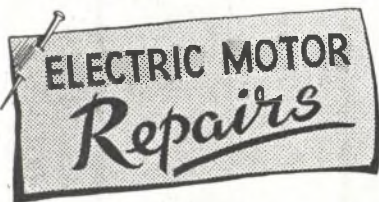
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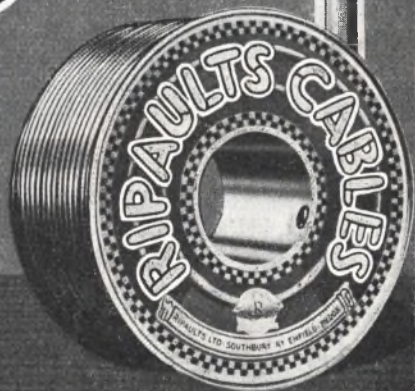
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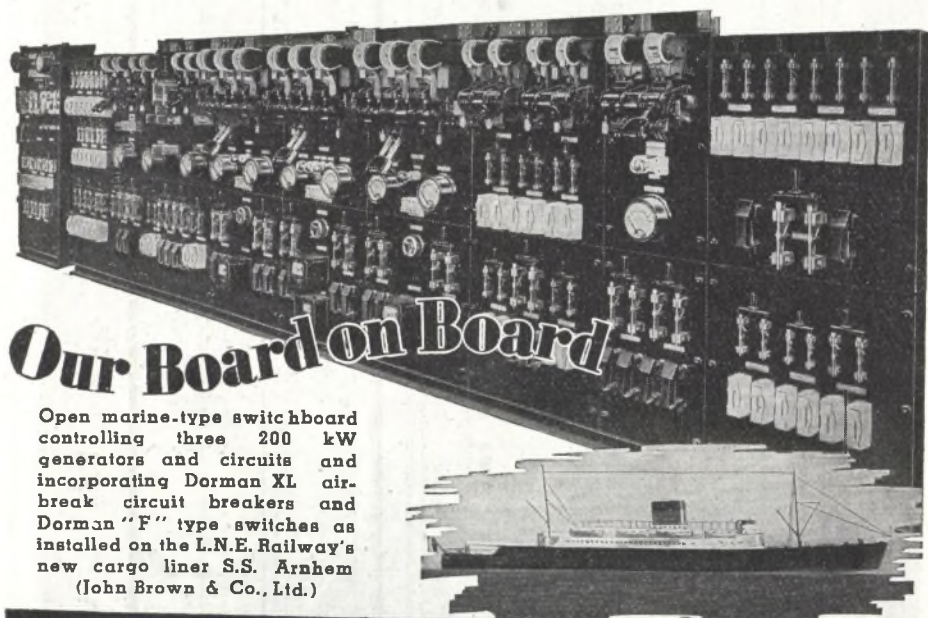
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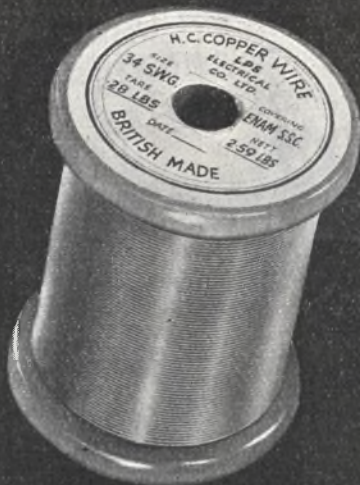
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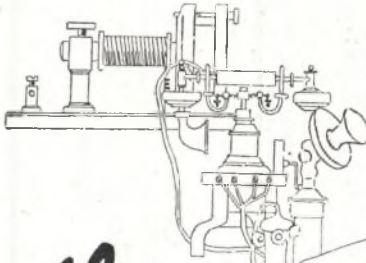


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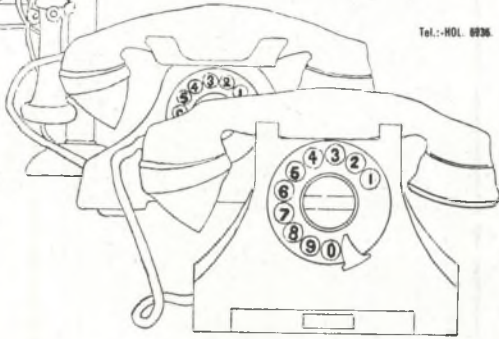


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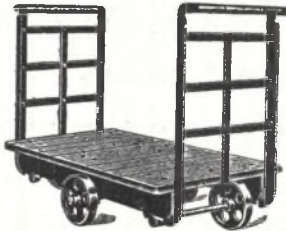
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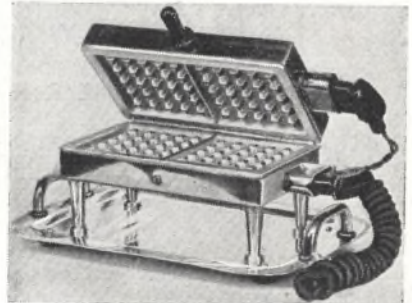
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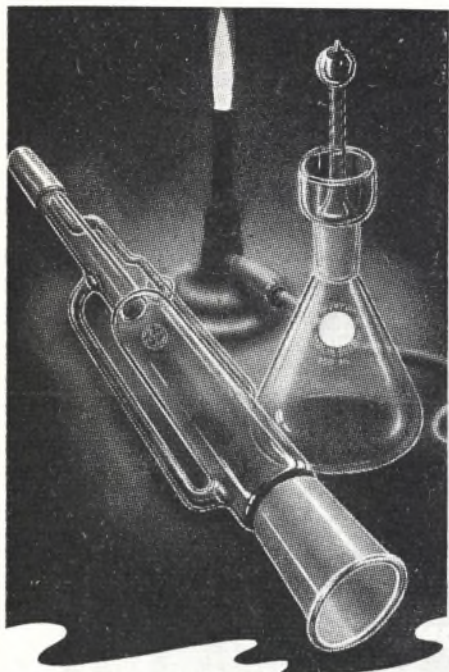
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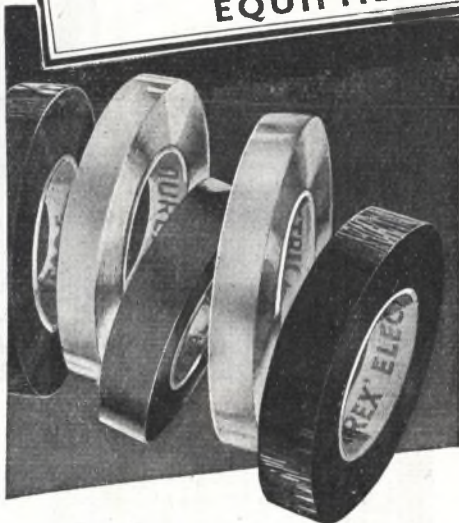
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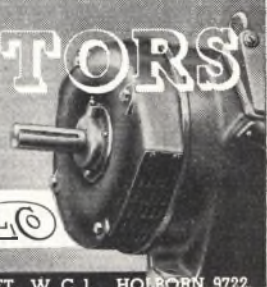


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ESTABLISHED 1861

*Bouverie House - 154 Fleet Street - London EC 4*

*Telegrams: "BENBROTIC FLEET LONDON" Telephone: CENTRAL 3212 (16 lines)*

*Editor: STANLEY G. RATTEE, A.M.I.E.E.*

*Publisher and Manager: JOHN VESTEY*

Number 3624

28 NOVEMBER 1947

Vol. CXXXIX No. 22

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## Railway Equipment

REFERENCE to the possibility of a wagon shortage this winter has been made in these columns on several occasions, the latest as recently as last week. So seriously do the railways regard the danger and so grave may its effects be upon the supply industry with respect to coal deliveries, that we draw attention to the position once more.

The shortage is a result of the inability of the railways during the war years to keep their stock in good repair while still meeting the transport demands of war impedimenta, coupled with the fact that a number of railway workshops normally engaged in maintenance and replacement were used for manufacturing war machinery. To overcome the shortage the railways are accelerating repairs and building, but the circumstances are aggravated at this time of the year by the increased coal, steel and other materials output for which railway transport is essential.

The problem is not easy of solution, neither is it the business of the railways alone to solve it. The electrical manufacturing industry, as much as any other, uses railway transport for the acceptance of raw materials and for the delivery of its products, and coupled with demands made by electricity supply for coal deliveries, the task which the industry sets the railways is formidable.

If raw materials, including coal, are to reach the industry in reasonable time, and if the delivery of heavy and other plant is to be made without undue delay, immobilisation of wagons by detention at stations and works pending discharge

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or loading of their contents must be reduced to a minimum. The standing time of wagons at both loading and delivery points is one which the industry can largely determine on its own account, and in its own interest should be of the smallest possible duration, so that rolling stock can be returned to duty with a minimum possible delay. The railways themselves are taking special practical measures to overcome the difficulties of the situation, about which industry is being informed through its associations and organisations. The railways cannot by themselves, however, eliminate the dangers attaching to the possibility of a wagon shortage this winter. They need the help of the industry to keep their limited stock moving; to see that the "turnabout" of the wagons is quicker than it has ever been before. Withholding that help may precipitate a crisis.

### Steel Priority

EARLY this year a selective priority scheme was applied to the steel requirements of the heavy plant extension programmes and the export drive, which, as recorded in *THE ELECTRICIAN* of October 17, resulted in the number of authorisations exceeding allocations. This clogged the distributive system of the steel industry and, according to a Government Committee appointed to unravel the muddle, the unfulfilled orders amounted at that date to two million tons of steel, or nearly one quarter's production. Last week, the details of a new scheme were made known in the House, but so far as can be seen there has been no review of the allocation machinery of a type which will make impossible a repetition of the blunder of authorising more steel than is available. Many claims to steel already authorised will, under the new scheme, have to be either cancelled or postponed, for though the House was informed that a reduction of steel deliveries to the power industry need not cause detriment to the extension programmes, it was at the same time advised that some production must be held up. This is made clear from the official explanation that one of the principles of the scheme is a gradual paring down of the quantities of priority allowed to the power station programmes, presumably to figures which will be in agreement with the

capital equipment cuts to be announced in the White Paper referred to in *THE ELECTRICIAN* of October 31. The need for an effective method of distributing steel is recognised, but while information on the subject of allocations and authorisations is so vague, it is impossible for any constructive criticism to be made. Even details of the tonnage of iron and steel now being used for different purposes would serve as a useful starting point, for with knowledge of this sort the power and other industries would be able to divorce from the general steel consumption figures their own particular responsibility in the matter.

### Practical Training of Engineers

AT the Institution of Electrical Engineers last week was opened a discussion on the report on the Practical Training of Professional Engineers, an abstract of which was given in *THE ELECTRICIAN* of July 18. The length of the discussion and the standing of those who took part show that the industry regards the report as a valuable contribution to the solution of the future man-power problem, and more, no doubt, will be heard of it. The Chairman of the Committee which drew up the report has more experience of technical training than most and, as a thought upon which the industry might ponder, quoted "if you plan for a year, grow corn; if you plan for ten years, grow trees; if you plan for a hundred years, grow men." The contribution to the discussion from Birmingham expressed a point of view which is not, perhaps, generally appreciated, despite its importance, and about which there will possibly be more ventilation of opinion in the next few months. The report and the discussion are of special importance to the industry at this time, for with the disturbance created by the war years, the demand for the professional engineer with suitable practical training is, unless care is taken, likely to become acute.

### Overseas Trade

THE October trade returns show that so far as figures go, the general import and export position was such that the adverse balance was reduced from £58.3 millions in September to £49.2 millions last month, the lowest since March. From the beginning of the year imports



have amounted to £1495 million and total exports £977 million, making the gap up to the end of October £518 million. When reviewing these figures it must be remembered that the adverse trade balance is, however, not the only problem; there is also the matter of dollars. In this respect the October issue of official figures, though showing some improvement, is not as good as many had hoped. The statistics covering trade with individual countries in the third quarter of the year record, once again, the failure of exports to the North American Continent to increase to anything like the same extent as shipments to other parts of the world. A satisfactory feature of the third quarter's figures, however, is the steady return of trade between this country and the European Continent.

### Electrical Exports

THE value of electrical exports shipped during October amounted to £6 982 095, compared with £5 772 000 for the corresponding month of 1946. So far as electrical goods and apparatus were concerned, the figure was £4 689 117, which was above the official export target. Compared with September shipments dropped by £496 703, due to a falling away in generators, telecommunication and radio equipment, vacuum cleaners, and accumulators, but for the ten months of the year, January to October, there was an improvement of over £19 000 000 in the value of electrical shipments, compared with the same period of 1946. The aggregate for October and for the ten months of the year, respectively, exceeded the 1938 figures by more than three times, indicating thereby that, despite its heavy plant commitments at home, the electrical industry is more than holding its own in the export field. For the ten months, electrical exports were valued at £61 506 128, compared with £42 397 658 in 1946 and £18 292 001 in 1938. An achievement of which the industry may well be proud and an example which other industries might follow.

### New Submarine Cable

THE cable ship "Monarch" is this week due to commence laying for commercial use between Aldeburgh, Suffolk, and Domburg on the Island of Walcheren, Holland, a new type of coaxial cable

which, it is claimed, embodies features not incorporated in any other submarine cable. The new cable will carry eighty-four simultaneous telephone conversations without the use of submerged repeaters; it has, we are informed, a much lower attenuation characteristic than any other submarine cable; and it contains a central conductor which is "not used for transmission purposes." The h.f. speech conducting waves travel on the outside of an inner copper tube and on the inside of an outer copper tube, the central conductor and the copper tubes being insulated from each other by polythene. The cable, which has been manufactured by Submarine Cables, Ltd., to the specification of the Post Office, weighs 19 tons to the nautical mile, and on her first trip the "Monarch" will carry 1 400 tons of it. The total length will be 82 nautical miles, and the shore ends have already been laid. Special roller bow gear for paying out the cable, so that it will not be subjected to bends less than six feet, has been installed in the "Monarch," and it is hoped to complete the operation in a week.

### Future of the E.D.A.

THE future of the E.D.A. has been a matter of interest for some time, and the suggestion by Lord CITRINE, as chairman of the B.E.A., that the association carry on until the end of 1948 has increased the topicality of the subject. According to the general manager, Mr. V. W. DALE, the North of Scotland Hydro-Electric Board has been recommended by its vice-chairman, Mr. A. E. MACCOLL, to accept responsibility for subscriptions to the association, as and when the Board takes over, and we gather that the B.E.A. is taking action which will be effective until 1948 at least; after that date the matter will be subject to review in the light of experience. The altered conditions will, of course, need some modification in the Council membership, and Mr. J. ECCLES has said on this point that such membership would be limited to representatives of the Area Boards and of the Authority, with, in all probability, Board representation in the majority. In the circumstances, the present Council have decided that estimates of expenditure for the next financial year be prepared.

# Portrait—Prof. E. W. Marchant

**E**MERITUS Professor of Electrical Engineering in the University of Liverpool, Edgar Walford Marchant was born in 1876. He was educated at University School and at the Central Technical College, and includes among his academic awards a Siemens Medal, B.Sc., London University, with Honours in Physics and Mathematics, D.Sc. Granville Scholar.

He received his works training with A. Hilger and Co., and was superintendent of the Blythswood laboratory and workshop. He worked with W. Duddell on the development of the bifilar oscillograph and with Lord Blythswood on the absorption of X-rays by aqueous solutions of metallic salts, showing that it depended on the atomic content.

In 1900 he made experimental tests on the oscillatory discharge of condensers through coils with iron cores showing non-isochronous discharge and rapid damping, from which the ohmic resistance of spark discharges carrying currents up to 2 000 A were estimated. He was appointed senior lecturer under Silvanus Thompson at Finsbury Technical College, and in 1901 became lecturer in electrotechnics at University College, Liverpool.

When Liverpool University was founded he was appointed the first David Jardine Professor of Electrical Engineering. He designed equipment for the accurate measurement of the strength of radio signals and read in 1914 before the I.E.E., a paper on the conditions affecting the variations in signal strength from the Eiffel Tower and from a high power radio station erected in Brussels.

Prof. Marchant was appointed chairman of the Manchester Section (now the N.W. Centre) of the I.E.E. in 1914, and was President of the Liverpool Engineering Society in 1915. In 1918 he read a paper before the I.E.E. on Transient Currents in Electrical Supply Systems and on the Transmission of Electric Power at High Voltages. Other papers at this period dealt with the operation of fuses and circuit breakers, which led to the adoption of copper fuses for house services in Liverpool, on methods of eliminating the current and voltage ripples due to mercury arc rectifiers, and on the resistance of earthing plates. Tests were made on the heating of buried cables used in Liverpool electricity supply area, which were published as part of the report on the subject read before the I.E.E. He was the first Chairman of the Liverpool Sub-Centre and in 1929 was Chairman of the Mersey and N. Wales Centre.

In 1933 E. W. Marchant was appointed president of the I.E.E.; in 1927 he



delivered the Kelvin Lecture; and in 1935 the Faraday Lecture.

He designed a new high voltage laboratory for the impulse testing of high voltage cables which was opened in 1940. He retired from the David Jardine Chair in 1941 and spent the next four years in developing a laboratory for the testing of small servo mechanisms and data transmission equipment for the Ministry of Supply. He has been Governor of Liverpool College for over 20 years, a member of the Royal Liverpool Golf Club and of the University Club for over 40 years, and was President of the latter in 1929-30. He is now Chairman of the Liverpool School for the Deaf in connection with which a new residential school for partially deaf children, fully equipped with hearing aids, is to be opened next year in Birkdale.

He married in 1902 Mary Ethel Brooker and has had four sons. The eldest is a member of the I.E.E. and, during the war, as Commander R.N.V.R. was responsible for the degaussing of all ships entering the port of Liverpool. The second was an Education Officer in Nigeria and died in Lagos in 1933, the third is farming and the youngest is a doctor, who served with the R.A.F. in North Africa and Italy during the war.



# The Circle Diagram

## Its Relation to Three-Phase Star Connected Loads

By G. W. STUBBINGS, B.Sc., A.M.I.E.E

THE circle diagram for a single-phase circuit comprising constant reactance and variable resistance is described in all the elementary text books. The corresponding diagram for a star connected three-phase circuit with two resistances and variable reactance is rarely described and is comparatively unfamiliar to students. As circuits of this kind are used in phase sequence tests, a short explanation of the three-phase circle diagram may be of interest.

The star-connected circuit is shown diagrammatically in Fig. 1 (a), and Fig. 1 (b) is the geometrical construction for obtaining the vectors of star voltages given the triangle of line voltage vectors  $ABC$  and the ohmic values of the components of the star circuit.  $AC$ , the vector of the line voltage applied to  $R_1$  and  $R_2$ , is divided

at  $D$  so that  $\frac{DC}{DA} = \frac{R_2}{R_1} = a$ .  $P$  divides  $BD$

so that  $\frac{DP}{PB} = \frac{aR_1}{(a+1)X}$ . A circle is described on  $BD$  as diameter and  $QR$  is the radius perpendicular to  $BD$ .  $RP$  is produced to meet the circle at  $O$ . Then  $OA$ ,  $OB$  and  $OC$  are the voltages on  $R_1$ ,  $X$  and  $R_2$  respectively.

We note that as the angles  $BOR$  and  $DOR$  stand on equal arcs,  $OR$  bisects the angle  $BOD$ , so that  $\frac{OD}{OB} = \frac{aR_1}{(a+1)X}$ .  $OB$  is therefore the vector of the voltage on  $X$  when it is connected to a single-phase source, the c.m.f. of which is represented by the vector  $DB$ , in series with a resistance having the value  $\frac{aR_1}{(a+1)}$ , equivalent to the parallel combination of  $R_1$  and  $R_2$ . As  $DB$  is the vector of the voltage between the common

removed, the construction is justified by Thevenin's theorem.

The construction can also be verified directly by geometry. If  $DE = DA$ , and

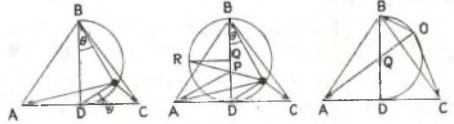


Fig. 2

$EC_1$  is drawn parallel to  $DO$ , then  $\frac{OC_1}{OC} = \frac{R_1}{R_2}$  and  $OC_1 = \frac{OC}{a}$ . If we assume

for the sake of simplicity that  $R_1$  is 1 ohm, then, if  $OA$  is the vector of the voltage on  $R_1$  it is also the vector of the current  $I_A$ , so that  $OC_1$  is the vector of  $I_C$ . Complete the parallelogram  $AOC_1F$ , and join  $DF$ . Then, as in the triangles  $DAF$  and  $DOC$

we have  $\frac{AD}{AF} = \frac{DC}{OC}$ , and  $DAF = DCO$ , these

triangles are similar,  $ADF = CDO$ , and  $FDO$  is a straight line, the diagonal of the parallelogram  $AOC_1F$ , so that  $\frac{OD}{OF} =$

$\frac{a}{1+a}$ . As  $OF$  is the resultant of the currents  $I_A$  and  $I_C$ , its reversal  $FO$  is the vector of the reactance current  $I_B$  so that  $DO =$

$I_B \times \frac{a}{1+a}$ . As by construction  $OB =$

$OD \times \frac{(a+1)X}{a}$ ,  $OB = I_B X$  and, moreover,

as  $OB$  is leading 90 degrees in phase on the  $I_B$  current vector  $FO$ ,  $OB$  must correctly represent the vector of the voltage on the reactance  $X$ .

A particular case of the star-connected circuit of Fig. 1 is that in which  $R_1 = R_2$ , and the triangle of line voltage vectors is isosceles. Circuits of this kind are used for phase sequence testing. The circle diagram for this condition is shown in Fig. 2. Here  $BD$  is the median of the triangle and is perpendicular to  $AC$ .  $DO$  is  $\frac{1}{2}I_B$  so that, if  $X = nR \tan \theta = \tan OBD =$

$\tan ODC = \frac{1}{2n}$  also  $OD = BD \sin \theta$ , then

connection of the resistances and the  $B$  terminal of the three-phase supply with  $X$

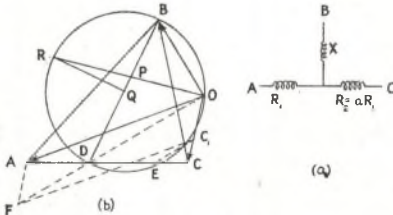


Fig. 1

connection of the resistances and the  $B$  terminal of the three-phase supply with  $X$

$$\begin{aligned}
 V_1^2 &= OA^2 = AD^2 + OD^2 + 2 AD \cdot OD \\
 &= AD^2 \sin^2 \theta + AD^2 \cos^2 \theta + \\
 &\quad BD^2 \sin^2 \theta + 2 AD \cdot BD \\
 &\quad \sin \theta \cos \theta \\
 &= AB^2 \sin^2 \theta + AD^2 \cos^2 \theta + \\
 &\quad 2 AD \cdot BD \sin \theta \cos \theta \dots (1)
 \end{aligned}$$

Similarly

$$V_2^2 = OC^2 = AB^2 \sin^2 \theta + AD^2 \cos^2 \theta - 2 AD \cdot BD \sin \theta \cos \theta$$

And  $K$  the ratio  $\frac{V_1}{V_2}$  is given by the expression  $K^2 = 1 +$

$$\frac{4 AD \cdot BD \sin \theta \cos \theta}{AB^2 \sin^2 \theta + AD^2 \cos^2 \theta + 2 AD \cdot BD \sin \theta \cos \theta}$$

The reciprocal of the variable part of  $K^2$ , depending on  $n$  and  $\theta$ , is

$$\frac{1}{4 AD \cdot BD} \left[ AB^2 \tan \theta + \frac{AD^2}{\tan \theta} \right] - \frac{1}{2}$$

Here the product of the two variable terms in the brackets is constant, so that the sum of these terms has its minimum value

when they are equal and  $\tan \theta = \frac{AD}{AB} = \cos A = \frac{1}{2n}$ , where  $A$  is the angle  $BAC$

of the line voltage vector triangle. The actual minimum value of the last expression

obtained by substituting  $\tan \theta = \frac{AO}{AD}$  is

$$\begin{aligned}
 \frac{1}{2} &= \frac{AB \cdot AD}{AD \cdot BD} - \frac{1}{2} \\
 &= \frac{1}{2} \left( \frac{1}{\sin A} - 1 \right) = \frac{1 - \sin A}{2 \sin A}
 \end{aligned}$$

And the maximum value of  $K^2$  is

$$1 + \frac{2 \sin A}{1 - \sin A} = \frac{1 + \sin A}{1 - \sin A}$$

when  $n = \frac{1}{2 \cos A}$

Substituting  $\tan \theta = \cos A$  in (1) we find that the value of  $V_1$  for maximum  $K$  is given by

$$V_1^2 = \cos^2 \theta (AB^2 \tan^2 \theta + AD^2 + 2 AD \cdot BD \tan \theta)$$

$$\begin{aligned}
 &= \cos^2 \theta \left( 2 AD^2 + 2 AD^2 \times \frac{BD}{AB} \right) \\
 &= 2 AB^2 \cos^2 A \cos^2 \theta (1 + \sin A)
 \end{aligned}$$

and as  $\tan^2 \theta = \cos^2 A$

$$V_1^2 = 2 AB^2 \times \frac{1 + \sin A}{1 + \sec^2 A}$$

and

$$V_2^2 = 2 AB^2 \times \frac{1 - \sin A}{1 + \sec^2 A}$$

in the condition when  $K$  has its maximum

value of  $\sqrt{\frac{1 + \sin A}{1 - \sin A}}$  and  $n = \frac{1}{2 \cos A}$ .

The foregoing results show how the vector diagram for the particular star-circuit can be drawn when  $K$  has its maximum value. The bisector  $AP$  of the angle  $A$  determines the point  $P$ , by which  $O$  is fixed. For

$$\cos A = \frac{AD}{AB} = \frac{DP}{PB} = \frac{DO}{OB} = \tan \theta, \text{ the condition required.}$$

In the Varley phase-sequence test  $R_1$  and  $R_2$  of Fig. 1 are two lamps of equal wattage. Ignoring variations of lamp resistance, the above results enable us to determine the conditions for maximum ratio of lamp voltages for various classes of supply.

With a three-phase 3-wire supply  $A = 60$  degrees,  $\cos A = \frac{1}{2}$ ,  $\sec A = 2$ , and

$\sin A = \sqrt{\frac{3}{2}}$ . The maximum value of  $K$

is  $\sqrt{\left(\frac{2 + \sqrt{3}}{2 - \sqrt{3}}\right)} = 2 + \sqrt{3} = 3.73$ , when  $n$

$= 1$  and the value of  $V_1$  in this condition is

$$\sqrt{\left(\frac{2 + \sqrt{3}}{5}\right)} \times V = 0.86V, \text{ where } V \text{ is the line voltage.}$$

If the circuit of Fig. 1 is connected to two line terminals and neutral of a three-phase

4-wire supply,  $A$  is  $30^\circ$ ,  $\cos A = \frac{\sqrt{3}}{2}$ ,

$\sec A = \frac{2}{\sqrt{3}}$  and  $\sin A = \frac{1}{2}$ . The maximum

value of  $K$  is  $\sqrt{3}$  when  $n = \frac{1}{\sqrt{3}}$  and

in this condition  $V_1 = 1.13V$ , where  $V$  is the star voltage.

If the reactor of Fig. 1 is connected to the neutral of a two-phase 3-wire supply,

then  $A = 45^\circ$ ,  $\cos A = \sin A = \frac{1}{\sqrt{2}}$  and

$\sec A = \sqrt{2}$ . The maximum value of  $K$

is  $\sqrt{\frac{\sqrt{2} + 1}{\sqrt{2} - 1}} = \sqrt{2} + 1 = 2.41$  when  $n = \frac{1}{\sqrt{2}}$

and the value of  $V_1$  in this condition is  $1.08V$ , where  $V$  is the line-to-neutral voltage.

The actual maximum value of the voltage  $V_1$  occurs when, as in Fig. 4,  $OC$  passes through the centre  $Q$  of the circle  $BOD$  for, in this condition, movement of the point  $O$  along the circle in either direction reduces the length of the  $OC$  vector. This maximum value of  $OC$  is equal to  $AQ + QO = AQ +$



$QB$ , so that it is always greater than the line voltage  $AB$ . As  $QB = \frac{1}{2} AB \sin A$ , and  $AD = AB \cos A$ , the maximum value of  $V_1^2$  is

$$AB \left[ \sqrt{\left( \cos^2 A + \frac{1}{4} \sin^2 A \right)} + \frac{1}{2} \sin A \right] \\ = \frac{V}{2} \left[ \sqrt{\left( 4 + 3 \sin^2 A \right)} + \sin A \right]$$

where  $V$  is the  $AB$  line voltage.

From this formula we easily find that the maximum values of  $V_1$  are  $1.09V$  for a three-phase 3-wire supply,  $1.15V$  for a three-

phase 4-wire supply with connection of the reactor to the neutral, and  $1.14V$  for a two-phase 3-wire supply.

It will be seen from Fig. 2 that if the point  $O$  which determines the voltage vectors on the components of the star circuit is the intersection of the circle  $BOD$  with the vector  $BC$  of a line voltage then, if the line voltage vector triangle is isosceles,  $\tan \theta =$

$\cot A$  and  $n = \frac{1}{2} \tan A$ . Thus, for all values

of  $n$  greater than zero and less than  $\frac{1}{2} \tan A$ ,

the point  $O$  lies outside the vector triangle  $ABC$  of line voltages.

## A "Blitz" Anniversary

New Office Block Opened at J. H. Tucker's Tyseley Works

ON Saturday, November 22, the seventh anniversary of the destruction by enemy action of the main premises of the company, the opening of the new office block of J. H. Tucker and Co., Ltd., at King's Road, Tyseley, Birmingham, was celebrated by the unveiling by the Lord Mayor of Birmingham of a commemorative plaque.

The ceremony took place in the drawing office and technical department, and the guests, numbering about 500, included Mr. Percy Good, president of the I.E.E., representatives of various Government departments and of electrical firms. Among those presented to the Lord and Lady Mayoress (Counc. and Mrs. J. C. Burman)—who were received by Mr. J. B. Tucker, chairman and managing director of the company, and Mrs. Tucker, the latter handing a bouquet to the Lady Mayoress—were Mr. W. L. Burrows (a director), Mr. S. A. Millington (general manager), Mrs. Cheovie (widow of the founder of the company), Mr. Arthur Bisby, who has been with the firm since its foundation by the late Mr. J. H. Tucker in 1892 until his recent retirement after 55 years' service; Mr. A. Rice, who retired this year after 45 years' service; and forty-four employees with service of 25 years and upwards, including Miss L. Jeffries (46 years) and Mr. O. Davis (42 years), head of the wood-working section.

The Chairman acknowledged the assistance received from friendly competitors when the premises were destroyed in November, 1940, and spoke of the difficulties under which the company had to operate with administration located in a few temporary huts and portions of the

plant housed in premises loaned or requisitioned as far apart as Aberystwyth and Bridgend as well as in local laundries, garages and stables. The first allocation of machine tools from the U.S.A. went to the bottom of the Atlantic, and a replacement consignment was bombed on the quayside at Liverpool. On the fall of France machine equipment intended for that country was diverted to Great Britain, and the company accepted with gratification an offer of some of those



The Lord Mayor of Birmingham unveiling the plaque, supported by the Lady Mayoress and MR. J. B. TUCKER, chairman and managing director of the company

machines, only to find that they were single-phase motored and unusable until converted. Eventually they got moving, and supplied nearly three million complete products to the Services before VJ-Day and an uncountable number of components to main contractors.

# Electrical Overseas Trade

## October Exports Well Above 1938 Average

ELECTRICAL exports fell in value from £7 478 798 in September to £6 982 095 in October, a decrease of £496 703. This was largely due to reduced shipments of generators, radio sets, telegraph and telephone equipment, wires and cables, batteries and accumulators. Last month's total was, however, considerably higher than that of October last year, which was £5 772 000. The monthly average for 1938 was £1 829 198. Imports increased in value from £326 514 in September to £343 305 in October, the value of the intake of motors having risen from £13 696 to £32 312. For the ten months ended October 31 exports reached £61 506 128 in value, compared with £42 397 658 for the corresponding period last year and £18 292 001 for five-sixths of 1938.

Last month the number of domestic radio sets sent overseas was 29 493, against

35 716 in September, 54 492 in October, 1946, and the monthly average of 7 053 in 1938; valves and cathode ray tubes, 427 661 in October, compared with 389 560 in September, 399 716 in October last year, and 183 826 in 1938; electric bulbs and discharge lamps, 2 330 946 in October, against 2 178 707 in September, 4 567 132 in October, 1946, and 1 638 099 in 1938; generators, 1 426 tons, contrasted with 2 364 tons in September, 1 629 tons in October, 1946, and 858 tons in 1938; motors, 1 415 tons, compared with 1 110 tons in September, 1 179 tons in October, 1946, and 927 tons in 1938; other electrical machinery, 3 107 tons, against 3 240 tons in September, 2 164 tons in October, 1946, and 1 935 tons in 1938; welded machinery and electrodes, 717 tons, compared with 583 tons in September, and 954 tons in October, 1946.

	IMPORTS			EXPORTS		
	Monthly average, 1938 £	Month ended October 31, 1946 £	1947 £	Monthly average, 1938 £	Month ended October 31, 1946 £	1947 £
Submarine cables ... ..	—	—	—	17 289	21 854	18 862
Other telegraph and telephone wires and cables ... ..	—	—	—	71 803	163 909	344 861
Electric cables, wires, etc.—						
Rubber insulated ... ..	31 246	3 113	8 486	117 533	307 655	564 359
With other insulation ... ..	10 148	8 234	593	153 256	401 412	578 590
Radio receiving sets ... ..	9 243	1 346	4 347	36 755	531 241	357 044
Radio long distance telegraph and telephone equipment ... ..	47 870	1 316 762	5 412	242 716	532 683	521 521
Radio and television transmitters, communication and navigational aid equipment ... ..	—	—	22 440	28 296	115 948	169 624
Other descriptions ... ..	—	—	5 412	57 848	133 437	213 683
Transmitting and industrial valves ... ..	10 893	15 563	44 133	41 272	23 156	27 900
Other electronic valves ... ..	—	—	—	—	98 265	114 739
Electric furnace carbons ... ..	4 054	—	41 881	—	—	—
Other electric carbons ... ..	2 301	5 517	3 837	—	—	—
Electric bulbs and discharge lamps ... ..	10 265	1 445	4 217	49 440	138 549	123 741
Other lamps, lighting appliances and fittings ... ..	38 662	2 444	5 308	48 565	250 593	331 137
Batteries and/or cells, primary ... ..	3 549	853	556	13 572	38 379	51 060
Accumulators ... ..	—	—	—	48 647	142 067	191 286
Parts and accessories ... ..	—	—	—	—	55 197	42 766
Heating apparatus and elements	—	—	—	14 064	86 946	115 236
Other heating equipment ... ..	—	—	—	16 600	64 743	117 789
Commercial electrical instruments and parts ... ..	32 057	2 782	26 418	15 878	78 341	94 963
House service meters ... ..	—	—	—	15 791	66 360	136 070
Other descriptions of instruments	—	—	—	9 612	57 079	84 826
Electro-medical apparatus ... ..	—	—	—	3 038	22 445	14 386
X-ray apparatus, vacuum tubes and parts ... ..	9 734	22 239	43 073	4 881	206 845	39 730
Insulating cloth and tapes ... ..	—	—	—	7 038	49 553	34 517
Other insulating materials ... ..	—	—	—	12 305	87 189	76 027
Other articles ... ..	52 980	13 984	27 025	108 083	394 567	324 400
Generators and parts ... ..	—	—	—	157 150	384 873	464 772
Motors and parts ... ..	26 033	1 399	32 312	145 045	310 899	472 167
Other electrical machinery ... ..	14 455	4 576	62 732	355 663	700 794	947 721
Vacuum cleaners and parts ... ..	—	—	—	26 662	101 352	177 338
Other portable appliances ... ..	24 627	2 611	3 032	10 394	56 029	26 134
Welding machinery (including electrodes) other than tube making ... ..	—	27 193	7 503	—	148 720	204 846
Total ... ..	328 117	1 430 061	343 305	1 829 198	5 772 000	6 982 095



# THE PROFESSIONAL ENGINEER

## I.E.E. DISCUSSION ON PRACTICAL TRAINING

**A**T a meeting of the I.E.E., on November 20, a discussion was opened on the report on "The Practical Training of Professional Electrical Engineers," prepared by a Committee appointed by the institution jointly with B.E.A.M.A. and the Radio Industry Council, and of which an abstract was given in *THE ELECTRICIAN* of July 18.

SIR ARTHUR FLEMING, chairman of the Committee, said that at the beginning of the century the so-called practical engineer was in the ascendant, and the usual way for the engineer to enter industry was to leave school fairly early, go into a works, and attend "night school." During the first decade of the century, however, a few firms began to realise the importance of the technically-trained man and to provide courses of training which would give him a background of general experience; in that way a number of different courses grew up, but there was no attempt at co-ordination.

The report under discussion recommended that apprenticeship should be available for two broad types, the graduate apprentice and the student apprentice. For the former the training in the works should be for two years, which need not be continuous; the student proceeding to a university might well undertake a year's pre-training beforehand. The latter, entering industry with the background of a good secondary school education, should spend four years in practical training. The object was not to make the engineer an artisan, but to give him broad experience. A considerable part of the training should be devoted to basic mechanical engineering, and an almost equal amount to basic electrical engineering. There should be no specialisation during the period of practical training.

The undergraduate should use the long vacations to gain experience either with a variety of firms, or in a power station, or as a supernumerary engineer on board ship or in foreign travel. For those obtaining their technical knowledge by part-time study the Committee recommended day release. The report also recommended the formation of apprentice associations, run by the apprentices themselves, to provide for lectures, sport and other activities which would bring men together. A large works, with men from all over the world, provided all the essentials of a great university. Incidentally, the officers of such an association could be very valuable in selecting new candidates. Overseas

students should be given the best training possible, because they would go home as missionaries.

MR. J. A. SUMNER (Norwich) said that it was a blot on the electricity supply industry that during the last 50 years only one or two undertakings had formulated a proper scheme of training. The Yorkshire Electric Power Company had had a very good scheme, and it was significant that in the years between the wars, men from that company were given some of the best jobs in the country. The report under discussion had been issued at the time of the inception of the B.E.A. It was to be hoped that that authority would adopt, for the first time, a national scheme of training for electricity supply.

A distinguished member of the institution had expressed the opinion that the world supremacy which this country held in electricity and electrical manufacturing between the wars was due to the training schemes formulated 20 or more years before by the two major electrical manufacturing concerns. If we were not prepared to train people properly we could not hope to forge ahead in competition with those countries which were putting academic and practical training in the forefront.

The report suggested that student apprentices who took part-time technical courses should take the Higher National Certificate rather than a degree. Personally, he thought that the man who took an engineering degree while doing his part-time training was better equipped than one who did four years at a university. His own undertaking reckoned to turn out one degree man a year.

MR. F. BRAY (Ministry of Education) said that the Ministry felt that the report showed a slight tendency to look through the eyes of the large firm. It spoke of the wider experience necessary for the apprentice with a small firm, but how was that to be obtained? Many students at technical colleges had no objective beyond getting the National Certificate, and were content to leave their practical training to their firm. Possibly the Regional Councils set up by the Ministry could interest themselves in the matter, or the local professional branches might be able to take steps with the firms concerned and make the necessary arrangements for the wider training of the brighter youngsters. The Ministry were opposed to compulsory evening education as a long-term policy. It might be necessary at the moment, but he hoped that an effort would be made all

over the country to get two days release a week if necessary.

MR. L. E. BALL (University of London Appointments Board) described the report as invaluable. At present there was a strong tendency for the university-trained engineer to bypass the normal works training and go straight into a specialist appointment, since the demand exceeded the supply. Most professors of engineering did their best to counteract that, and the support given to them by the report would be very helpful.

MR. D. P. SAYERS (Birmingham), dealing with the training of engineers for the supply industry from the standpoint of a large municipal undertaking, said he found great difficulty in applying the definitions of "professional engineer" and "technician" given in the report to this side of the industry. In his undertaking the total engineer staff numbered about 300, of whom 27 per cent. were corporate members of one of the major institutions; only nine held university degrees, but 62 had the Higher National Certificate. According to the classification suggested in the report, fewer than 30 of the senior staff, including only two of those with degrees, were among the professional engineers. Taken literally, the definitions given would mean that a shift engineer in direct operational charge of a modern power station would be only a technician, while a young university graduate employed on design work might claim to be a professional engineer. In the supply industry as a whole, the total number of staff engineers employed was about 9 000, or one engineer per megawatt; and, if the figures relating to the one undertaking he had mentioned applied to the whole, it meant that the industry directly employed fewer than 1 000 professional engineers, the remaining 8 000 being technicians.

It was generally recognised that a supply undertaking was not a suitable organisation for the fundamental training of engineers. On the other hand, the supply industry had great difficulty in obtaining proper numbers of trained engineers, and unless some of the larger undertakings provided training facilities there was likely to be a serious shortage in future. Generation and distribution were becoming almost separate professions, and this distinction was likely to be accentuated under nationalisation.

MR. E. M. HICKIN (chairman, London Students' Section, I.E.E.) emphasised the importance of providing hostels for students. He supported the idea of apprentice associations, to provide experience in reading papers and to organise works visits. The Students' Sections of the institution might play a part along-

side the apprentice associations. Some management training would be of value.

MR. H. G. TRELOAR (B.I. Callender's Cables) endorsed the suggestion of transferring boys from trade to student apprenticeship in suitable cases, and the interchange of apprentices between one firm and another.

MR. R. W. L. HARRIS (Professional Engineers' Appointments Bureau) said that he was continually finding that employers turned down engineers with good practical training and academic qualifications because they lacked a design background. It was often said that a man who took a job in the drawing office was there for life, and that there was no future in it. Both statements were untrue, in that many engineers made successful careers on the design side only, and many firms regarded the drawing office as the best recruiting ground for other departments.

MR. D. I. LAWSON (Pye, Ltd.) said his firm were so impressed by the report that they had reorganised their own apprenticeship scheme to come into line with it.

MR. G. A. TAYLOR (Philips Electrical, Ltd.) deplored the tendency to reduce the period of apprenticeship; he favoured six years rather than four. He hoped that the Ministry of Education would consider the possibility of having some organised scheme between industry and the teaching profession, so that teachers during vacations could take courses of training in industry.

MR. V. B. TWISS (W. T. Henley's Tel. Works Co., Ltd.) said that the fundamental principles of the report were applicable to the specialised production type of industry with which he was concerned. He had some misgivings, however, as to the educational requirements stipulated for the student apprentice, which should not be interpreted so as to exclude boys from the junior technical schools, possibly after they had done a year or so in industry.

COMMDR. J. C. TURNBULL, R.N., emphasised the need for apprentices to get to know the workpeople really well and associate themselves with the activities of the department in which they worked.

MR. F. E. ROWLAND (G.E.C.) pointed out that the report made no reference to sales engineers who, through part-time study, had passed the Higher National or the institution examination. There might be, he suggested, greater recognition of the ordinary National Certificate examination and the associate grade in the institution, a combination of which should be acceptable in technical administrative posts for which the high technical standards of a professional engineer were not essential.



# • Electrical Personalities •

*We are always glad to receive from readers news of their social and business activities for publication in this page. Paragraphs should be as brief as possible.*

MR. EVELYN BOYS, secretary of the Northmet Power Co., is retiring at the end of this month. Apart from 1914-1918, Mr. Boys has been secretary to the company for over 41 years, and also of a number of distribution companies as well as the London and Suburban Traction Co. and its subsidiary tramway companies. Mr. Boys has been a member of the Council of the Chartered Institute of Secretaries since 1933. Mr. J. E. Blair has been



MR. EVELYN BOYS

appointed secretary and accountant to the Northmet Power Co. as from December 1.

MR. FREDK. W. PURSE, hon. director of the National Register of Electrical Installation Contractors, and former chief engineer of the London and Home Counties J.E.A., occupied the chair at the opening session of the fourth annual building congress held at Folkestone on November 18 and 19, under the auspices of the Building Industries' National Council, of which he is president.

MR. F. T. COTTON has been appointed head of the physical laboratory of Ekeo



MR. F. T. COTTON

W. F. Griffiths has been appointed manager of the company's illuminating engineering department in London.

SIR ALFRED WOOD has been appointed to the boards of Radio and Tele-

vision Trust and its subsidiary companies. Brig-Gen. R. F. Legge and Mr. J. V. Holtman have also been appointed to the board of Radio and Television Trust.

SIR CAMPBELL STUART has retired from the board of A. C. Cossor, Ltd.

Employees of W. T. Henley's Telegraph Works Co., Ltd., with their wives and relatives numbering about 400, visited the extensive cable and engineering factories of the company at Northfleet, on Saturday, November 15. It had been suggested that such a visit would be of general interest and would be a particular attraction to some of the younger generation who might be finding employment there.

MR. B. N. MacLARTY, of the B.B.C. engineering staff, whose portrait is reproduced on this page, has been appointed a deputy engineer-in-chief of Marconi's Wireless Telegraph Co., Ltd., concerned mainly with broadcasting transmitters, television and associated equipment. Brief biographical details were given in our last issue.



MR. B. N. MacLARTY

DR. E. MUNDEL has resigned the position of chief engineer to the Hopkinson Electric Co., Ltd., Cardiff, to take up an appointment at Leeds University; he is being retained in a consulting capacity. Mr. G. Redfern has been appointed chief engineer to the company with effect from December 1. Mr. Redfern was educated at Cambridge University, graduating with first-class honours in Mechanical Science Tripos. Since then he has been with the British Thomson-Houston Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., mainly engaged in induction motor design and development. Mr. E. Kenneth Day has become an advertising manager, and Mr. E. J. Maturin, assistant estimating engineer. Mr. Maturin, who relinquishes an appointment with the machine sales department of Crompton Parkinson, Ltd., served in the R.E.'s through the late war.

MR. F. W. BRECKNELL, who retired from the position of borough electrical

engineer at Birkenhead, was the recipient of a presentation at a complimentary luncheon given by the local branch of the Electrical Contractors' Association last week. Mr. Walter Trace presided.

MR. B. C. JOHNSON, of the Leeds office of the Metropolitan-Vickers Electrical Co., Ltd., who has retired after 42 years' service with the company, was the guest of honour at a dinner party at the Great Northern Hotel, Leeds, recently, attended by the male members of the Leeds office staff and guests from the Manchester office and Trafford Park, including Messrs. W. A. Coates (manager, home sales), J. B. Hartley (manager, Manchester office), F. Gurney (manager, plant sales), and F. C. Tyrrell (Manchester office lamp department superintendent). Mr. Johnson, who is an enthusiastic engineer in his spare time, received a Biro fountain pen and a case of drawing instruments from his friends and colleagues in Leeds and Manchester. Earlier he had been given a case of tools by the staff of the Huddersfield electricity department. The evening was concluded with the presentation by Mr. Johnson to Mr. R. P. Horlock (manager, Sheffield office) of a silver sweet dish from the Leeds office staff, to mark Mr. Horlock's promotion to the position of Sheffield office manager.



MR. B. C. JOHNSON

MR. J. BILLINGTON, purchasing agent of the Metropolitan-Vickers Electrical Co., Ltd., will retire on December 31, after 45 years' service. He will be succeeded by the present contracts manager, Mr. G. T. King, on January 1, and Mr. King's assistant, Mr. H. Lawson-Jones, will then become manager of the contracts department. Mr. Billington joined the British Westinghouse Co. in 1902. In 1926 he was appointed purchasing agent and storekeeper and was thus primarily responsible for the supply of material to the Trafford Park works for nearly 30 years. Since August, 1945, Mr. Billington has also been chairman of the



MR. J. BILLINGTON

A.E.I. Group Purchasing Committee. Mr. King joined the contracts department of Metropolitan-Vickers in 1928, and in September, 1936, was appointed manager. Mr. Lawson-Jones went to the company as a special trainee in 1924, following service in the Welch Regiment in the first world war. After experience in the mechanical sales and mechanical engineering departments, he was transferred early in 1939 to the M-V. aircraft factory where he acted as commercial manager until the return to peace-time conditions. He then became assistant manager of the contracts department.

DAME CAROLINE HASLETT, director of the E.A.W., attended the marriage of Princess Elizabeth to Prince Philip, the Duke of Edinburgh, at Westminster Abbey. Dame Caroline had been privileged previously to accompany the Princess and Queen Mary on a number of industrial visits.

MR. GEORGE CATON has been appointed managing director of the Yorkshire Switchgear and Engineering Co., Ltd., in succession to the late Mr. W. H. Turner. He is also a director of the associated company, Electro Mechanical Manufacturing Co., Ltd. Mr. Caton was formerly technical director of the company, which he joined in 1938. Prior to that he was chief engineer and manager of the switchgear department of the Brush Electrical Engineering Co., Ltd., and previously had held a similar position with the Harland Engineering Co., Ltd. He is a member of the Committee of the I.E.E. North Midland Centre.

The Lancashire Electric Power Co.'s Amateur Dramatic Society excelled all their previous performances when they presented "Jacob's Ladder," by Norman MacOwan, at the Adult Education Insti-



MR. G. T. KING



MR. H. L. JONES

tute, Manchester, on November 13 and 14. Mr. A. Duff gave an admirable portrayal of David Maxton, the father who had three months to live, and was ably supported by the rest of the cast. After the final



curtain, Mr. S. M. Rix, secretary and assistant manager of the company and chairman of the society, said that the play had set a new standard for the society and



*Scene from the play "Jacob's Ladder" performed by the L.E.P. Co's Amateur Dramatic Society*

reflected great credit on the cast and those behind the scenes. A special word of thanks was due to Mr. I. L. Thomas, the producer.

MR. F. W. F. OLDHAM has taken over the management and commercial responsibility of the amplifier department of Philips Electrical, Ltd. He succeeds Mr. Meys, who is devoting himself to other Philips' activities. Mr. L. Odell will act as

technical commercial adviser in the public address and associated fields, and will continue his development activities.

ALD. A. CRITCHLEY has been re-appointed chairman of the Liverpool Electric Power and Lighting Committee, of which he has been a member for 23 years.

### Obituary

MISS EMMA IRENE BENN, last surviving child of the Reverend Julius Benn and sister of Sir John Williams Benn, founder of Benn Brothers, Ltd. (proprietors of *THE ELECTRICIAN*) at Wayside, Oxted, on November 22, in her 84th year. Sir Ernest Benn recalls that when he joined the firm as office boy in 1890, Miss Benn acted as clerk to Mr. Julius Benn, who at that time kept the books of the business. She was a devoted member of the Congregational Church at Stoke Newington and later at Ealing, and for the last 25 years had been a tower of strength at Oxted. An old lady of the most lively intellect, Miss Benn continued to take a keen interest in affairs, and particularly in the progress of the publishing business she had helped to found, until the last few days of her life. Within the past year she had personally organised a jumble sale which raised a considerable sum for local charities.

## Break Location in Multi-Core Jumpers

BY adopting a "partial-break locator," developed and patented by B.I. Callender's Cables, Ltd., for the detection of faults in the trailing cables of mining equipment, London Transport have appreciably reduced wastage of the ten-core jumper cables used for carrying traction and auxiliary apparatus control wires from car to car on their electric rolling stock.

In order to ensure the correct operation of the apparatus it is necessary to inspect and test these cables periodically, but apart from the usual examination of their external sheaths, the jumpers, on receipt at the Board's Acton works, were given only electrical tests, consisting of a high-tension test to earth and between each of the ten cores, and a continuity test which consisted of passing a current of 30 A at 4 V through the cable.

In practice these tests found those cables which were already defective but gave no indication as to whether a particular jumper was fit for a further length of service. It was therefore customary to fix a life of a certain number of years, this life period varying according to the position of the jumper in the train formation and the use to which it was subjected; for

example, at points where coupling and uncoupling were constantly taking place the life was only about two to three years.

The partial break locator, with which it is possible to detect one strand broken in a core of 19 strands of 0.018 wire, consists of a three-stage resistance-capacity coupled amplifier, the input being obtained from a high ratio gap-cored transformer. The ten-core cable to be tested is inserted in the primary circuit of the transformer, the cores being connected in series by means of coupling sockets provided, of which there are four, in order to accommodate different types of jumper and jumper heads from different classes of stock. A current of between 4 and 5 A is drawn from a 2 V accumulator, and an ammeter is used to check the current and indicate that the primary circuit is complete. When the jumper is agitated a noise is detected in earphones at the output of the amplifier if a wire is broken, this noise being caused by the change of resistance produced by the grating of the broken ends of the wire rubbing together. The location of the break can be detected as the greatest noise magnitude is obtained when the cable is tapped at the point of fracture.

# Telephone Cable

## I.E.E. Discussion on Measurements and Testing

AT the meeting of the I.E.E. Measurements Section on November 7, a discussion on "Telephone Cable Measurements" was opened by Mr. S. Hanford, who prefaced his remarks with a review of the tests normally made by the Post Office on cables of pair formation and by mentioning the normal ranges of test frequencies. He asked whether in the view of the meeting the extensive programme of tests could be reduced. Several subsequent speakers stressed the need for a satisfactory direct-reading crosstalk meter. It was now possible to measure attenuations in submarine cables up to 200 db and the same equipment might be used for direct-reading crosstalk measurement. Visual crosstalk meters with electrically-weighted indicator circuits were in use, but in the settlement of disputes where high accuracy was essential, more time had to be expended in checking the accuracy of the meter than would be required for a series of individual frequency measurements in conjunction with an agreed weighting curve. In all cases of dispute with contractors, it was preferable to assemble the necessary test gear from high grade standard components. The older methods were not necessarily cumbersome and slow.

On the question of crosstalk units, many speakers thought that decibels should be used throughout, but others were of opinion that there was no point in altering existing millionths scales; there might be a case for standardising decibels for carrier frequencies.

A suggestion that signal/noise ratios might be given in conjunction with all crosstalk measurements was depreciated on the ground that error might creep in through misinterpretation of the term. In any case, crosstalk was of importance only in the absence of a "signal."

Pulse methods of revealing and locating faults were discussed, and it was suggested that with more development and the use of specially shaped pulses, these might become useful. At present it was thought that their accuracy and resolving power for faults at distances of the order of 50 miles, could not compare with graphical impedance methods. Instrument designers could, however, be of assistance to maintenance engineers if they would produce a differential galvanometer with a sensitivity of the order of 4 000 mm/uA for the detection of incipient insulation troubles in the presence of inductive disturbances on the line.

It was generally agreed that any reform of testing methods must wait on questions of policy in the drawing up of specifications. A suggestion that cables might be graded according to function, and less stringent tests applied for short repeater sections, did not find favour. It was felt that a continued use of standard specification cable would provide greater flexibility and also maintain continuity of manufacture. Several speakers thought that the present elaborate system for testing complete cables might be replaced by detailed tests on factory lengths and that the final test should be one of function.

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## Mobile Film Displays

WE were accorded an opportunity recently of attending a demonstration of the Brooks continuous projector developed by Sound Services, Ltd., 269, Kingston Road, London, S.W.19, for showing films to selected audiences.

Sixteen-millimetre projection apparatus is used, and each unit is mobile and self-contained. It includes the sound film equipment, screen, portable operating booth, reproducer for incidental music from records and all accessories; a petrol electric generator is provided for use where there is no power supply. The whole is carried in a van and is in the charge of an experienced operator-driver. Auditoria may be any buildings in which an audience can be gathered, as for example, electricity showrooms, town and village halls, dealers' showrooms, canteens, etc.

The Brook projector is not available for sale in this country, although later a special model may be developed for export. The equipment is offered for hire, the rate depending upon the period of hire and also the degree of service and replacement of parts which is asked for. As an example of the practical way in which the projector has been planned, it should be noted that the screen is high enough to enable people to see the picture comfortably over the heads of those in front of them; the design is such that it takes down into three main parts and each one of them of a size that can be taken through a 3 ft. doorway; once the film has been threaded, it is "push-button" operated.

The film can be shown where it is needed and in daylight or artificial light, and in any convenient room or corner.



# Iron-Loss Measurements

## A.C. BRIDGE AND CALORIMETER METHOD

A CALORIMETER designed to measure the power loss in magnetic ring specimens under non-incremental audio-frequency excitation was described in a paper delivered by Prof. J. Greig and Mr. H. Kayser at a meeting of the I.E.E. Measurements Section on November 21. Entitled "Iron-Loss Measurements by A.C. Bridge and Calorimeter," the paper stated that the aim of the instrument was to check the results of measurement by an Owen bridge under conditions involving appreciable non-linear distortion. After reasons for the choice of the calorimetric method had been given, the authors considered the application of the calorimeter as a transfer instrument, and discussed the use of the Owen bridge for iron-loss measurements.

PROF. J. T. MacGREGOR-MORRIS, opening the discussion, said it should be possible to measure the iron-loss at, say, 1 000 c/s not only by bridge and calorimetric methods, but also by means of the dynamometer wattmeter. To deal with certain errors in that instrument, however, so much had to be done that there was a danger of ending up with a massive apparatus consisting of a tiny instrument surrounded by devices to make it behave itself. The calorimetric method appealed to him very strongly, because it measured the whole of the losses and nothing else of significance, thus giving the information really required. The only objection to it was that it was very slow.

DR. G. A. V. SOWTER (Telegraph Construction and Maintenance) said he was surprised that the differential calorimeter had not been given more consideration. When working on harmonic distortion, he had been struck by the non-uniform distribution of flux at joints, particularly at inter-leaved joints. By avoiding implicated joints and using butt joints, however, it was possible to double the operating induction. An enormous increase in losses could be due to non-uniform distribution of flux, and if laminations had to be used they should be assembled in such a way as to have a uniform flux distribution.

MR. D. EDMUNDSON (B.T.H.) remarked that calorimetric methods were still used to measure losses in turbo-alternators, and had the advantage over bridge methods that it was unnecessary to have any series impedance in the specimen primary winding, apart from the winding

itself, so that the causes of flux distortion could be minimised. He hoped the authors' work could be extended to the field of power frequency work at the higher densities, about which there was very little information. It was still customary to assess the quality of magnetic sheets in terms of their loss at a maximum density of 10 000 gauss, but it was nowadays frequently necessary to work up to 18 000 gauss or even higher, and in this region there was available little authoritative information on the losses in materials in current use.

MR. A. LANGLEY MORRIS (Malvern) said that he had been concerned with the development of transformers for aircraft, where the prime factor was size, which implied the full magnetic loading of the material. Whereas a few years ago they were running at flux densities of 5 000 gauss at 1 600 c/s, because of the loss limitations of the material, they were now going up to 10 000 gauss with radio metal, partly because the silicone dielectrics had removed the temperature limitation, and partly because the iron manufacturers were continuously improving their product. It had therefore become of prime importance to look at what happened in the non-linear regions of the magnetic materials. He felt that the calorimetry method was suitable for radar pulse transformers. There were also micro-calorimetric methods in use by chemists which might make it possible to overcome the difficulty with interleaved stampings by determining the losses on individual stampings.

MR. O. I. BUTLER (Liverpool University) agreed that the Owen bridge could be relied on to give accurate measurements. Like the authors, they found that the difficulty of maintaining a constant voltage at the correct frequency limited the accuracy, but concluding that the main source of the trouble was the induction alternator, they finally used a beat frequency oscillator followed by a cathode follower type of amplifier, which gave the necessary low impedance source at all frequencies.

DR. L. HARTSHORN (N.P.L.) praising the calorimetric method, said that its real importance was that it gave a quantity without any ambiguity. He would, however, discount the suggestion of micro-calorimetry, which he did not think would be as good as the authors' method.

# Electricity Supply

**Southend-on-Sea.**—Pointing out that certain difficulties may arise in transmitting



*Southend load condition indicator*

gives an instantaneous reading of the conditions obtaining and indicates the districts affected by feeder tripping on the daily load shedding rota.

**Accrington.**—An order has been made for the compulsory purchase of 17 728 acres of farmland for the new Huncoat station.

**North-East England.**—The C.E.B. have notified electricity undertakers that the new grid tariff, which came into force throughout the other scheme areas of the country at the beginning of 1946, will be applied to North-East England as from January 1, 1948.

**Newcastle-on-Tyne.**—Fluorescent lighting fittings, made by the B.T.H. Co., Ltd., have been installed on six existing standards in Northumberland Street, one of the city's main thoroughfares. Although the results are said to have shown a marked improvement on the previous lighting method, it is not likely that the system will be further extended at present.

**Glasgow.**—Consent has been received for the installation of a third 50 000 kW turbo-alternator and two additional boiler units at the Braehead power station. The Corporation is acquiring additional ground for coal storage space and railway sidings. The station will ultimately cost approximately £8 000 000, and work on the foundations has already begun.

**Bolton.**—Lord Citrine, chairman of the B.E.A., has suggested that Bolton should not appoint a new electrical engineer. In a letter to the local M.P., he points out that under the Electricity Act, 1947, there will be separation of generation and distri-

bution, and such reorganisation is bound to make some change in the conditions of chief engineers. "Nothing in the nature of a long-term contract should be entered into," writes Lord Citrine. "Any appointment that is made should be an acting one, and made in such a way as to leave the B.E.A. free to reopen the matter after vesting date.

**Stretford.**—Directions for the installation of a 15 000 kW gas turbine driven generating plant at the Trafford power station have been received from the C.E.B. by the Stretford and District Electricity Board. The new plant, states Mr. H. G. Bell (chief engineer and manager), will be the first of its kind in the country and will be manufactured by the Metropolitan-Vickers Electrical Co., Ltd. It will operate on the open-cycle principle, burning fuel oil, and it is anticipated that the thermal efficiency will at least be equal to that of the most efficient steam station. The Trafford station is situated in the concentrated industrial area of Trafford Park, and already contains 60 000 kW of modern steam plant. The restrictions imposed by the site render gas turbine plant particularly suitable for further extensions. A 30 000 kW, 33 kV, steam plant is at present being commissioned there.

## Area Boards' Chairmen

THE appointment of eight of the ten chairmen of the area boards to be set up under the Electricity Act has been announced. They are:

**S. Eastern.**—Mr. Norman Elliott, 41, general manager and chief engineer, London and Home Counties Joint Electricity Authority.

**Southern.**—Mr. H. Nimmo, one of the Electricity Commissioners.

**Eastern.**—Mr. C. T. Melling, borough electrical engineer of Luton, Beds.

**East Midland.**—Mr. C. R. King, retired from general managership of the Midland Counties Electric Supply Co. 12 months ago.

**South Wales.**—Mr. L. Howles, general manager South Wales Electric Power Co.

**Yorkshire.**—Mr. W. M. Lapper, district manager (N.E. and Mid. E. England) of the Central Electricity Board.

**N. Eastern.**—Mr. H. H. Mullens, deputy general manager, North-Eastern Electric Supply Co.

**N. West.**—Mr. George Gibson.



# Overhead Travelling Cranes

## Motor Rating and Control Methods

CONSIDERABLE interest was shown in the rating of crane motors in the discussion which followed the reading of a paper on "Electrical Aspects of Overhead Cranes," by Mr. G. V. Sadler (Vaughan Crane Co., Ltd.), at the I.E.E. Installations Section meeting on November 13.

The paper was intended to serve as a guide to engineers who desired to instal electrically - operated lifting equipment over an area of factory, warehouse, stock-yard or power plant. Emphasis was laid on performance rather than design, and mention of many of the smaller items of crane equipment was purposely omitted. The paper discussed the information required from the purchaser by the manufacturer, and indicated the results that the purchaser might expect to get at the crane hook. A brief survey of regulations affecting the installation of cranes was given, together with some remarks on maintenance and running costs.

MR. W. M. WATSON (Morris's, Ltd.), opening the discussion, said that a moderate long-travel speed for service, which consisted of innumerable short journeys in ordinary shop practice was better than a high speed, owing to the importance of the factor of acceleration.

MR. F. T. MUNGEY (Southern Railway) expressed surprise that Metadyne control was not more widely used on cranes, as its principles lined up very well with requirements, and it had been extensively used in other fields where availability and low maintenance were essential. It was also surprising, he said, to find from the figures given in the paper, that the electrical equipment cost as a percentage of total crane cost, was no higher for such a relatively complicated scheme as eddy-current slip coupling, than for plain series control.

MR. H. H. BROUGHTON, speaking as a member of the B.S.I. Committee concerned with the subject, said that electrical engineers should be ashamed to still bring forward half-hour and one-hour ratings for motors. He thought that either a load-factor rating or an r.m.s. rating based on the actual operating cycle should be substituted. A safe rule to follow for the ordinary overhead travelling shop crane was not to use contactor control gear if a drum controller would do the work. It would be unwise to under-rate the future possibilities of the a.c. commutator motor. For braking, d.c. solenoids were superior to a.c., and even

if it was decided to use a.c. on a crane there was no reason why a rectifier should not be used to operate the brake solenoids. With regard to future development, he would advise the cutting out of all unnecessary electrical gadgets.

MR. R. S. PHILLIPS (G.P.O.) agreed with the author that the rating of motors should be on the duty cycle. For crane purposes he thought that the fixed brush gear a.c. commutator motor with an induction regulator, had many advantages over the moving brush gear type. The brush gear was simpler, fewer brushes were needed, commutation was better, and maintenance costs, particularly in dirty surroundings, were much less.

MR. A. N. D. KERR, who began by describing the electrical engineer as "a mechanical engineer who understands insulation," rejected time by itself as a basis of intermittent rating and agreed with the author that the duty cycle method of rating was likely to prove more economical and less wasteful of material. In considering how to translate the present short-time ratings into ratings based on the duty cycle, an empirical rule was that a one-hour rated motor was equivalent to one operating on rated load for one minute and then off load for two minutes, or a 33½ per cent. intermittency of operation. In the same way, a half-hour rated motor was one which operated on rated load for one minute and off for four, giving a 20 per cent. intermittency of operation. The percentage intermittency of operation on rated load over an agreed period might thus be used as a basis for the duty cycle.

MR. F. H. MANN (Factory Department) emphasised the danger of allowing men to work anywhere near trolley wires, and pointed out that 15 per cent. of the fatalities in factories were due to contact with such wires.

MR. G. V. SADLER, replying to the discussion, said that Metadyne control on cranes was usually employed to obtain maximum acceleration, and it was only for cranes for very special duties, as in steelworks, that the cost would be justified. In reply to a question, he said that it was early to trust electronic equipment for use on cranes, but he thought it would be necessary to do so before long. The rating of motors on a different basis from half-hour or one-hour was principally a problem for the motor manufacturers, who should be guided by knowing what the crane makers had to do.

# Correspondence

*The Editor welcomes the free expression in these columns of genuine opinions on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression*

## The Domestic Consumer

[TO THE EDITOR]

Sir,—The recent article in "The Economist" entitled "Should Electricity be Taxed" will undoubtedly have come under your notice. I do not wish to criticise it on any grounds connected with the figures and calculations advanced by the writer.

Since the Budget, the question of a tax on electricity is virtually dead. But what in the article, in the current phrase, shakes me, is the wider implication of the defeatist doctrine that underlies it.

The keynote is set, I think, by the concluding words of the last sentence of the first paragraph: ". . . . . the maximum load which consumers would like to *inflict* upon the generating system . . . . ." (my italics).

Here, Sir, is the characteristic note of that bossiness which regards consumers as a herd to be chivvied about by their intellectual superiors, as people who annoy the boss with their requirements—the totalitarian outlook.

This article shows throughout the utmost contempt for one of the striking facts of modern civilisation—the fact that the British people, with their natural instinct for doing the right thing in an emergency, are more and more turning to electricity as the solution of many of their daily difficulties. Surely it is obvious after the lessons of 1939-45 that if there is one thing, after adequate defence, upon which money can be well spent, it is upon the widest possible electrification of the country.

Following the same line of argument, the article goes on to complain because "the domestic consumer is using too much electricity because it is too cheap." If so, the consumer is simply doing what sensible people have done from the beginning of organised communities. He is minding his own business and choosing the best option.

Despite all the inflictions of bureaucracy it does not seem that the cost of electricity to industry has caused industry to fare too badly. For once in a way it can surely be admitted that the domestic consumer might have the benefit of the deal. Taking the broad view, and trying honestly to study and balance the claims and interests of all sections, it is surely a matter for congratulation that the load factor rose as it did between 1938 and 1946.

There is an unpleasant assumption of

conscious recititude in the annoyance implicit in the article's statement that it pays the consumer, in certain circumstances, to use electric fires, and that if it should prove necessary to increase charges to the consumer, the resulting surplus could not "very readily" be left in the hands of the industry. Why on earth not? To please Whitehall? The accounts of the supply industry are indeed "broadly speaking" balanced, and one would have thought that was a very good thing in this insolvent age.

Yours faithfully,  
BASIL H. TRIPP.

Sanderstead, Surrey.

## Sound Recording

THE great importance of transients in high fidelity sound recording and reproduction was stressed by Sir Ernest Fisk (managing director, E.M.I., Ltd.), in an address before the Royal Society of Arts, in London, last week. Sir Noel Ashbridge, deputy director-general of the B.B.C., was in the chair.

Explaining how the frequency distribution of these irregular non-repeating wave-forms determined the tonal character of a particular sound, Sir Ernest said that transients extended well up to the top limit of human hearing, and even beyond it into the supersonic range. For the first time, frequencies up to 20 000 cycles were now being recorded on gramophone records produced by his organisation. In terms of electrical reproduction, this major development meant that every note and tonal characteristic detectable by the human ear in an original performance could now be heard with equal fidelity indirectly off a gramophone record.

Later in his address, Sir Ernest Fisk dealt with the development and progress of photographic methods and with more recent advances in magnetic tape systems, and he described and demonstrated the latest E.M.I. magnetic tape recorder, designed and made in England for use in broadcasting stations and film studios, and capable of recording a programme, with play-back and erasing facilities, of up to 20 minutes duration.

Sir Ernest said the big companies here and in America were spending large sums in research and development in connection with new systems.



# Southwick "B" Station

## First Pile Driven at Brighton

THE driving of the first of the 4 500 concrete piles on which the new Southwick "B" station will be built, was begun by the Mayor of Brighton at a civic ceremony, on Tuesday morning.

Designed for an ultimate capacity of 315 000 kW, made up of six 52 500 kW (m.c.r.) turbo-alternators steamed by 12 boilers, the new station, it is estimated, will cost £15 000 000. Directions have so far been issued by the C.E.B. for the completion of the first half of the station, comprising three sets and six boilers, by Christmas, 1950. This stage is expected to cost £8 400 000.

Lying to the west of the present Southwick "A" station, on a narrow strip of land flanked by the Channel and Shoreham harbour, the buildings will finally extend to a length of 900 ft. and a width of 350 ft. At either end there will be a 350 ft. chimney. The whole building will be supported on a piled raft, the piles, it is anticipated, extending to an average depth of 55 ft.

As is the case with the existing Southwick station, coal supplies will be collier-borne, and ash will be loaded into special vessels for dumping in the Channel.

The largest order ever handled by their land department, the first three turbo-alternators will be made by Richardsons, Westgarth, of Hartlepool, and will be 3 000 r.p.m. sets working under steam conditions of 900° F. and 900 lb. per sq. in. The boilers will be of the Babcock and Wilcox pulverised-fuel fixed type, rated at 320 000 lb. per hr., and each equipped with mechanical dust separators and electrostatic precipitators.

Acting as engineering consultant for the mechanical and electrical equipment is the chief engineer of the Brighton undertaking, Mr. H. Pryce-Jones, who has designed the station, and will also direct its construction. Messrs. L. G. Mouchel and Partners, with Mr. J. H. Somerset as consulting architect, are the consultants for the foundations and buildings, and Sir William Halcrow and Partners will supervise the circulating water system, harbour works and roads.

At a luncheon which followed the pile-driving ceremony, the chief guests included Sir Henry Self (deputy chairman of the B.E.A.), Sir William Halcrow, Mr. W. N. C. Clinch, who was chief engineer of the undertaking until 1943, Mr. H. Pryce-Jones, Mr. C. H. Sparks (Babcock and Wilcox), and Mr. J. N. Waite (manager, S.E. England C.E.B.).

Sir Henry Self, in the course of a speech, spoke of the problems likely to arise when, on vesting date, the generation and transmission side and the distribution side of electricity supply had to be separated. He hoped that the Area Boards would be appointed soon, and he stressed the importance of continuity at the time of handing over.

Pointing out that the site chosen for the new station had ideal "text-book" properties—sea-borne coal supplies and an unlimited supply of cooling water—Mr. Pryce-Jones said that C.E.B. directions were received in August, 1946, and already contracts worth £3 500 000 had been placed.

At the conclusion of the luncheon Ald. E. Simms (chairman, Electricity Committee) presented a certificate to Mr. B. Jeal, who had earlier, as the employee with the longest service in the undertaking, assisted at the pile-driving ceremony.

## Contracts Open

WE give below the latest information regarding contracts for which tenders are invited. In the case of overseas contracts, particulars are to be had from the Board of Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated:—

**Farnworth, December 10.**—Supply of: steel sub-station kiosk; two 500 kVA transformers; 11 kV switchgear; electricity meters; overground pillar boxes and underground boxes. Specifications from Electrical Engineer, Electricity Works, Albert Road, Farnworth, Lancs.

**Delhi, December 18.**—Supply, delivery, erection, connecting-up, testing and commissioning of the cables at Delhi "B" power station. Specification from Merz and McLellan, Milburn, Esher, Surrey; deposit, £5 5s.

**Walsall, January 2.**—Supply of: (a) One 500 kW mercury arc rectifier, including transformer, for operation from 6.6 kV, three-phase, 50 cycles, system to 550 V, two-wire d.c., excluding e.h.t. switchgear; (b) one six-panel open-type flat back 550 V d.c. switchboard; (c) one remote supervisory control equipment. Specifications from the Engineer and Manager, Electricity Supply Department, Upper Bridge Street, Walsall.

# Industrial Information

## Arresting Window Display

Reproduced on this page is a photograph of the window display at Crown



*Window display at Crown House, Aldwych, London, illustrating large power station plant made by the Metropolitan-Vickers Electrical Co., Ltd.*

House, Aldwych, London. Designed to illustrate the large power station equipment manufactured by the Metropolitan-Vickers Electrical Co., Ltd., the display has as its main feature a detailed scale model of a 54 000 kW high pressure, two-axis Metrovick turbo-alternator at Brimsdown power station.

## I.E.S. Summer Meeting

The Illuminating Engineering Society has arranged to hold a summer meeting to take place at Harrogate from June 16-19 next year. The proceedings will open with a reception, and during the next two days technical sessions will be held.

## Gold Watches for Long Service

Fifty-six long-service employees of Lancashire Dynamo and Crypto, Ltd., Trafford Park, Manchester, were presented with gold watches at the firm's staff dance at Manchester on November 15. Their total service amounted to 1 609 years, and averaged 29 years.

## Work by Married Women

Former women employees of the English Electric Co., Ltd., at Thornbury, Bradford, now married, are playing a substantial part in efforts to increase production by assembling components at their homes. A van delivers the parts and collects the finished articles.

## Switchgear "Queen"

Employees of Brookhirst Switchgear, Ltd., Northgate Works, Chester, at a

concert in the works' canteen, elected Miss Rita Jones, a 17-years-old shop clerk in the component assembly department, as "Miss Brookhirst 1948." Mr. G. P. Belsham, works manager and chairman of the firm's social and athletic club, presented to her the silver cup given by Mr. J. O. Knowles, chairman and joint managing director, for annual competition, and a silk sash.

## Wedding Gifts

Among the wedding gifts appearing in the official list of those presented to Princess Elizabeth are the following: From the B.E.A.M.A., a selection of domestic electrical appliances including a plate warmer, toaster, kettle, coffee percolator, clock and electric fire; also, among larger appliances, an electric cooker, floor polisher, washing machine and a water heater. From the E.A.W., an electric blanket. From the W.V.S., a refrigerator. From the directors and employees of Hoovers, Ltd., two electric cleaners. From the people of Leamington, Warwickshire, a gift of 200 guineas, with which a dish-washing machine has been purchased. From the ex-Servicemen and women at St. Dunstan's, Ovingdean, an electric reading lamp in their own craft work.

## Fluorescent Lighting in Garden Lounges

When the R.M.S. "Queen Mary" was reconditioned after her war-time service,



*New garden lounge on the R.M.S. "Queen Mary" lighted with Mazda fluorescent lamps*

two new garden lounges were built into the forward end of the promenade deck, to port and starboard. The lighting of these spaces was entrusted to the British Thomson-Houston Co., Ltd., and, for the first time, fluorescent lamps were introduced into the ship. The main lighting in



the garden lounges comes from Mazda 40 W "warm-white" fluorescent lamps in special Mazdalux dished fittings mounted on the deckhead. Other "warm-white" lamps, concealed above the jardinières, add to the charm of the scheme, which creates a warm, sunny atmosphere.

### New X-Ray Equipment

The X-ray department of the Gravesend and North Kent Hospital has been re-equipped with new apparatus supplied by Philips Electrical, Ltd.

### Showrooms Opened

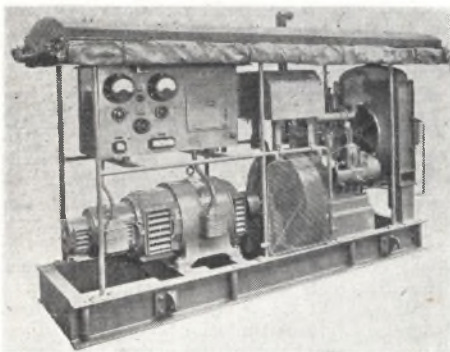
Charles Selz, Ltd., announce that they have opened new showrooms at 25, Oxford Street, London, W.1 (opposite Frascati's Restaurant), where they have a display of lampshades and wrought iron electrical fittings, etc.

### Change of Address

Mr. Wiwan Chand Mahajan, importer and distributor of electrical stores, late of Post Box No. 353, Lahore, India, announces that his present address is Gopi pura Street, Parthankot, East Punjab, India.

### Diesel Generating Sets for Oilfields

Illustrated on this page is one of twenty self-contained 20 kW Diesel generating sets recently supplied by Associated



*One of 20 self-contained 20 kW Diesel generating sets supplied by Associated British Oil Engines, Ltd., to provide power for lighting purposes in oilfields*

British Oil Engines, Ltd., to a well-known oil company to provide power for lighting purposes on derricks in oilfields. Each set comprises a McLaren "MR2" two-cylinder totally-enclosed high-speed four-stroke cycle airless injection engine, developing 50 B.H.P. at 1 000 r.p.m., flexibly coupled to a Crompton Parkinson 20 kW alternator. The set, which is mounted on a combined bedplate, is covered by a steel plate awning, having canvas side screens.

mounted on tubular supports, which also carry the fuel tank and a Brush switch-board.

### New Overseas Telephone Exchange

To make room for the growth of the Continental and inland trunk services at



*Section of a switchboard at the new Overseas Radio Telephone Exchange. Reduced height affords operators more light and air*

the International Exchange, Faraday Building, the Overseas Radio Telephone Exchange, serving the British Commonwealth, Ceylon, India, the U.S.A., South America, Moscow, Iceland and other places, has been transferred to a G.P.O. building, in Wood Street, London, E.C.1. The overseas radio-telephone service commenced on January 7, 1927, when the first public call was made between London and New York, the only city served at that time. Now communication is provided with 54 countries and places as well as five Atlantic liners, and the charge for a call to New York has been reduced from £15 to £3 for three minutes. At the Faraday building the switchboard grew from one operating and two booking, or recording, positions in January, 1927, to 31 operating and 22 booking positions. In the new exchange at Wood Street, which opened on Monday, there are 50 operating positions and 21 booking positions with room for considerable extension to accommodate an expanding service.

### Portsmouth Training Schemes

Facilities available in the Portsmouth electricity service for the training of youths for various posts in the supply industry are outlined in a booklet issued by the department. The training schemes for trade apprentices, engineering students and other trainees, are arranged on broad lines, and provide opportunities for apprentices showing good promise, to qualify, through progressive stages, for positions of responsibility in the undertaking. The booklet also contains an interesting description of the Portsmouth

undertaking, its generating plant, distribution network, and the opportunities for advancement afforded those who enter the industry.

### Battery Electric Vehicles

Three more distributors have been appointed for "Brush-Bred" battery electric vehicles. Reeves and Stedeford, of Birmingham, will cover Staffordshire and Birmingham; Prail Motors, of Hereford, the counties of Hereford and Shropshire; and Charles Sidney, Ltd., of Bradford, the whole of Yorkshire. Industrial Motor Services, distributors for Scotland, are holding exhibitions of "Brush-Bred" vehicles at their showrooms in Glasgow from November 24 to December 6, and at the showrooms of Alexanders at Edinburgh from December 10 to 20.

### B.S. for Pipe Flanges

The British Standards Institution has published a revision of Part 1, Tables A, B and C, of B.S. No. 10, Pipe Flanges for Land Use, Tables A, B and C, giving dimensions of flanges made from cast iron, bronze, cast steel, wrought iron and malleable cast iron, for maximum working water pressures up to 400 ft. head (173 lb. sq. in.) at a maximum temperature of 212°F. A feature of this revision is that the minimum properties of the flange material have been included. Copies may be obtained from 24, Victoria Street, London, S.W.1, price 2s., post free.

### Supply Legislation

In August the London and Home Counties Joint Electricity Authority published a book entitled "The Electricity Supply Statutes as adapted and modified by the Electricity Act, 1947," compiled by Mr. Norman Elliott, general manager and chief engineer of the Authority. An index was included, but it embraced only the provisions of the Electricity (Supply) Acts up to 1936 dealt with in the book. The Authority has now issued an index—"The Electricity Statutes, Orders and Regulations Index"—also compiled by Mr. Norman Elliott, which absorbs that contained in the earlier publication, and is expanded to include the Electricity Act, 1947, the Electricity Supply Regulations, and Orders and Regulations made under the 1947 Act. Copies are available from the Clerk's Office, 5-6, Lancaster Place, Strand, W.C.2, price 5s.

### Rural Automatic Exchanges for N.Z.

The General Electric Co., Ltd., has completed an order from the Post and Telegraph Department of New Zealand for twelve 25-line and twelve 50-line rural automatic exchanges, specially designed for use in sparsely populated areas. Maximum economy of plant is obtained by the employment of multi-party line working.

Facility is provided for junction working to parent manual exchanges, and flexibility is obtained as the R.A.X. junction terminations may be adapted to operate to a variety of line conditions at the parent exchange. By the provision of suitable relay sets, the system can be arranged for tandem working to adjacent R.A.X.'s. To facilitate operation over the long lines encountered in rural areas, Simplex dialling is employed and satisfactory working is obtained over subscribers' lines having a loop resistance of 3 000 ohms. The exchanges are constructed on the unit principle and the capacity can be increased to an ultimate limit of 90 lines (including junctions).

### Trade Publications Received

Publications issued by the Tudor Accumulator Co., Ltd., 50, Grosvenor Gardens, Westminster, S.W.1, giving particulars of Tudor accumulators for electric vehicles (No. 80) and sealed type cells in glass boxes (No. 678).

"Bakelite Progress," published by Bakelite, Ltd., 18, Grosvenor Gardens, London, S.W.1, describing several new developments and applications of Bakelite products.

New publications, Nos. 907/1, 925/1 and 942/1, issued by the Automatic Telephone and Electric Co., Ltd., Strowger Works, Liverpool, giving details of special services available to users of "Strowger" private automatic telephone exchanges, namely: Key-calling for executives, fire alarm, and code-calling.

### *B.E.A. and Company Staff*

THE Electricity Supply Senior Administrative Staff Association is the name given to the body formed from within the supply industry by officials in receipt of a salary of £700 or more, who have in the past considered it unnecessary to protect their interests by joining a trade union.

Mr. W. F. Cross, the association's first secretary, states that the body was formed by representatives of the senior employees of 23 power companies, and is receiving increasing support. The nationalisation of the industry, he points out, has made it imperative that the higher salaried grades of workers shall have the opportunity of official representation on future discussions of matters likely to affect them. The association has already been in touch with the B.E.A. with a view to receiving official recognition, and, it is understood, that the Authority's attitude is that it will be willing to receive representatives when the establishment of joint machinery for the industry is under discussion. The address of Mr. Cross is 58, Abbey House, Victoria Street, London, S.W.1.



# Company News

**CRABTREE ELECTRICAL INDUSTRIES, LTD.**  
—Net pft. £68 353 (£68 606), fin. div. 5% (same), and cash bonus 7½% (same), mkg. total annual distributn., 17½% (same).

**ELECTRIC FURNACE CO., LTD.**—Loss for yr. to Mar. 31, £15 279 (£31 195). To prfd. ord. div. 8% (same), ord. div. 8% (same).

**FALK, STADELMANN AND CO., LTD.**—Trdg. pft. to Mar. 31, £239 708 (£158 874), a net pft. £151 770 (£94 003). Ord. div. 10% and bonus 5%, mkg. 15% (10%).

**VICTORIA FALLS AND TRANSVAAL POWER, LTD.**—Income for 1946 £2 551 622 (£2 083 210). Deduct Jo'burg administration £102 748 (£84 269), Ldn. and Rhod. exes. £43 938 (£43 020), deprecn. tax and contings. £1 804 661 (£1 373 871), lvg. £600 275 (£582 050). To res. £150 000 (same), pref. div. 10% (same), ord. div. 19½% (19%); fwd. £423 940 (£351 790). Brit. Govt. secs., etc., £9 833 907 (£8 983 578), stores (£596 549 (£475 067), debtors £713 114 (£649 487), tax cert. £1 835 000 (£2 400 000), cash £1 453 318 (£1 379 845), creditors £4 886 295 (£4 401 827), tax provn. £3 643 226 (£9 905 867), reserve £1 900 000 (£1 750 000).

**NIGERIAN ELECTRICITY SUPPLY CORP., LTD.**—At the company's three power stations, announced Maj. E. Seaborn Marks (chairman) at the annual meeting, 44 639 930 units were generated during the year, a decrease of 25 per cent. on the previous year's figures. Actual power sales showed a decline of 26.4 per cent. Although small, the supply of power to the township of Jos at 1 628 378 units showed an increase of 32 per cent., due to more domestic apparatus becoming available. There was room for further expansion, but the town was so situated that it could not be expected to develop to a very large extent. It was satisfactory to note, the Chairman went on, that an additional mining company had lately entered into a contract to take power, and there were inquiries from others, but it was not expected that the extension of the system would be completed for about two years, because of the long delay in

the delivery of the necessary plant. The main development work during the year had been the installation of a meter testing department.

**BAGDAD LIGHT AND POWER CO., LTD.**—Reviewing the activities of the undertaking at the annual meeting, Sir Kinahan Cornwallis (chairman) said that total units sold during 1946 amounted to 20 852 000 kWh, representing an increase of 283 000 units; consumers connected at December 31, 1946, numbered 25 831, compared with 23 107 at the end of 1945. Maximum demand had reached 7 200 kW. The erection of the 6 000 kW turbo-generating set and 30-ton boiler, ordered in 1944, was completed in July last; the much needed additional generating capacity which had thus become available would allow some alleviation of the restrictions in supply which continued in force throughout 1946. With the placing in commission of the 6 000 kW set a definite step had been made towards better operating conditions. Not, however, until the 12 500 kW set became available would the position be really satisfactory.

## Metal Prices

		Monday, November 24		
		Price	Inc.	Dec.
<i>Copper—</i>				
Best Selected ...	...per ton	£130 10 0	—	—
Electro Wire bars ...	.. "	£132 0 0	—	—
H.C. Wires, basis ...	.. "	£149 10 0	—	—
Sheet ...	.. "	£173 10 0	—	—
<i>Bronze Electrical quality</i>				
<i>1% Tin—</i>				
Wire (Telephone) ...	per ton	£172 5 0	—	—
<i>Brass (60/40)—</i>				
Rod basis ...	...per lb.	1s. 1½d.	—	—
Wire ...	.. "	1s. 6½d.	—	—
<i>Iron and Steel—</i>				
Pig Iron (E. Coast Hematite No. 1) ...	per ton	£9 10 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	.. "	£35 15 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ...	.. "	£22 15 0	—	—
<i>Lead Pig—</i>				
English ...	.. "	£91 10 0	—	—
Foreign or Colonial ...	.. "	£90 0 0	—	—
<i>Tin—</i>				
Ingot (minimum of 99.9% purity) ...	.. "	£442 10 0	—	—
Wire, basis ...	...per lb.	5s. 6½d.	—	—
<i>Aluminium Ingots</i>				
Spelter ...	.. "	£70 0 0	—	—
Mercury (spot) ...	...per bott.	£16 0 0	—	—
<i>(ex. warehouse)</i>				

Prices of galvanised steel wire and steel tape supplied by C.M.A. Other metal prices supplied by B.I. Callender's Cables Ltd.

## I.M.E.A. Convention

THE annual convention of the Incorporated Municipal Electrical Association will be held at Eastbourne from June 7 to 11, inclusive, next year. A preliminary programme is being prepared and will be published later.

# Commercial Information

## County Court Judgments

**NOTE.**—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.

**EARL RADIO ELECTRIC CO.** (a firm), 372, High Street, Kensington, Middlesex, electrical dealers. £10 12s. 4d.; September 24.

**ELECTRONIC ENGINEERING CO.** (a firm), 295-297, Staines Road, Hounslow, Middlesex, engineers. £13 18s.; October 3.

## Winding Up Order

**BOWMAC ELECTRIC, LTD.**—Registered office, 86, Richmond Road, Kingston-on-Thames, Surrey. At the High Court of Justice. Winding-up Order, November 10, 1947. Presentation of petition. October 23, 1947.

## Intended Dividend

**ELECTRICAL UTILITIES, LTD.**—Registered office, Rosedale Works, Rosedale Road, Richmond, Surrey. At the High Court of Justice. Dividend amount per £: 2s. 11d.; third and final. Payable at 23a, St. James's Street, London, S.W.1, December 8, 1947.

## Bankruptcy

**PEAT, N. F. AND SONS** (sued as a firm) (other than an infant partner), 28a, Blackheath Village, Blackheath, London, electrical engineers. Court: Croydon. Receiving Order dated April 25, 1947, rescinded. Petition filed February 8, 1947, dismissed. Date: November 7, 1947. Grounds: Debts paid in full.

**FIELDING, ARNOLD**, residing and carrying on business at 223, Whalley New Road, Blackburn, Lancs., electrician. Court: Blackburn. Application for discharge, December 15, 1947, 10.30 a.m., at 64, Victoria Street, Blackburn.

# Coming Events

## Friday, November 28 (To-day)

**TELEVISION SOCIETY.**—London. The I.E.E. "Impressions of American Television," by T. M. C. Lance. 6 p.m.

## Saturday, November 29

**I.E.E., LONDON STUDENTS' SECTION.**—Visit to Faraday Building.

## Monday, December 1

**I.E.E., S. MIDLAND CENTRE.**—Birmingham. "Neutral Earthing of Three-Phase Systems. With Particular Reference to Large Power Stations," by J. R. Mortlock and C. M. Dobson. 6 p.m.

**I.E.E., N. WESTERN STUDENTS' SECTION.**—Manchester. Brains Trust. Joint Meeting with the N. Western Graduates' Section of the I.Mech.E. 6.30 p.m.

**I.E.E., N. EASTERN CENTRE. RADIO AND MEASUREMENTS GROUP.**—Newcastle-on-Tyne. "Remote Metering Systems for Continuous Indication," discussion opened by A. P. M. Montgomery and J. W. Faulkner. 6.15 p.m.

**I.E.E., MERSEY AND N. WALES CENTRE.**—Liverpool. "The Application of Electrical Technique, to the Service of Some Other Industries," by H. Cobden Turner and G. M. Tomlin. 6.30 p.m.

## Tuesday, December 2

**I.E.E., N. MIDLAND CENTRE.**—Leeds. "Record of Experience on the Irish Electricity Supply System," by A. Burke, R. C. Cuffe and W. O'Neill. 6.30 p.m.

**INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS, LONDON CENTRE.**—L.T.R. Headquarters, Refreshment Club, Waterloo Bridge House, S.E.1. "Some New Ideas on Test Room Procedure," by B. H. Moore. 5 p.m.

**I.E.E., N. WESTERN CENTRE.**—Manchester. "Electric Traction on the Southern Railway," by C. M. Cock. 6 p.m.

**I.E.E., E. MIDLAND CENTRE.**—Loughborough.

"Commercial Development of Electricity Supply as a Consumer Service," by C. T. Melling. 6.30 p.m.

**I.E.E., CAMBRIDGE RADIO GROUP.**—Cambridge. "Industrial Applications of Electronic Techniques," by Dr. H. A. Thomas. 6 p.m.

## Wednesday, December 3

**JUNIOR INSTITUTION OF ENGINEERS, MIDLAND SECTION.**—Birmingham. James Watt Institute. "Impressions of Power Plant Development in the U.S.A.," by L. F. Jeffrey. 7 p.m.

**I.E.E., RADIO SECTION.**—London. "The Design and Operation of High Power Broadcast Transmitter Units With Their Outputs Combined in Parallel," by T. C. Macnamara, A. B. Howe and P. A. T. Bevan. 5.30 p.m.

**I.E.E., N. EASTERN CENTRE. TEES-SIDE SUB-CENTRE.**—Middlesbrough. "Electric Traction on the Southern Railway," by C. M. Cock. 6 p.m.

## Thursday, December 4

**I.E.E., S. MIDLAND CENTRE. RUGBY STUDENTS' SECTION.**—"The Place of the Engineer in the Post-War World," by Sir A. P. M. Fleming.

**LEICESTER ELECTRICAL SOCIETY.**—Electricity Offices, Charles Street. "Television," by A. Folwell. 6.45 p.m.

**I.E.E.—London.** "Speech Communication Under Conditions of Deafness or Loud Noise," by W. G. Radley. 5.30 p.m.

## Friday, December 5

**ILLUMINATING ENGINEERING SOCIETY, BIRMINGHAM CENTRE.**—Imperial Hotel. "Lighting and Industrial Decoration," discussion opened by A. L. Hall and S. D. Lay. 6 p.m.

**I.E.E., MEASUREMENTS SECTION.**—London. "Economics of Metering," discussion opened by M. Whitehead. 5.30 p.m.



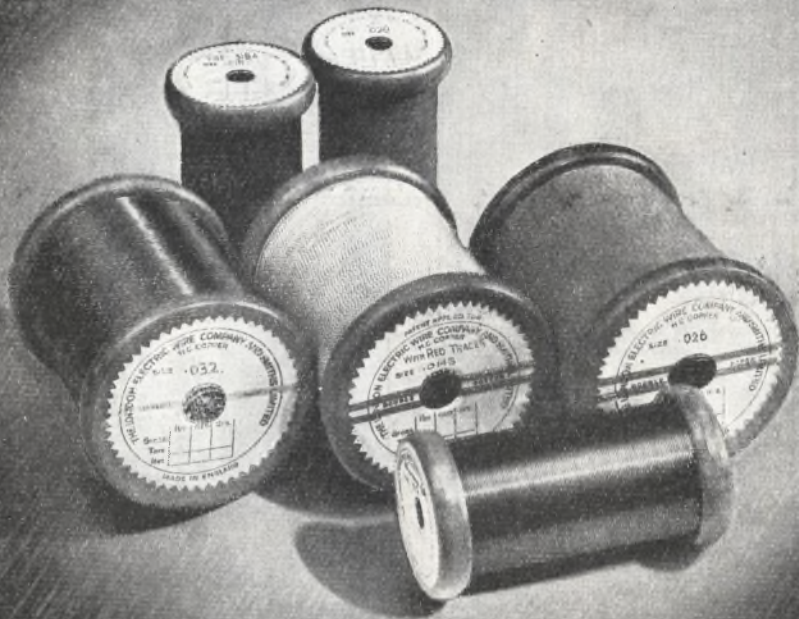


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## INSULATED WIRES & STRIPS

*for Coils of all types*



THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED, LEYTON, LONDON, E.10

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TECHNICAL DIVISION

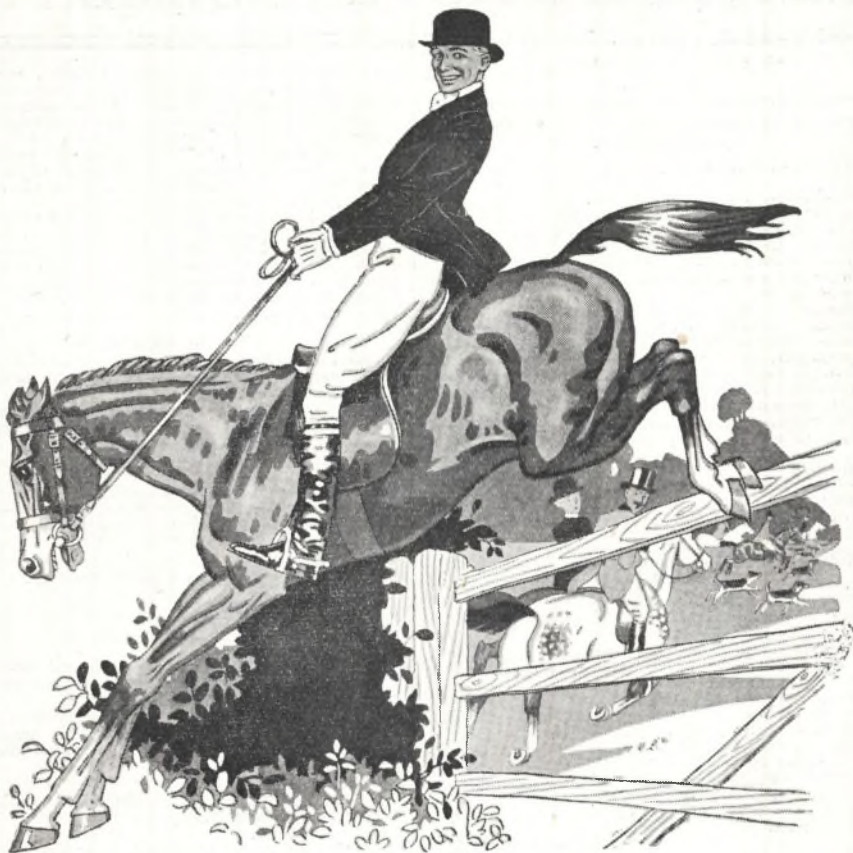
OIL-PROOF    PETROL-PROOF  
NON-AGEING    FLAME-RETARDING

DURATUBE & WIRE LTD.

REGISTERED TRADE MARK



# YOU CAN'T STOP A MAN WITH A GOOD IDEA



“Fox be jiggered! It’s Lorival I am after—*they* will be able to say whether it can be made in rubber.”

## RUBBER OR PLASTICS?

★ *While each material possesses its own characteristics, in many applications one is as suitable as the other, and in these times of scarcity it is as well to have this in mind. Firms in need of components, complete articles or packaging should seek our advice, which is based upon wide experience and specialized knowledge. We produce articles in rubber and ebonite as well as plastics, and our service includes design and manufacture.*

# LORIVAL PLASTICS



UNITED EBONITE & LORIVAL LIMITED  
LITTLE LEVER, NEAR BOLTON, LANCS

# CLASSIFIED ADVERTISEMENTS

## TENDERS

### BOROUGH OF EPSOM AND EWELL ELECTRICITY DEPARTMENT.

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

H.T. Switchgear and Transformers. Specification and tender form may be obtained from W. B. Hayden, M.I.E.E., Borough Electrical Engineer, Electricity Showrooms, Church Street, Epsom, upon payment of one guinea, which will be refunded on receipt of a *bona fide* tender. Additional copies may be purchased at a cost of 6s. each.

Tenders, on the prescribed forms, in sealed envelopes endorsed "Tender for H.T. Switchgear and Transformers," must reach the undersigned not later than 10 a.m. on Monday, January 19th, 1948. No name or mark indicating the sender must be placed on the outside of the envelope. Any tender not complying with these requirements will not be considered.

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

Town Hall,  
The Parade,  
EPSOM.

November 18th, 1947.

EDWARD MOORE,  
Town Clerk.

(383)

### BOROUGH OF EPSOM AND EWELL ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply and delivery of:—

High and Low Tension Cable, paper insulated, lead covered, armoured and served.

Specification and form of tender may be obtained from W. B. Hayden, M.I.E.E., Borough Electrical Engineer, Electricity Showrooms, Church Street, Epsom.

Tenders, on the prescribed forms, in sealed envelopes endorsed "Tender for High and Low Tension Cables," must reach the undersigned not later than 10 a.m. on Monday, January 19th, 1948. No name or mark indicating the sender must be placed on the outside of the envelope. Any tender not complying with these requirements will not be considered.

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

Town Hall,  
The Parade,  
EPSOM.

November 18th, 1947.

EDWARD MOORE,  
Town Clerk.

(384)

*None of the vacancies in these columns relates to a man between the age of 18 and 50 inclusive, or a woman between the ages of 18 and 40 inclusive, unless he or she is exempted from the provisions of the Control of Engagement Order, or the vacancy is for employment exempted from the provisions of that Order.*

## SITUATIONS VACANT

### CIVIL SERVICE COMMISSION.

APPLICATIONS are invited for two appointments as Assistant Technical Costs Officers (Male) in the Contracts Department of the Post Office.

Candidates must be British subjects, and at least 25 and under 40 years of age on September 1st, 1947. They should have served an apprenticeship in an engineering factory or workshop and have had some experience in rate fixing, together with practical experience in one or more of the following fields: Manufacture of electrical apparatus and equipment required for automatic telephone exchanges and transmission stations, subscribers' telephone instruments, radio equipment, thermionic valves, cables and cords, external plant, poles, wires, fittings, ducts, power

plant including motor generators, batteries, rectifiers, switchgear, lifts, conveyors and postal accessories. A knowledge of installation of internal tele-communications equipment and external plant would be an advantage.

The scale of salary is £300 x £12—£360 x £18—£450, plus consolidation addition varying from £78 to £90.

For starting pay purposes, the minimum of the scale would be regarded as linked to age 25, with one increment for each year above 25 up to the age of 30.

Forms of application may be obtained from the Secretary, Civil Service Commission, 6, Burlington Gardens, London, W.1, quoting No. 2064. Completed application forms must be received at the Commission not later than December 22nd, 1947, for candidates in the United Kingdom, and January 22nd, 1948, for candidates overseas. (385)

Ref. No. ICI/X/34.

*This advertisement is published by permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1947.*

IMPERIAL CHEMICAL INDUSTRIES LTD., Wilton Works, near Redcar, Yorks, require **DRAUGHTSMEN** to assist with the design and detailing of a large new works. Successful candidates will be appointed to the established staff.

Preference will be given to applicants who hold the Higher National Certificate or higher qualification and have the appropriate experience as follows:—

**DRAUGHTSMEN.**

ARCHITECTURAL. Design of offices, laboratories, houses, welfare and general industrial buildings.

Order No. D.31.

CIVIL. Design of roads, railways, drains and water services.

Order No. D.27.

STRUCTURAL. Design of buildings and structures, and design and detailing of reinforced concrete work for industrial buildings.

Order No. D.28.

MECHANICAL. Design of pipework for steam, gas and water, compressed air stations, layout of chemical plant, etc.

Order No. D.29.

POWER STATION. Design and layout of modern H.P. boiler plant and power plant.

Order No. D.227.

ELECTRICAL. Layout of plant electrical installations, including motors, starters, distribution boards, cables and lighting, and necessary calculations.

Order No. D.30.

INSTRUMENT. Layout of mechanical and electrical instrument installations for chemical plant. Preference for men experienced in modern automatic control and measurement instruments for temperature pressure and flow.

Order No. D.239.

Applications, giving full details and quoting advertisement reference ICI/X/34 and the Order No. should be addressed to the Manager, Employment Exchange, South Bank, Yorks.

LM/RH.  
November 4th, 1947.

(329)

### THE YORKSHIRE ELECTRIC POWER COMPANY.

APPLICATIONS are invited for the position of Stores Officer (Engineering) to be in charge of the whole of the stores side of an electricity undertaking under the supervision of a Stores and Transport Superintendent.

Candidates should be qualified electrical engineers with a good working knowledge of the materials and parts used in generating stations, substations, mains, and installation work generally. Salary in accordance with qualifications.

Applications, giving full details of age, training and subsequent experience to GM/GH, The Yorkshire Electric Power Company, Bramhope, near Leeds. (387)



## SITUATIONS VACANT

## COUNTY BOROUGH OF CROYDON ELECTRICITY DEPARTMENT.

DEPUTY DISTRIBUTION SUPERINTENDENT. APPLICATIONS are invited from Corporate Members of the Institution of Electrical Engineers for this appointment at a salary on N.J.B. Schedule, Class H, Grade 3 (1), at present £761 per annum.

Applicants should not be over 40 years of age. They must have had a good engineering training and a sound knowledge of the technical and commercial operation of a distribution department, with experience in the design, construction and maintenance of urban distribution networks, including substations up to 33 000 volts.

The appointment will be subject to the Local Government Superannuation Act, 1937, and to one month's notice. The successful candidate will be required to pass a medical examination.

Applications (with copies of three testimonials) endorsed "Deputy Distribution Superintendent," are to be delivered not later than noon on Tuesday, December 9th, to the General Manager, "Electric House," Wellesley Road, Croydon, and must state age, training, qualifications and experience.

Canvassing will disqualify.

E. TABENER, Town Clerk.

Town Hall, CROYDON, November, 1947.

(586)

## FOR SALE

BRITISH Electric Co. (Beco) Ltd. can supply most types of A.C. and D.C. Motors from stock.—British Electric Co. (Beco) Ltd., Electra House, 25-29, Lower Road, Rotherhithe, S.E.16. Bermondsey 3449. (20)

CHANGEOVER Switches ex stock. Unit offers facilities for controlling 100/150 amp, 4-pole power circuits and 4-pole, 30 amp lighting circuits. Electrically interlocked and fitted with pilot light. Price £20.—Apply: Hobson, 43, Springfield Road, Linslade, Leighton Buzzard. (392)

COMPULSORY reduction in electricity consumption. Staggered hours and night shifts are expensive. Install a Meadows Generating Plant and produce your own light and power without restriction. We can supply a limited number of 9 kVA, 230 v., 50 c., single-phase, A.C., coupled direct to B.T.H. generator, complete with switch-board panel, size 30 in. by 32 in. Fitted with necessary switches and instruments providing a 40 v. D.C. circuit for battery charging, etc. Price £395. Inspection at any of our depots.—Spurlings, The Hyde, Edgware Road, Hendon, N.W.9. Tel. Col. 7171. (390)

D.C. to A.C. Motor Alternators, 110 volts D.C. input. 220 volts, 50 cycles, single-phase A.C. output at 250 watts, screen protected, ball-bearings, £12 10s. each. 1 000 watts output, as above, £20 each. As above, but 24 volts D.C. input, 150 watts output, suitable for mobile public address, etc., £7 10s. each.—Johnson Engineering, 319, Kennington Road, S.E.11. Reliance 1412-3. (349)

ELECTRIC HOIST BLOCKS, capacity 5 cwt. to 7 tons. Reasonable delivery.—A. Morgan and Co., 50, Wilkin Street, London, N.W.5. Telephone: GUL. 1147. (24)

ELECTRIC MOTORS, A.C. and D.C. We supply all types and sizes of electrical machinery. Motorised slow speed reduction gears built to customers' specific requirements. Short deliveries.—Electropower Co., Ltd., 3, Retreat Close, Kenton. Wordsworth 4928. (14)

ENAMELLED and E.S.S.C. Wires, surplus to requirements.—S.a.e. particulars: Radio Service Works, 68a, Abington Avenue, Northampton. (396)

FLUORESCENT Lighting. 4 ft. and 5 ft. single, double and triple lamp fittings manufactured by B.T.H., G.E.C., Siemens, Ediswan, Crompton, etc., complete with ring gear and lamps, supplied immediately from stock ready for installation, or can be installed by us (in London area only). All fittings and gear fully guaranteed. Full range demonstrated in our showrooms.—Apex Industries Limited, 27, North Audley Street, W.1 (near Selfridges), Mayfair 0618-8960. (89)

## FOR SALE

FLUORESCENT LIGHTING UNITS, 5 ft. Reflector or Swallow, £5 18s.; 4 ft. Reflector, £4 18s. 6d.; 4 ft. Batten, £4 9s. 6d. All self-contained and complete with new tubes. Call or write for September lists. Also 80 watt silent tapped Chokes, 27s. 6d.; 40 watt ditto, 25s. Bi-pin Holders, P/F Condensers, 4 ft. Tubes.—MOSS BROS., 53, Goodge Street, W.1. Mus. 5385. (TC114)

FOR immediate disposal, brand new single-phase A.C. Generators, 9 kVA, 0.8 P.F., 50 cycles, 230 v., 39.2 amps, 1 500 revs. Complete with exciter and Isenthal automatic voltage regulator. Powered by Coventry Climax petrol-driven engine, radiator and fan cooled, with water pump additional cooling, governor controlled. R.A.C. rating 15 h.p., 51 b.h.p. at 3 500 r.p.m. Mounted on steel-framed chassis, direct coupled, and with approx. 25 gall. petrol tank.—Apply: Commercial Structures Ltd., Staffa Works, Staffa Road, Leyton, E.10. (373)

FOR SALE from stock. New Lundberg SWITCHES, 2 in. x 1½ in. x 1 in. Adhesive Tapes, white, 1 in. and 14 in.—For particulars and price apply: E. S. Mashal, 86, Alie Street, E.1. Phone: Royal 4405/6. (264)

LADDERS, Trestles, Steps, Handcarts, etc.—From: Ramsay & Sons (Forfar) Ltd., Forfar. Phone 172. (10)

MATHEW Brothers offer: Two-ton Ransome & Rapier Petrol/Electric Mobile Cranes, overhauled, 3 available, from £750 each; Tiny Tim 15-v., 20-amp. Petrol Charging Sets, new, boxed, £25 each; Coventry Climax self-contained 2½-kVA, 130/3/50 Petrol Alternator Sets, fitted 4-cyl. water-cooled engine, £35; Onan self-contained 2-kVA, 230/1/50 Petrol Alternator Sets, overhauled, £110; Ford self-contained 5.6-kVA, 230/1/50 Petrol Alternator Sets, overhauled, £220; Newman self-contained 200/250-v., 12-kW D.C. Petrol Generating Sets, new in packing cases, £295; G.E.C. self-contained 110-v., 16-kW Petrol Generating Sets, mounted on four-wheeled trailer, £250; Austin self-contained 15-v., 200-amp. Battery Charging or Plating Generating Sets, new, £220; Homelite 30-v., 1 500-watt D.C. Petrol Charging Sets, less a few parts, £20; 40-h.p. B.T.H. 400/3/50 Squirrel Cage Motors, R.O. bearings, 3-terminal type, no starters, £67 10s.; ½-h.p., 110-v. D.C. shunt wound Hodgson Motors, 680 r.p.m., new, £12 10s.; 6-h.p., 110-v. D.C. shunt wound Crompton Parkinson Motors, 1 000 r.p.m., flange mounting, new, £22 10s.; 1-h.p. J.A.P. Industrial Petrol Engines, new, £17 10s.; 3-h.p. Petter Industrial Petrol Engines, new, £37 10s.; 10-h.p. ditto, new, £57 10s.; 14-h.p. Continental Petrol Engine, totally enclosed, new £65; 6-v., 230-a.h. Storage and Starter Batteries, £11; 12-v., 168-a.h. ditto, £18; 400-a.h. ditto, £18.—Mathew Brothers, Wallington, Surrey. Telephone: Wallington 4050. Telegrams: Matbro, Wallington. (324)

NEW General Motors Diesel Engines, 6.71, 90 b.h.p. at 1 200 r.p.m., £400, complete with equipment. Inspection running.—Norths, 94, Vicar Lane, Leeds. Phone 26248. (380)

NO. 35 Choke Clamps, No. 6 Upright Transformer Clamps Also various metal components for the wireless and electrical trade. Quick deliveries.—Versatile Engineers & Co. Rutland Street, Middleton, Manchester. Telephone Mid 2377. (381)

ONE-WAY and Two-way Switches, 5 amp shuttered Sockets recessed and surface. 5 amp Switched Sockets. Fluorescent Tubes, 4 ft. Iron and Ceramic Elements.—J. Rivlin, 17, Brunswick Street, Leeds, 2. (397)

QUANTITY Electric Bulbs, 12 v. and 24 v. small-bay-cap suitable for decoration lighting.—Suplex Lamps Ltd., Suplex House, 239, High Holborn, London, W.C.1. Hol. 0225 and 4543. (394)

QUANTITY of 3-way S.P. and Neutral, 500 v., 15 amp., 1/C. Fuseboards. Also quantity of 5 ft. Fluorescent Tubes, D/B, used one month only for exhibition lighting, 20s. each.—MOSS BROS., 53, Goodge Street, W.1. Mus. 5385. (TC110)

SELF-PRIMING ELECTRIC PUMPS, 300 g.p.h., £15 15s.—JOHN E. STEEL, Bingley, Yorks. Phone 1066. (TC112)

**FOR SALE**

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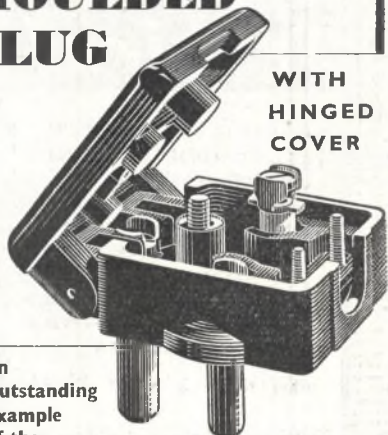
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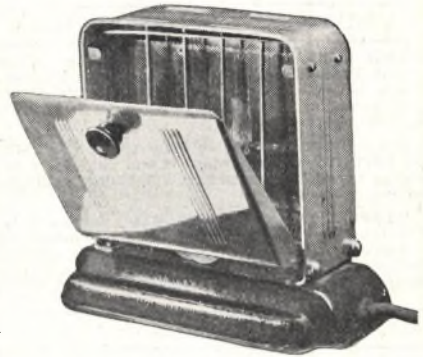
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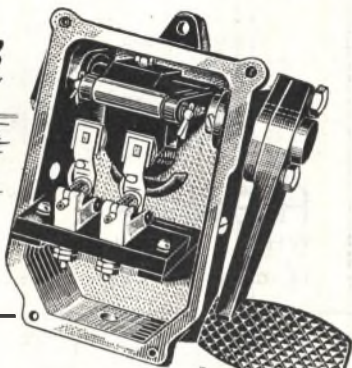
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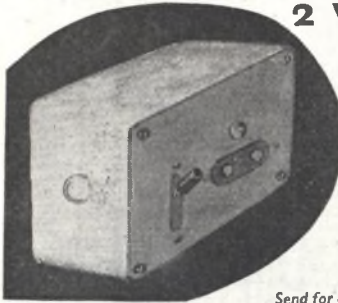
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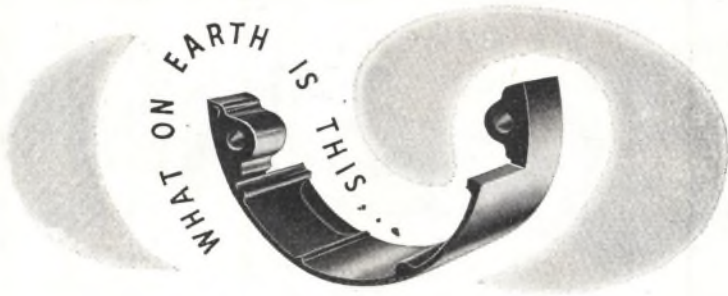
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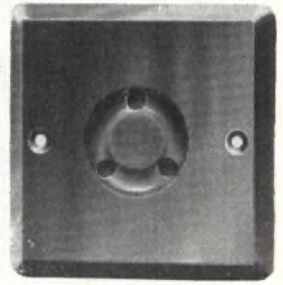
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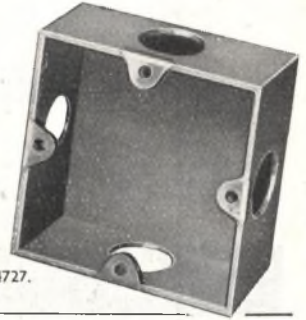
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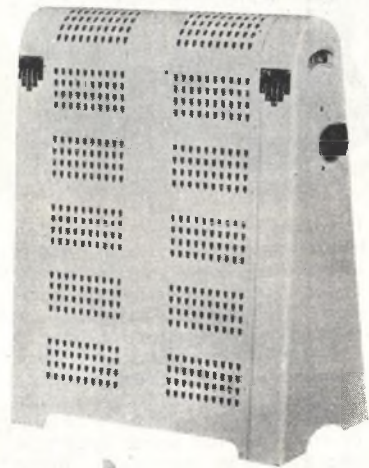
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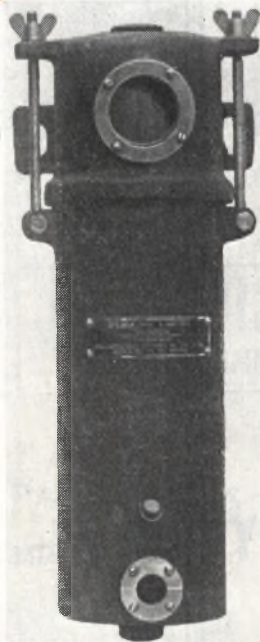


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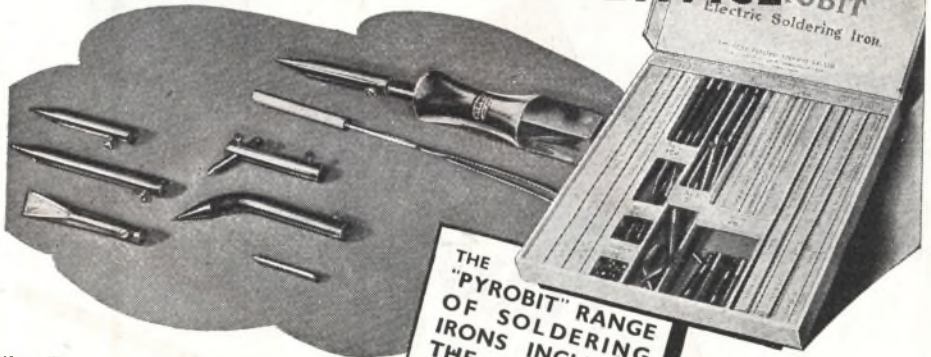
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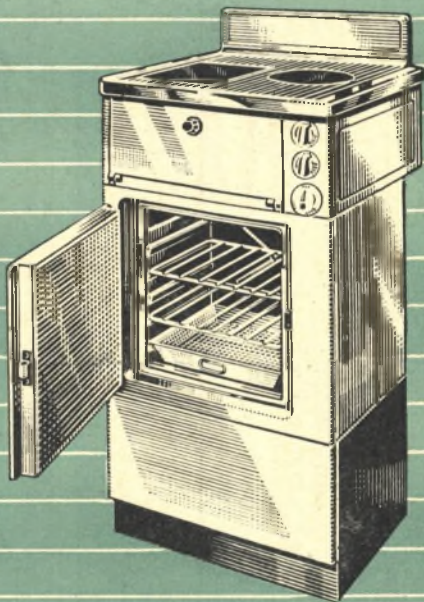
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Printed in Great Britain by Straker Brothers Ltd., 194-200 Bishopsgate, E.C.2. and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, London, E.C.4. (Registered at the General Post Office. Entered as second Class at the New York, Post Office.)—Friday, November 28 1947.