THE
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THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

8 AUGUST 1947
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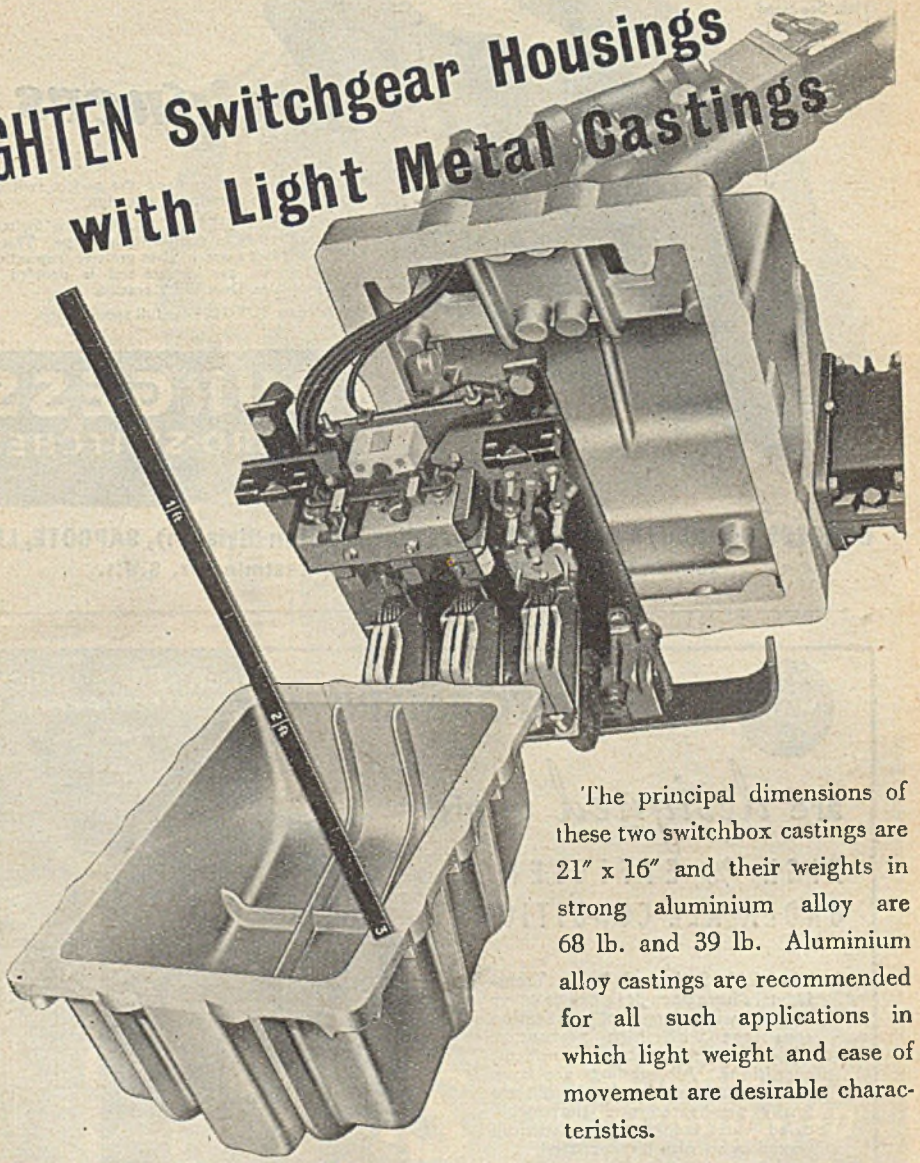

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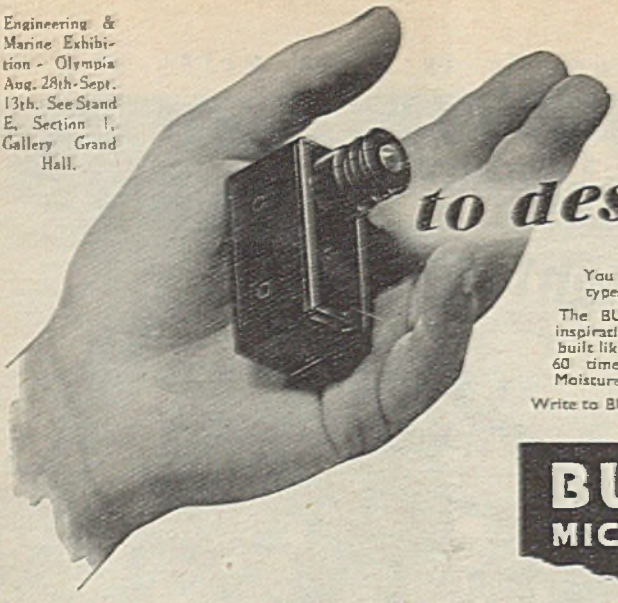

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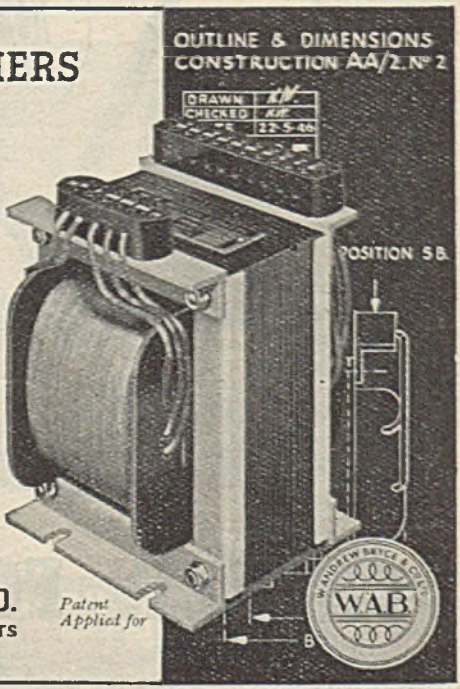

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Research Finance

ONE of the effects of nationalisation upon the electricity supply industry will be to deny it the opportunity of contributing in its present form to the funds of the E.R.A., and with the increasing expenditure involved in the establishment of the Leatherhead project, this is likely to have a delaying action unless something is done to prevent it.

It is true that under nationalisation, the Central Electricity Authority may be expected to contribute funds towards electrical research, but since it may be some time before the authority is sufficiently settled to deal with the matter, the E.R.A. may be called upon to wait for its support for a year or more.

The Leatherhead project, as is now generally understood, will involve a capital expenditure of no small dimensions, and if by any change in the administration of the supply industry, contributions to that expenditure are delayed, the work of the association will need to be continued at the present cramped premises at Perivale with all the limitations which the Leatherhead project is designed to eliminate.

The position, as we understand it, is that with nationalisation to all intents settled in all major details except the vesting date, it is important that there should be an indication of an assertive and progressive outlook by the association at this stage. This would doubtless make all the difference between initial absorption of the association into the reorganised supply industry, with loss of its autonomy; and continuation of its

present structure, with preservation of the correct balance between the supply and manufacturing sides of the industry. The supply industry, both municipal and company, and the manufacturers, should therefore see to it that in the next few months the E.R.A. is awarded funds of a capital nature to meet the heavy expenditure which the Leatherhead undertaking will involve, and which will entitle the association to make the maximum demand upon any Government grant awarded through the D.S.I.R.

The E.R.A. and Future

THE work of the E.R.A., so far as readers of THE ELECTRICIAN are concerned, needs no amplification; even so, few may realise, perhaps, that since 1920, upwards of 1 200 technical reports have been issued, covering among other things transmission, insulation, switchgear, power plant, consumer research, co-ordination, standardisation, etc., and some 250 papers and articles by members of the staff have been published. Since the erection of the Perivale laboratory in 1935, most of the association's research has been carried out in that laboratory; but on account of space limitations there, extension of the work is now dependent upon the erection of the new establishment at Leatherhead. In these circumstances, the industry must anticipate appeals to meet capital expenditure in its development, and with nationalisation just round the corner such appeals should be answered without delay so that (1) there should be no break in the rhythm of the association's research on behalf of the industry; (2) the existing co-operation between manufacturers and supply industry can be maintained until the Central Electricity Authority is able to organise its own contribution, enabling the authority to settle down to its task with the knowledge that the work of the E.R.A. is not in any way being delayed by the change in administration; and (3) the technical lead already established by this country in many fields of electrical engineering may not only be maintained but advanced.

Street Lighting Relaxation

IN the interest of safety and prevention of crime, present restrictions on street lighting, which were imposed as an emergency measure last February, will be relaxed to some extent when Double Summer Time ends on Sunday, August 10. From that date lighting authorities throughout the country are expected to adopt a standard of street lighting which will bring about a minimum saving in current consumption of 50 per cent. on pre-war figures. A similar appeal was made, it will be remembered, in 1946, but the saving as a result of it was no more than 30 per cent. of pre-war consumption. Those who control our destiny in the matter of street lighting restrictions should not lose sight of the increase in traffic which our roads now have to carry, nor should they overlook the doubtful merit in the small saving in current consumption resulting from reduced street lighting. Public lighting at the best of times is only a small load upon the national generating capacity and against a reduction of it to 50 per cent. must be measured the increase in road accidents, road deaths and public depression which will result.

The R.E.M.E.

SO many who now find themselves in the electrical industry will have served with the R.E.M.E., that the remarks made by Maj.-Gen. Sir E. BERTRAM ROWCROFT before the Batti-Wallahs' Society last week, will have about them something approaching the personal. Many a well established engineer in the industry found himself in 1942 applying peace-time engineering experience to war-operations, while many who after graduating joined the R.E.M.E., now find themselves adjusting war-time engineering experience to peace-time production. The importance of the electrical engineer was long ago recognised by the Royal Navy, and with the growth of the technical branches in the Army and the Royal Air Force he has assumed equal importance in all three Services. This is just as it should be, for whatever the R.E.M.E. may be called upon to do in the future it is certain that the Corps will become more and more electrical in its rôle. The maintenance of radar equipment for detection, course plotting, gun laying; the maintenance of the electrical equipment on battery sites for fire control, for communication, and a hundred and one other services, will, if not so already, soon be relatively simple, compared with the work which the Corps

will be called upon to do when electrification becomes even more general and when atomic physics are further developed. Indeed, we foresee the possibility of the senior "Mechanical" following the energetic "Electrical" in more ways than in the Corps' shoulder flash.

Crisis and the Community

BOTH as Chairman of the General Electric Co. and as a distinguished engineer, Sir HARRY RAILING can speak on industrial matters with the weight of considerable authority, and his views on the economic situation, given in his speech at the company's annual meeting, last week, deserve attention. A year ago, when many were viewing the national prospects with a mixture of complacency and false optimism, he gave a warning that the maintenance of our standard of living was conditional upon an all-out effort to raise productivity and increase exports. Now, as Sir HARRY remarked last week, there is at least evidence that "recognition of these hard facts has begun to penetrate a good part of the community." It is essential, however, that leadership, whether political, industrial or economic, should concentrate all its energy on making them obvious to everybody. "I am confident," Sir HARRY continued, "that the community will be equal to the challenge, provided the common objective and common interests are clearly understood and not obscured by nebulous theories and wishful thinking, impracticable of fulfilment all at the same time in a world of realities." In Parliament this week, the "world of realities" has been painted in uncomfortable terms.

Utility and Quality Goods

LATER in his speech, Sir HARRY RAILING raised another matter of importance that has not so far received so wide a measure of attention as may be desirable. His remarks on this score bear quoting in full. Speaking of the present tendency to encourage the manufacture of utility standard goods, he urged that the manufacture of apparatus of a higher class should be carried on at the same time. "Utility goods, in many cases, will in the end be made locally abroad," Sir HARRY said, "and it is only by keeping ahead in advanced design and quality production that we can expect to maintain and ultimately increase our export markets. This applies equally to capital and consumer goods. Unless speciality production requiring high skill continues alongside quantity production, our special skills in design, production and special workmanship will unfailingly die out and will not be available when the present demand for utility goods is satisfied." If these markets disappeared this country would suffer more than any other, because more than any other it had gained from them in the past, when there was a reasonable consumption for a variety of quality goods within the country and when, on account of our reputation for quality, buyers preferred our products. "It is important, therefore," Sir HARRY added, "that the preference given to utility versus special quality products—fully justified within limits—should be applied with judgment and not pressed too far." At present, when there are good reasons why every possible export channel should be exploited to the full, a real danger exists that poorly designed or worthless goods, bearing the slogan "British-made," may be directed into still hungry markets overseas.

Load Staggering

INFORMATION relative to the schemes to be formed up and down the country with a view to bringing about a one-third reduction in the national peak load is still to the effect that there is nothing more positive than the fact that special committees, to deal with local problems are being set up. The latest of these is in the Eastern Counties, where the Regional Board has indicated that a District Committee will nominate one employer member and one trades unionist, who, with representatives of local electricity undertakings, will form town committees for operation in electricity authority areas. Each electricity undertaking is to be treated as a unit and the methods to be adopted for load reduction will be left to the town committees. The Eastern Regional Board itself has set up an electricity committee, the eastern region will be divided into three areas—Norfolk, Cambridgeshire and part of Suffolk; part of Suffolk and part of Essex; and Bedfordshire, Hertfordshire, and part of Essex. There will be an area committee in each section.

Portrait—The Earl of Mount Edgcumbe

THE son of Richard Edgcumbe, M.V.O., Sergeant-at-Arms to Queen Victoria, Edward VII and George V, the Earl of Mount Edgcumbe was born in Vienna in 1873. He was educated at Harrow School, in Germany, and at University College, London, of which college he was later made a Fellow. He was a student at Crompton's Arc Works, Chelmsford, before they were burnt down in 1896, and when the Northampton Polytechnic (then Northampton Institute) started in 1898, he became a lecturer there. In 1900 he founded, with E. I. Everett, the firm of Everett Edgcumbe and Co., with works, first at Charterhouse Square, London, with about 12 men, then at Great Saffron Hill and later at the Colindale Works, Hendon, where he was joined by Patrick Hamilton (late personal assistant to Lord Kelvin).

He became a Student of the I.E.E. in 1894, was elected President in 1928 and an Hon. Member in 1946. He joined the "Civils" as Student in 1894, and is now a Member. He is an Hon. Member of the E.R.A. and is now its President. Lt.-Col. K. Edgcumbe, as he is perhaps better known, is an Hon. Member of the "Dynamicables," having been a member since 1922; a Fellow and Past President of the Illuminating Engineering Society, and a Fellow of the Institute of Physics.

Lord Mount Edgcumbe is known as a specialist in electrical measuring instruments for industrial purposes, as well as in photometry, and he assisted A. P. Trotter in the construction of some of his early photometers—now in the Science Museum at South Kensington. Always interested in international work, he was Hon. Secretary of the International Electro-technical Commission for some 15 years, and was Vice-President of the International Commission on Illumination. He served for 25 years in the Territorial Army, having joined the London Electrical Engineers, when founded by Dr. John Hopkinson as President of the I.E.E., and he served all through the 1914-18 war and subsequently commanded an Anti-Aircraft Battalion of the Corps.

Among other items of personal interest, Lt. K. Edgcumbe has been Vice-President of the B.E.A.M.A. since 1929, he is a Justice of the Peace for Hertfordshire, and succeeded to the Earldom of Mount Edgcumbe in 1944.

Of two houses in Cornwall, the older (built about 1 250 and which has been in his family for nearly 600 years) is being given to the National Trust for the use of the nation; the other, Mount Edgcumbe, Plymouth, was almost burnt down by incendiaries during an air raid on Plymouth in 1941, but it is hoped to rebuild part of the house as a building of historic importance.

Lord Edgcumbe is a member of the Athenæum Club.

The subject of this week's "portrait" is well known for his work in the field of electrical measurements, and it is interesting to recall that he was, in his early days, an assistant to Mr. A. P. Trotter, Editor of THE ELECTRICIAN *from 1890-95, whose death on July 23 last, at the age of 91 years, was recorded in our issue of August 1.*

STAR CONNECTED RESISTANCES
TAKING BALANCED CURRENTS

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

IF three impedances are connected in star to a three-phase supply, the vectors of the voltages on the impedances will be represented by lines drawn from a point to the angular points of the triangle of line voltage vectors, and if the phase angles of the impedances are all equal, this point will lie within the triangle. If, further, the ohmic values of the impedances are all equal, then the point determining the vectors of the voltage drops will correspond geometrically to the neutral of the system voltages; these voltage drops will be identical with the star voltages of the supply as usually defined, and the positive and negative sequence components of the star voltages will be respectively identical with the star voltages derived from the positive and negative sequence components of the line voltages if these are unbalanced. Three impedances of similar phase angles, say, three non-inductive resistances, may have such ohmic values that, when connected in star, they take equal currents from an unbalanced voltage three-phase supply. In this condition the phase differences between the voltage drops on the resistances must have equal values of 120°, because the equal vectors of the currents must form a equilateral triangle, placed end to end. Such voltage drops of a star connected system of resistances taking balanced currents have some interesting properties, the most striking of which is that their arithmetical sum is the least possible for any kind of star connection.

The geometrical proof of this last statement is quite simple. In Fig. 1, ABC is the triangle of line voltage vectors, and O is a point within the triangle which determines three vectors of voltage drops on three star connected resistances. Suppose that the voltage between the star point and the line B has the value corresponding to the minimum sum, then as the other two voltages OA and OB vary, the point O will move on the arc of a circle having B as centre and OB as radius. According to a well-known geometrical principle, the sum of the distances OA and OB will be a minimum when the lines OA and OB make equal angles with the tangent to the arc of the circle at the point O, and as the radius OB is perpendicular to the tangent at O, this means that OA and OB must be equally inclined to BO produced. Arguing similarly, we see that, if OA has a value corresponding to the minimum sum, OB and OC must be inclined at equal angles to AO produced. It therefore follows that each of the vectors AO, BO and CO when produced will bisect the angle between the other two, so that the angles AOB, BOC and COA are each 120°. Thus, when the phase differences of the vectors of the voltage drops are each 120°, the arithmetical sum of

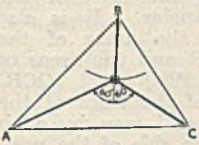


Fig. 1

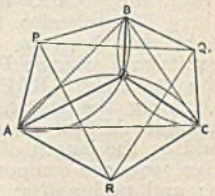


Fig. 2

these drops is the least possible for a stipulated line voltage vector triangle.

The geometrical construction for obtaining the point O for a given vector triangle is also very simple, and this construction is shown in Fig. 2, in which ABC is the line voltage vector triangle. On the sides of this triangle three 30° isosceles triangles APB, BQC and QCR are constructed. With centre P and radius PA the arc AOB is drawn, and with centre Q and radius QB a second arc BOC is drawn. These arcs intersect at O the required point. It is easy to see from the geometry of the diagram that as the angles in the circle segments AOB and BOC are each 120°, the angles AOB, BOC and COA all have this value and therefore satisfy the required condition. Further, as the angle in a segment of a circle having R as centre and RC as radius subtends an angle of 120°, three arcs so described will be concurrent. If the ohmic values of three star connected resistances are made proportional to the lengths of the vectors OA, OB and OC, then these resistances, when suitably connected to the system having the line voltage corresponding to the triangle ABC, will take equal and balanced currents.

The triangle PQR determined by the vertices of the 30° isosceles triangles is known to be equilateral and to be that of the positive sequence component voltages of the line voltages. The voltage vector OA is the join of the intersections of arcs struck with P and R as centres; it is, therefore, perpendicular to PR. Similarly

OB is perpendicular to PQ and OC is perpendicular to QR. Thus, the vectors of the voltage drops on the resistances are respectively perpendicular to the vectors of the positive sequence components of the line voltages. But the vectors of the positive sequence components of the star voltages corresponding to the triangle ABC are perpendicular to those of the positive sequence component vectors of the ABC system. Therefore, the vectors OA, OB and OB are in phase with the positive sequence component of the star vectors of the supply voltages.

Consider the hexagon APBQCR. Its area is equal to the sum of the areas of the triangle ABC and the area of the three 30° isosceles triangles. It is also equal to the sum of the areas of the equilateral triangle PQR and the areas of the triangles RAP, PBQ and QCR. Denoting the lengths of the sides of the triangle ABC in the usual way by a, b and c; the length of the side of the positive sequence component triangle PQR by p; and noting that OA, OB and OC are respectively perpendicular to and bisected by RP, PQ and QR, we can easily write down the two values of the area of the hexagon. For, the area of the 30° isosceles triangle BQC is equal to $\frac{a^2}{4\sqrt{3}}$, so that, if S is the area of ABC, the area of the hexagon is $S + \frac{1}{4\sqrt{3}}(a^2 + b^2 + c^2)$.

The area of the triangle PQR, with its equal sides of length p, is $\frac{\sqrt{3}}{4}p^2$ and as the area of the triangle RAP is equal to $\frac{OA}{4} \times p$, the area of the hexagon APBQCR must also be equal to

$$\frac{\sqrt{3}}{4}p^2 + \frac{p}{4}(OA + OB + OC)$$

Equating these two values of the area of the hexagon, we have

$$S + \frac{1}{4\sqrt{3}}(a^2 + b^2 + c^2) = \frac{\sqrt{3}}{4}p^2 + \frac{p}{4}(OA + OB + OC)$$

and multiplying throughout by $2\sqrt{3}$,

$$2\sqrt{3}\,S + \frac{1}{2}(a^2 + b^2 + c^2) = \frac{3}{2}p^2 + \frac{\sqrt{3}}{2}p\,(OA + OB + OC)$$

but the quantity on the left-hand side of this last equation is by symmetrical component theory known to be equal to $3p^2$. Thus,

$$\frac{3}{2}p^2 = \frac{\sqrt{3}}{2}p(OA + OB + OC)$$

and $OA + OB + OC = \sqrt{3}\,p = 3 \times \frac{p}{\sqrt{3}}$

so that the sum of the voltages represented by the vectors OA, OB and OC is equal to the sum of the three positive sequence component voltages of the star voltages of the supply system.

British Research in the Radio Field

THE publication of a report "British Research in the Radio Field," has been authorised by the Council of the I.E.E., and copies may be obtained at a cost of 1s. each. After reviewing the research at present carried out in Great Britain, the report emphasises that the work should be stimulated so that those engaged in it may receive a steady flow of new discoveries and ideas; an essential to a flourishing and progressive radio industry, capable of holding its own in the conditions of world-wide competition. The report draws attention to the necessity of research leaders and of workers trained in the research outlook, capable of tackling new problems as they arise, and able to assess the impact of discoveries on existing methods and techniques.

The extent of the research carried out in the universities, in Government establishments and in industry has been studied, and it is emphasised that an adequate proportion of the national man-power should be directed to the furtherance of research and development in the radio field. The effective co-ordination of the research work undertaken by various agencies now operating has also been examined and recommendations are made to foster discussions between those responsible for the conduct of basic researches.

The work undertaken by the Radio Components Research and Development Committee of the Ministry of Supply has been studied and though difficulties in peace-time may arise in obtaining a similar pooling of effort, the report recommends that the work should be continued in a wider field, by a committee sponsored perhaps by the Radio Industry Council and the Tele-communication Engineering and Manufacturing Association.

The early availability of research results is of vital importance and the report recommends that an agency should be set up to disseminate details of research work; the bureau might operate under the aegis of the D.S.I.R.

MODERN SUPERTENSION CABLES

by C. C. BARNES, A.M.I.E.E., A.I.I.A

Parts I and II of this series which appeared in THE ELECTRICIAN *of July 18 and August 1, respectively, reviewed the various designs of mass impregnated screened type cable and dealt briefly with Oil-Filled, External Gas Pressure, and one particular design of Internal Gas Pressure cable. In this, Part III of the series, further designs of Internal Gas Pressure cable are dealt with, and the main characteristics of the various designs considered, are summarised.*

The Impregnated Pressure Cable.[15]—The impregnated pressure cable is manufactured on much the same lines as the normal screened cable, viz.: the conductor is a standard stranding without smoothing or screening layers of metal foil and the dielectric is built up from impregnated paper, formed, dried, and vacuum impregnated in accordance with the normal technique used for solid type cables.

In order to allow the flow of gas throughout a length of single-core cable, the lead sheath is applied with a small clearance, and for three-core feeders a thick walled lead gas communication pipe is incorporated in one of the filler spaces in order to maintain gas flow along the cable under initial charging, and possible gas fault conditions.

The gas pipes are not joined at the cable joint positions but communicate freely with the interior of the joint.

In addition (if required), a two-core pilot cable, covered overall with a metallised paper electric screen, may be inserted in a second of the filler spaces, in order to provide an indication at the joint when the pressure in the joint falls to a predetermined level.

Each joint is equipped with a pressure switch, which is connected across the two cores of the pilot cable through a characteristic resistance which is different in every joint. Thus, when any switch is closed it is possible by resistance measurements on the cores of the pilot to determine which switch has been operated. At the end joint the twin pilot is brought out through the pressure retaining skin and is connected to a leak locating bridge.

Reinforcement of the lead sheath of the impregnated pressure cable to provide both longitudinal and circumferential strength is necessary. To control the longitudinal stresses (i.e., to reinforce the cable against the tendency to stretch axially under the internal pressure) a single layer of ½ in. wide tapes 10 to 20 mils thick are applied, butting at a lay angle of 20° on to the bedding wrapped over the lead sheath, followed by two circumferential tapes, one to two inches wide and 10 to 20 mils thick (the actual dimensions of the reinforcing tapes vary with the size of the cable) applied with an overlay of 50 per cent., to provide reinforcement against hoop or bursting stresses. Copper tapes are used on single-core and steel reinforcing tapes on three-core cables.

The impregnated pressure cable is formed with only one lead sheath, anti-corrosion protection of the reinforcement tapes and of the lead sheath is obtained by alternate layers of rubber tape (having 50 per cent. overlap) and bitumen impregnated cotton tape.

In 1944, an impregnated pressure cable —the first 3-core 132 kV cable ever to be placed in service—was manufactured and the principal dimensions are tabulated in Table 4.

TABLE 4
132 kV 3-core Impregnated Pressure Cable

Design	Thickness (inch)	Diameter (inches)
Conductor tinned copper 61/093	—	0.837
Dielectric (including M.P.)	0.500	1.837
Over laid up cores, M.P. screened pilot cable and gas pipe	—	3.930
Over C.W.F.T. binder ...	0.015	3.960
Lead sheath...	0.190	4.340
Over C.W.F.T.	0.015	4.370
Over steel reinforcement ...		4.540
Overall diameter		4.840
Maximum conductor temperature		85° C.
Elec. stress at conductor surface		93.5 kV/cm.
Rating of cable laid direct ...		450 A (103 MVA)

The Gas Cushion Cable.—The gas cushion cable[16] originally owed its name to the screened space between the dielectric and the lead sheath in which the inert gas was maintained, in a series of gas cushions formed by means of spiral spacers wound over the metallised paper screened core, the spacer being made up of layers of metallised paper retained in position by a narrow metal strip.

This metal strip was coated with a film of low melting point alloy before application to the cable, in order to make it subsequently adhere to the lead sheath and provide a barrier to prevent escape of gas.

The name is still maintained but the present gas-cushion cable[17] consists of the

normal conductor stranding to B.S. 480-1942, paper insulated (for a maximum operating stress of 85 kV/cm.) followed by a metallised paper screen.

After impregnation, free compound is removed from the outer surface of the cable and for single-core cables the sheath is applied loosely while in three-core cable the screened cores are laid up without any centre paddings and bound together with a fabric-tape binder incorporating copper wires as in the case of screened cables, no sheath clearance being allowed as there is sufficient inter-core space available to limit the maximum gas pressure in operation.

The lead sheath is wrapped with a bedding which usually consists of copper woven fabric tape, then, by one set of reinforcing tapes applied in two sections with reversed lay at an angle of about 45°.

Non-ferrous tapes (e.g., brass) are used for single-core cables, and for three-core cables tinned steel has advantages on the score of strength and cheapness.

The reinforcement is protected from corrosion by a second lead sheath followed by compounded coatings of fibrous materials, paper, cotton, and hessian, or any waterproof covering employing rubber in its composition can be used.

If the design with a second lead sheath over the reinforcement is utilised this double lead construction permits of accurate gas-leak location, using the circular space between the two lead sheaths.

The Gas Impregnated Cable.—One design of theoretical interest, but of doubtful commercial application is the "gas-impregnated" cable described by Armen[18], which represents the ultimate characteristics of the internal gas-pressure cable if the insulation is completely drained of oil.[19]

There is no oil in this cable, which was developed to take full advantage of the excellent dielectric properties of compressed dry nitrogen, at an operating pressure of 200 lbs. p.s.i.

This pressure eliminates ionisation under normal working conditions and the absence of impregnating compound results in a very low dielectric loss.

Limitations of this design, however, are the use of lead covered conductors (to reduce the maximum stress) and very thin (expensive) insulating papers resulting in a costly product, while the absence of a "slipper" compound impairs the flexibility of the cable, and the high thermal resistivity (1 300 thermal ohms/cm.^{3}), of the dry paper dielectric results in a reduction in current rating when compared with the gas and oil filled designs already described.

Summary and Comments.—The main characteristics of the commercial gas cable designs only are summarised in Table 5, the oil filled design, together with the Moellerhoj cable forming a separate group.

The above designs operate at a pressure of 200 lb. p.s.i. and the resulting increase possible for the maximum stress has the following important advantages:—1. The reduction in dielectric wall thickness results in a smaller and lighter cable for a given load, and thereby extends the sphere of the three-core cable. 2. The decreased dielectric thickness reduces the thermal resistance[20] of the cable, thus permitting an increased current loading. 3. The application of pressure to the dielectric controls the effect of heat cycles and makes it possible to increase the maximum conductor temperature to 80°C (85°C is quoted for the I.P. cable[15]) resulting in a further increase in the permissible current loading.

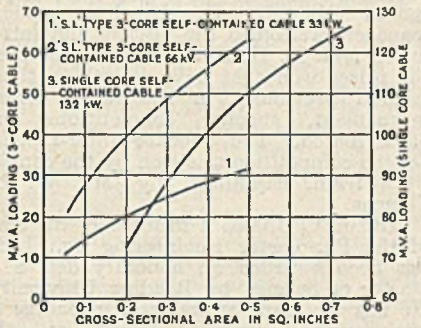
TABLE 5
British Supertension Gas Cable Designs

Designation	Normal and maximum operating gas pressure	Special characteristics	Maximum design stress	Permissible temperature rise*		Maximum conductor temperature
				Laid direct or in ducts	In air	
Compression cable (originally termed Pressure cable)	200 and 250 p.s.i.	The gas is separated from the oil impregnated dielectric by diaphragm lead sheaths	70-110 kV/cm	65° C	55° C	80° C
High pressure gas-filled cable	200 and 250 p.s.i.	(1) Conductors passed through smoothing dies to provide a flat bed for screening metallised papers applied over the strand (2) The dielectric is built up from pre-impregnated paper tapes (3) Nitrogen gas is in contact with the dielectric	Up to 85 kV/cm	65° C	55° C	80° C
Impregnated pressure cables	200 and 250 p.s.i.	Nitrogen gas is in contact with the dielectric	93.5 kV/cm	70° C	60° C	85° C
Gas-cushion cable	200 and 250 p.s.i.	Nitrogen gas is in contact with the dielectric	Up to 85 kV/cm	65° C	55° C	80° C

* Assumed ground temperature 15° C; assumed ambient air temperature 25° C.

To date British practice adopts high gas pressure, 200 lb. p.s.i. gauge, for 66 kV, and higher operating voltages (oil filled[21] cables are normally designed for lower, hydrostatic, pressures), but one American[22 23] company has subdivided their cables for voltage ratings from 10 kV to 138 kV as follows :—

Low pressure gas-filled cable systems, 10 kV to 40 kV operating at gas pressures from 10 to 15 lb. p.s.i. Medium pressure



Ground temperature 15°C. Maximum conductor temperature 80°C. Depth of laying 42 in. Soil thermal resistivity 120°C/W/cm.

Fig. 1.—MVA loading for "SL" type self-contained compression cable, laid direct in ground. MVA loading for "SO" construction and pipe line is slightly lower

systems, 40 kV to 69 kV operating at gas pressures from 24 to 40 lb. p.s.i. High pressure systems 69 kV to 138 kV operating at gas pressures from 150 to 200 lb. p.s.i.

When comparing screened type cables with gas or oil filled cables for 33 kV operation (which represents the lowest possible economic level for these special designs), the following points should be noted :—

1. 33 kV screened type cables are invariably wire armoured (British practice, but many European users specify steel tape armoured 33 kV cables for economic reasons), and designs of gas and oil filled cables for 33 kV generally have a reinforced lead sheath and a second lead sheath, or some combination of textile and rubber corrosion resisting finish, which results in a lower degree of mechanical protection.
2. Gas and oil filled cables for 33 kV have been used to a limited extent but, in general, screened type cables are adopted.

For higher voltages the relative merits of the various super-voltage designs require individual considerations since performance characteristics and economic levels are still far from being finalised.

Fig. 1 provides MVA loadings for various designs of compression cable—space limitations prevent a detailed comparison of the permissible loading for all the designs considered but, in general, for a given load, and voltage, the conductor section for each type of gas and oil filled cable is approximately the same.

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Consent has been given to West Ham to the extension of the Canning Town generating station. The work will include the installation of a 30 000 kW turbo-alternator, two 180 000 lbs./hr. boiler units and a 2.8 million galls./hr. cooling tower, together with all necessary building and civil engineering work.

• 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. T. D. MARTIN, Nelson borough electrical engineer, has been asked by Colne Corporation to act in a joint capacity by taking charge of their electricity

MRS. D. H. KENDON, *wife of the general manager, presenting the sports prizes at the S.W. and S. Electric Power Co.'s garden party at Mucklow Hill*

undertaking. Ald. E. Duckworth, chairman of Colne Electricity Committee, said the appointment would date from August 1 and remain until March 31 next year, when the position would be reviewed.

MR. T. L. BIRRELL, sales director of B.X. Plastics, and Mr. H. Senior, managing director of Caseeloid, have been appointed directors of British Xylonite.

MR. ERNEST WHITLOCK TURNER, vice-chairman of the Electricity Committee, is to be Croydon's next Mayor. Mr. Turner has been prominent in local affairs for many years.

MR. R. F. GYNGELL, who has been assistant secretary of the company for a number of years, has been appointed secretary of W. T. Henley's Telegraph Works Co., Ltd., as from August 1, in succession to Mr. A. H. M. Jacob, who resigned the position when he became an executive director of the company.

The unpleasant weather conditions that prevailed did not damp the spirits of the staff of the S.W. and S. Electric Power Co., numbering nearly 380, with their relatives and friends, who attended a garden party in the grounds at the central offices of the company at Mucklow Hill, Halesowen, recently. There were games of skill and side shows and, in spite of a late start and interruptions by heavy showers, a full programme of novelty sporting events gave pleasure to the participants and provided amusement for the onlookers. At the conclusion of the sports, Mr. D. H. Kendon, general manager, welcomed the visitors and introduced Mrs. D. H. Kendon, who presented the prizes won that day, as well as those secured previously in the table tennis tournament, snooker competitions and bowls match. The Snooker Inter-District League competition was won by the central office team, captained by Mr. W. H. Thomas.

MR. J. T. GALE, a member of the staff of the Pulsometer Engineering Co., Ltd., has been awarded an honorary degree of Master of Science by Reading University. He has for many years been in charge of engineering evening classes at the university.

MR. O. G. COOK, chief electrical engineer and manager to the Bingley Urban District Council, has been elected chairman of the Mid-East England Centre of the I.M.E.A. Mr. Cook has been vice-chairman for the last two years, and for some years has been a member of the Council of the I.M.E.A.

Fine weather and a good attendance of spectators and athletes contributed to the success of the Ekco fifth annual athletic meeting held at the company's sports

MRS. E. K. COLE, *wife of the managing director of E. K. Cole, Ltd., who presented the prizes, receives a bouquet from a competitor at the Ekco's fifth annual sports meeting*

ground, on Saturday, July 26. The inter-departmental tug-of-war between the plastics, offices and radio divisions went to plastics division who beat offices by two

pulls to one. In spite of this defeat, however, the offices were the winners of the inter-departmental athletic trophy, with 53 points, the runners-up being plastics division with 49 points. At the conclusion of the meeting, Mr. D. Willman, chairman of the Ekco Social and Sports Club, introduced Mr. E. K. Cole, managing director, who congratulated all those taking part, on their fine athletic display. A bouquet from the club was presented to Mrs. Cole, wife of the managing director, who distributed the prizes.

PROF. J. D. COCKCROFT has had a slight operation in a nursing home at Oxford. He is making a good recovery.

MR. LESLIE GAMAGE, vice-chairman and joint managing director of the General Electric Co., Ltd., has been appointed chief business adviser to Lord Nathan, Minister of Civil Aviation.

MR. B. A. ENSELL has been appointed managing director of Moulded Products, Ltd. Mr. N. D. Newall and Mr. H. P. Bridge have joined the board. Mr. D. E. Lowndes, the works manager, has been appointed works director. Mr. H. W. F. Ireland still retains his interest as director of the parent company, National Plastics, Ltd., and the subsidiaries, British Moulded Plastics, Ltd., and Moulded Products, Ltd.

MR. C. MILTON MARSHALL, the works manager, of British Moulded Plastics, Ltd., has been elected to the board and appointed works director.

MR. B. C. WESTALL and Mr. J. Eerdmans have resigned their directorships of Scottish Plastics, Ltd., and Mr. C. Milton Marshall has been elected to the board.

MR. F. J. HARDY, a Northern representative of Ekco-Ensign Electric, Ltd., has been selected to play tennis for Yorkshire at the county championship tournament at Cheltenham. Mr. Hardy, who was with E. K. Cole, Ltd., before the war, has a distinguished war service record with the R.A.F. He gained a D.F.C. and A.F.C. as a bomber pilot.

MR. ARTHUR J. WILDE, of Burnley, who has gained a B.Sc., in Mechanical Engineering at Manchester University, is, we understand, to take up an appointment as assistant constructional engineer in Blackburn electricity department. Mr. Wilde's university course was interrupted by Army service in Italy and Palestine. He attained the rank of captain.

MR. C. DITCHFIELD, Dean Golf Club, Bolton, won the competition held by the Lancashire and Cheshire Radio and Electrical Industries Golfing Society, for the "Manchester Evening Chronicle" Challenge Cup at Ringway Golf Club, Cheshire. His score was 82 gross, less 12-70 net. Three members, Messrs. C. M. Gadd, R. L. Scott, and L. Gilbert, tied for second place with scores of 73 net. The subsidiary 9-hole greensome competition for prizes presented by Mr. B. H. C. Moore, was won by Mr. J. Duxbury and Mr. G. Smallman with a score of 2 up.

MR. REGINALD F. NORRIS, former sales manager, oil engine division of John Fowler and Co. (Leeds) Ltd., has joined the sales staff of Associated British Oil Engines Ltd. Consequent upon the acquisition by the latter company of the Fowler engine business. Mr. Norris was a member of the London sales organisation of the Metropolitan-Vickers Electrical Co., Ltd., from 1924 to 1936.

A.P.L.E. Conference

THE nineteenth annual meeting and conference of the Association of Public Lighting Engineers will take place in the Cambridge Hall at Southport from September 15 to 19, the headquarters being at the Prince of Wales Hotel. The preliminary programme is as follows:—

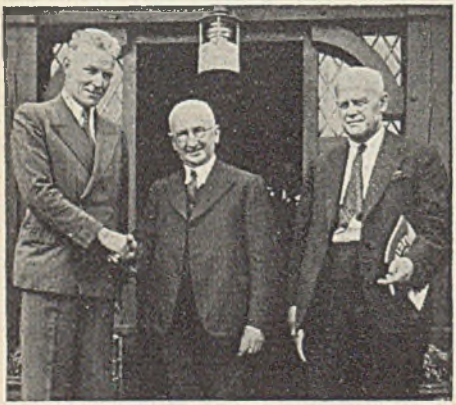
Monday, September 15: 2.30 p.m., Council meeting; 3.30 p.m., annual general meeting; 4 p.m., official opening of the Conference by the Mayor of Southport. Induction of new president, Mr. Thomas Wilkie (lighting engineer, Leicester); 7.30 p.m., reception by the Mayor of Southport in the Floral Hall. Tuesday, September 16: 10 a.m., Presidential Address, Mr. Thomas Wilkie; 11 a.m., Conference session. Paper: "Street Lighting in Relation to Road Safety, Traffic Problems and Crime Prevention," by Mr. A. E. Marchant (Barking) and Mr. Robert Bell (Erith); 2.30 p.m., Paper: "Maintenance of Street Lighting" by Mr. J. Woodhouse (Sheffield). Wednesday, September 17: 10 a.m., Conference session. Paper: "Photometry in Relation to Public Lighting," by Dr. S. English; 12.30, Conference luncheon in Floral Hall; 2.45, Conference session. Manufacturers will explain details of street lighting installations erected for the Conference on roads specially allocated in Southport. Evening: Official inspection of outdoor demonstration of street lighting. Thursday, September 18: 10 a.m., Conference session. Paper: "Lighting of Class 'B' Side and Residential Roads," by Mr. R. W. Steel (Cheltenham); 2.30, Paper: "The Royal Fine Art Commission and Lamp Columns," by Mr. A. B. Knapp-Fisher; 8 p.m., reception by the President, followed by a dance and entertainment in the Floral Hall. Friday, September 19: Coach tour (destination to be arranged) via Liverpool, where the Mersey Tunnel lighting will be inspected.

New Showrooms and Offices

English Electric Open Premises in Blackburn

AT a luncheon following the opening by Ald. E. Porter, M.P. for Warrington and chairman, Blackburn Electricity Committee, of a new sub-office and showrooms of the English Electric Co., Ltd., in Preston New Road, Blackburn, on July 29, Mr. E. B. Banks, commercial manager of the company, who presided, handed to the Alderman a birthday gift in the shape of one of the company's electric radiators.

After drawing attention to the company's world-wide ramifications, Mr. Banks said those connections had brought a vast amount of business to the city. Sir George Nelson, chairman of the company, was leading a delegation to Russia with trade negotiations in view and these would, he hoped, result in further business. Apart from their overseas connections, the company had always maintained close contact with Lancashire, for among the constituents of the original merger under the English Electric banner were Dick Kerr's of Preston—not only pioneers in electric traction, but also builders of bomber engines during the war period, under the guidance of Mr. A. Sheffield, the works manager. The English Electric Co. had struck another root in Lancashire, in reply to the Government's request that they should take over the Napier shadow factory at Liverpool; those works had now been converted into an English Electric factory and would give employment to a good many people in that part of Lancashire.



MR. E. B. BANKS, *commercial manager, English Electric Co., Ltd., welcoming* ALD. E. PORTER, *with* MR. G. F. SILLS *on right*

Mr. Banks spoke of the company's close associations with the power stations of Lancashire, particularising the installations at Blackburn, Preston, that of the Mersey Power Company, at Wallasey, Bolton, Warrington, the Lancashire E.P. Co., and elsewhere.

Ald. Porter said his presence at the opening of the showrooms was due to the prompting of Mr. R. H. Harral, engineer and manager, Blackburn, who apparently had made all arrangements in the knowledge that his birthday fell that week. Like other electrical concerns in Lancashire, the Blackburn undertaking had done a great deal of spade work to encourage textile industrialists to modernise their plant and equipment.

ALD. PORTER *performing the opening ceremony, supported by, among others,* MR. R. H. HARRAL, *engineer and manager, Blackburn*

Exhibits for "Enterprise Scotland, 1947," the Scottish National Exhibition of Industrial Design which opens in Edinburgh on August 25, have now been chosen by the selection committees whose emphasis has been on good design, craftsmanship and finish.

Among manufacturers whose goods have been selected for display are the following:—Scientific instruments: Barr and Stroud, Ltd., Dent and Co. and Johnson, Ltd., Ferranti, Ltd., Kelvin, Bottomley and Baird, Ltd., Lumsden Lamp Co. Electrical appliances: Aeroplastics, Ltd., British Made Electrics, Ltd., British National Electrics, Ltd., E. K. Cole, Ltd., Ekco Ensign Electric Ltd., J. and G. Coughtrie, Ltd., Robert Maclaren and Co., Ltd., Scottish Heat and Vacuum, Ltd. Domestic appliances: Acme Wringers, Ltd., British Vacuum Cleaner and Engineering Co., Ltd., Carron Co., the Falkirk Iron Co., Ltd., James Howden and Co., Ltd., Lane and Girvan, Ltd., Napier Brothers, L. Sterne and Co., Ltd., Vactric, Ltd. Radio: E. K. Cole, Ltd., Philips Hamilton Works, Ltd., Vidor, Ltd. Clocks: Smiths English Clocks, Ltd.

Motor H.P. at Partial Loads

By A. N. D. Kerr, A.M.I.E.E.

WORKS engineers are aware of the drawbacks of using motors larger than are necessary for their drives, as such overmotoring results in low power factor and poor load factor. In trying to match motor output to load requirements, however, they often find difficulty in determining merely from ammeter readings the actual horsepower being developed by the motor. What they need is a curve connecting the ampere input and horsepower output. In the absence of efficiency figures an approximation to such a curve may be constructed by the simple graphical method described below.

The only information required is the full load current, as stamped on the motor nameplate, and the no-load current, which may be determined by completely disconnecting the driven equipment and measuring the current on a suitable ammeter, accuracy in obtaining this reading being reflected in the accuracy obtainable from the curve.

Where it is not practicable to remove the load, the no-load current may be assumed from the following table which

Synchronous r.p.m.	3 000	1 500	1 000	750	600	500
No load current as a percentage of full load	25	30	35	40	50	55

gives the magnetising current as a percentage of full load current for a number of standard speeds.

These values relate to medium size motors of 5 H.P. and upwards; for lower integral horse-power ratings down to 1 H.P. the values may have to be increased by as much as 50 per cent. The percentage no-load current increases with the number of poles due to the increase in magnetising current required.

As these are only average values and individual motors vary appreciably, it is preferable wherever practicable to take an actual current reading. With modern instruments of the clip-on or Tong-Test type there is no need to disconnect the leads to the motor. It is, however, necessary to ensure that all load is removed from the motor when taking the no-load reading. A light load reading will give unreliable information.

The graph is constructed as shown in Fig. 1; 100 per cent. represents full load current and rated output. Through the 50 per cent. output reading a vertical line is drawn. Point A represents the 100 per cent. value, point C the no-load value, expressed as a percentage of the full load figure. Point D is then determined, as it is halfway between C and the point of origin.

Points A and D are joined by a line which cuts the 50 per cent. output line at point B; finally B and C are joined. The curve ABC now represents for different motor horse-power outputs the corresponding current inputs; the current in every case being expressed as a percentage of nameplate or full load value.

For example, consider a 25 H.P., 1 000 r.p.m. induction motor with a full load current of 34 A. By actual measurement the no-load current is found to be 12 A

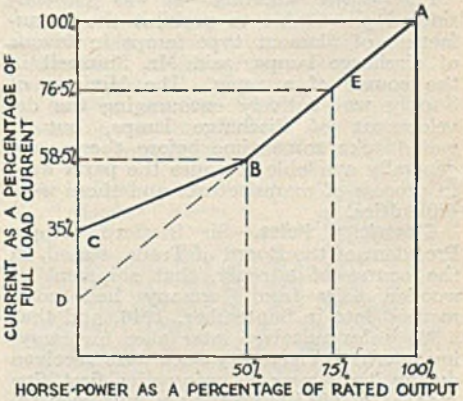


Fig. 1

(or 35 per cent. of the nameplate full load figure). Point A as 100 per cent. will then correspond to 25 H.P. and 34 A; point C as 35 per cent.; point D being halfway between point C and the origin will be 17½ per cent. and by joining A and D this gives point B on the half load output, which will be found to be 58.5 per cent. of full load current—a figure very near for the machine considered.

Assume a partial load measured as 26 A input; which corresponds to 76.5 per cent. of the nameplate current. This gives point E on the curve and from the curve we see this current input obtains at 75 per cent. of the rated H.P. output; or ¾ of 25 H.P. So that at 26 A the load or drive requires 20 H.P.

This method is usually accurate to within 5-10 per cent. If the nameplate figure is correct at rated voltage and the no-load current is actually measured on the motor under test a high degree of accuracy may be relied on.

In Parliament

Cooker Production.—Replying to Mr. Chetwynd, the Minister of Supply stated that 18 130 electric cookers were produced during April, 1947. This compared with 20 080 coal-burning ranges and 33 050 gas cookers.

Amplifier System, House of Commons.—The Minister of Works stated, in reply to a question, that engineers of the Ministry, in conjunction with the B.B.C. and other experts, would make tests on improved systems of sound amplification in the House of Commons throughout the Recess. It was hoped to instal, next year, a permanent new system which would improve audibility in all parts of the House.

Fluorescent Lighting.—It was not considered practicable to prohibit the manufacture of filament type lamps in favour of discharge lamps, said Mr. Shinwell in the course of a reply. The Minister of Supply was actively encouraging the development of discharge lamps, but it would take some time before these were generally available, because the parts were in process of manufacture, and there were difficulties.

Electricity Poles.—Sir Stafford Cripps, President of the Board of Trade, stated, in the course of a reply, that shipment of wooden poles from Germany had commenced late in September, 1946, and that 5 348 poles suitable, inter alia, for carrying overhead electricity lines were received during that year. During the first five months of 1947, 19 590 poles had been received from this source, and it was hoped they would continue to arrive at the same rate during the second part of the year. A fair proportion would be made available for electricity purposes.

Telephone Statistics.—Replying to a question, the Postmaster-General gave the number of telephone stations per thousand of the population for 1945 (the latest year for which figures were available) as follows:

United Kingdom	86
Belgium	45
Bulgaria	7
Denmark	140
France	46
Mexico	10
New Zealand	152
Norway	109
Portugal	4
South Africa	22
Sweden	183
Switzerland	148
United States	211

Approximate figures for the surpluses of income over expenditure (after charging interest on capital) for the telephone service in this country were: 1944-45, £23 000 000; 1945-46, £20 600 000; 1946-47 (provisional), £14 000 000. Comparative pre-war figures were: 1937-38, £429 000; 1938-39, £269 639; 1939-40, £995 156. The gross number of telephones installed at March 31, 1947, was 832 101, representing an increase of 65.1 per cent. over the previous year and an increase of 224.6 per cent. over the level of 1932.

Coal Washing Plants.—Between the end of 1945 and the end of 1946, Mr. Shinwell stated, 39 coal cleaning plants, including washeries, were installed. During the same period, 41 plants were dismantled. The total number of plants at the end of 1946 was 542, and during that year 47.4 per cent. of the total output of saleable deep-mined coal was cleaned before sale.

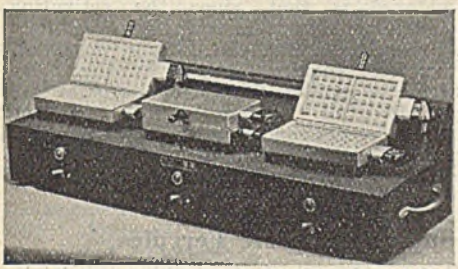
District Heating Schemes.—In the course of a reply, Mr. Shinwell said that district heating schemes had been approved and were under construction at Urmston, Salisbury and Bonnyrigg, and, in addition, 23 other schemes scattered throughout the country had been submitted to the Committee on District Heating or were known to be under construction. None of the schemes was in a sufficiently advanced state to establish the costs of operation or what saving in fuel could be achieved.

Electricity Bill.—The Lords amendments to the Electricity Bill were considered in the House of Commons on Tuesday. One, seeking to insert into the Bill special provision for holding companies, was rejected, and Mr. Shinwell then moved to disagree with an amendment which would have made provision for the creation of an authority to examine tariffs and consider appeals against charges. While he was in full sympathy with the principle embodied in the amendment, the Minister said, he could not accept it in the form proposed. He would look into the matter before the Bill was considered in its final form in the House of Lords, and if he could find a convenient form of words would arrange for their insertion. Failing that, he would ask for powers to enable him, as Minister, to create some form of independent body—not necessarily a tribunal, but of an advisory character—so that in the event of disagreement between the consultative councils, area boards and the Central Authority, he would not be the sole person to decide matters affecting tariff rates. The motion to disagree was carried, and the House then agreed to the remaining Lords amendments. The position arising from the Government's rejection of the Lords amendments was considered in the House of Lords later in the week.

Equipment and Appliances

Catering Model Waffle Machine

The "Lexington" waffle-making machine, recently described in these columns, has now been designed as an industrial model for the catering trade. Three waffle elements are mounted on a metal base, with separate indicator lamps

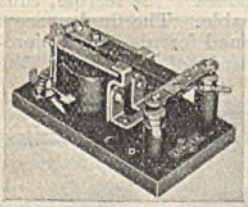


This three-element "Lexington" waffle machine is for catering establishments

and switches for each. The waffle units themselves, which are constructed throughout in aluminium, each employ a 450 W nickel-chrome tape element in the top and bottom sections. Large Bakelite handles allow easy handling over long periods. The input sockets are mounted on mica supports, and connection is made to the mins with three-core flex' terminated by two side-entry shrouded plug sockets on each waffle machine. The total loading of the industrial unit is 2.7 kW.

Relay for 10 kV Working

A high-voltage relay, designed during the war by Londex, Ltd., of 207, Anerley Road, London, S.E.5, for use in aircraft wireless equipment, and until recently retained on the secret list, is now available for industrial use. A coil excitation of between 19-24 V d.c. can be used, it is claimed, to control high-voltage transmission up to 10 000 V at ground level or 8 000 V at high altitudes. The switching capacity, which depends on the nature of the load and voltage, is given as 10 000 V a.c. at 50 mA or 230 V a.c. at 5 A. Working in any position, the relay is vibration proof and has two sets of 8 mm. silver contacts to give double make and double break action. If required, a third contact, to make when the h.t. contacts open, can be supplied for earthing or other purposes. The relay weighs approximately 4 oz., is mounted on a plastic base and is recommended for the control of anode circuits or h.t. test gear. The coil resistance is 160Ω.

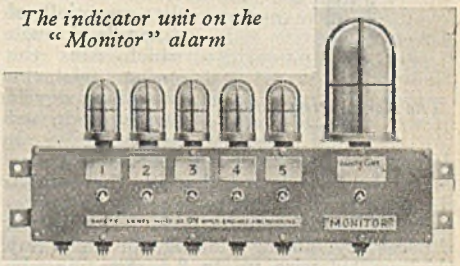


Londex 10 kV a.c. relay

Safety Alarm System

Up to the present time, it is stated, nearly a thousand ships have been fitted with safety alarm equipment designed by Mr. C. L. Stokoe for Monitor Patent Safety Devices, Ltd., of King's Road, Wallsend-on-Tyne. The instruments also have numerous land applications, of which the monitoring of transformer oil-cooling systems, or of the forced lubrication systems of oil engines, steam turbines and water turbines are typical examples. The "Monitor" alarm system consists of a central panel, to which may be connected up to five satellite instruments. These, depending on the type of installation in use, may consist of thermostats, float or

The indicator unit on the "Monitor" alarm

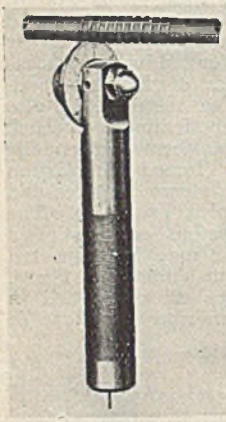


pressure alarms or flow indicators. The central panel is fitted with a large red "danger" lamp, and five small white pygmy signal lamps. On the operation of any one of the alarm circuits—which are connected to the central panel through three-core cables—as a result of rising temperature, a failure of the cooling supply or other dangerous symptom, the danger lamp is switched on, while the relevant pygmy lamp goes out, thus indicating the part of the installation in which trouble has occurred. The danger lamp can be made to flash, if required, and an audible alarm can be connected in parallel with it. The engine-room lighting circuit is normally used to operate the equipment, and isolating switches allow the alarm to be shut off in any particular circuit. A typical installation, applied to an oil engine, would consist of a shut-off valve fitted in the fuel-oil line and arranged to stop the engine if the lubricating oil or cooling water fails; a float alarm, giving warning

of low level in the fuel tank, a thermostat to monitor the temperature of the cooling water outlet from the jackets; a flow indicator showing the intensity of flow to jackets and giving the alarm if the flow falls below a certain level and a pressure alarm which responds to low pressure in the lubricating oil delivery manifold to the bearings.

Spring Winding Tool

A small tool which should prove useful in medium or small workshops, or in larger concerns where small quantities of special springs may be required, is the "Universal" helical spring winder recently introduced by the Acru Electric Tool Manufacturing Co., Ltd., of 123, Hyde Road, Ardwick, Manchester, 12. The winder consists essentially of a handle through which runs the spring wire, a tensioning device and a graduated wheel which determines the spacing between turns. Since the wire is fed through the handle, the makers claim, there is safety in operation, while the tension can be adjusted, if necessary, during winding, for which any thickness of wire up to 2.5 mm. may be used. A spare fibre friction disc is supplied with each winder as, if required, is a box of assorted lengths of spring wire.



The Acru spring winder in use

Soldering Fluids and Fluxes

Recently developed by H. J. Enthoven and Sons, Ltd., of Thornton Road, West Croydon, Surrey, is a soldering fluid which they have called "Tricence." Pointing out that the ideal soldering flux is one that will react vigorously during the soldering operation, but which will leave no subsequent residue, the makers claim that in the new flux both these conditions are satisfied. Technically, they state, the fluid is an aqueous solution of a compound which contains an inorganic acid bound to a non-metallic organic base. This compound decomposes at the temperature of the operation and sets free an acid to clean the metal surface, as well as a strongly reducing base to break up the oxide film and keep the joint clean. The component parts of the flux are completely broken up and dissipated into the air during the soldering operation, and there is thus no residue remaining to affect the joint. After an investigation in the laboratories of a London hospital, it is claimed, it has been established that the new flux is considerably less toxic under ordinary soldering conditions than the zinc chloride fluxes. An allied product is "Telecene" rosin-based liquid flux. This consists of rosin dissolved in spirit with the addition of an activitating medium. A feature of this material is that, since the activating medium is soluble in rosin, it is not held in suspension, and the solution does not, therefore, require frequent stirring. By virtue of rapid-working characteristics and its improved "wetting" properties, the flux is recommended for telephone work, where an excess of pre-tinning metal within slots, hooks and shoulders of soldering tags would be undesirable.

Solderless Cable Ferrules

A rapid method of attaching ferrules to insulated cables which, they state, has been used successfully in Switzerland for many years, has recently been introduced by the Bowthorpe Electric Co., Ltd., of Goodtric Works, Brewer Street, Oxford. Its advantages are said to be that it dispenses with the need for soldering, and averts repairs arising from burnt insulation, while the end of the ferrule protects and anchors the insulation. The makers especially recommend the method for connections where ferrules are subject to heat —as in cables connected to resistances or electrodes—since the absence of solder reduces any risk of melting. The ferrules take the form of a copper shell which is placed over the end of the bared cable and then inserted in a simple tool, the top of which is struck firmly by a hammer: this "pinches" the ferrule, thus securing it to the cable. The final process is to place the flattened ferrule into a piercing tool for insertion of a hole of the required size. Two main types of ferrule are available, each with a variety of lengths and internal diameters, for normal and heavily insulated cables. In the latter case, the ferrule is made with a slightly bulged open end.

Illustrating the stages in the application of Bowthorpe ferrules

Developments in India

From Our Own Correspondent

QUESTIONS relating to the control of electricity supplies and finance in India, and which affect the growth of power supply undertakings in the country, were recently discussed at an electricity conference held at Simla, Mr. D. L. Muzumdar, Secretary, Works, Mines and Power, presiding. The discussions were based on the principles already recommended by a Special Advisory Board of the Government, of which Mr. H. M. Mathews, Electrical Commissioner to the Government of India, was chairman.

Mr. Muzumdar pointed out that the principles, far from introducing control over the supply industry, constituted only an attempt to remove certain anomalies in the working of the Indian Electricity Act, 1910. Moreover, though the Advisory Board had recommended that the principles could constitute the Sixth Schedule of the Electricity Bill, they were neither merely its adjunct nor its incident. In fact, added the Chairman, the principles could be incorporated in the existing Act of 1910, in which case the Provincial Governments would enforce them directly.

The principles devised to regulate the finances of private electricity companies were intended to safeguard the interests of the consumer and the investor without, at the same time, impairing the reasonable gains of the entrepreneur. To achieve this, they attempted, in the first place, to reduce the selling price of electricity by limiting the interest charges and fixing the dividends payable to an extent which would not affect the flow of development capital into the business. Secondly, the principles allowed a reasonable or fair return on investments and enforced a system of compulsory depreciation. They also sought to regulate the commission and expenses of managing agents within reasonable limits, special regard being paid to the circumstances of the industry.

While general agreement prevailed on the broad fundamentals of the principles, discussion at the conference centred round the specific formulæ to make the necessary calculations. These formulæ related to capital, the basis on which dividends, etc., had to be fixed, the standard rate by which the reasonable return to companies would be determined, the depreciation fund, and the managing agents' remuneration. The consensus of opinion at the conference favoured the application of the definition to new electricity undertakings only, and the exemption of existing companies, as it might clash with their present commitments.

The Chairman said the proposed depreciation fund scales could be revised. He also assured the conference that the Government would consider how best to apply the principles relating to the depreciation fund without straining the financial position of those companies obliged to make up arrears in this respect. While it was contended, on the one hand, that electricity companies need not pay their shareholders more than 2 or 3 per cent. above "gilt-edged" securities, it was urged, on the other, that the return to shareholders' companies should approximate to that from other ordinary undertakings. The Chairman, summing up, said that while electricity undertakings were not to be penalised by the fixation of unduly low rates of return on the capital invested, they should be distinguished from other industrial undertakings by virtue of their enjoying a limited monopoly. The proper rate of return on the capital invested would be one midway between the rate on hazardous industrial undertakings and that on gilt-edged securities.

The Chief Electrical Engineer of Hyderabad stated at a Press conference that his Government contemplated an increased tariff as a result of an increase in salaries of employees, and to meet increased cost of materials, due to inflationary conditions and the increase in the price of coal.

The Government of Madras has sanctioned an estimate of Rs. 2 640 000 for the advance construction (instead of in 1951-53) of the Madura-Tirumangalam-Rajapalayam-Tenkasi 66-kV transmission line with pilot telephones, and three sub-stations, in the Papanasam hydro-thermal electric system. The scheme is intended to meet a large demand for power that has arisen in the Tenkasi, Rajapalayam and Tirumangalam areas, especially for agriculture and industrial requirements.

These observations on the position of the supply industry in India were made by our correspondent in Colombo, and relate to the consideration being given to certain anomalies in the working of the 1910 Electricity Act. Company undertakings in particular are affected, as also are consumers. Commissions and expenses paid to managing agents have been under review, but our correspondent gives no indication of the conclusions reached.

BOOK REVIEWS

Economics In One Lesson.—By HENRY HAZLITT. (London: Ernest Benn, Ltd.) Price 6s. net.

Satiated as we have become in the technical verbiage of fashionable economics, it is refreshing to find an economist writing simple understandable English. There is no drudgery, no headache in Mr. Henry Hazlitt's book; it provides a couple of hours of good reading and, strangely enough for a work on economics, intellectual comfort. The Economic Sophisms of Frederic Bastiat, now more than a century old, have provided the framework into which the author has fitted a wealth of modern illustration, but the simple story is just as told by the greatest of all the classical French economists. It might be called "Cause and Effect," "The Second Move," or "Action and Reaction," and it sets out to remind us that when we confer a benefit on Mr. "A," we also impose the cost of it on Mr. "B" or Mr. "C." When the benefit and cost are of equal value the process may be worth-while; if, for instance, the miner is four times better off by quadrupling the price of coal then the processes, political or otherwise, which have given such results may be generally acceptable. But in most of these movements too little thought and attention are given to "the forgotten man" who is now paying, in both money costs and shortage, far more than the total of the benefits so readily voted to organised sections and classes. Much of the widespread human distress is directly due to "the insane doctrine of wealth through scarcity." It is a doctrine that may always be privately true, unfortunately, for any particular group of producers considered in isolation—if they can make scarce the one thing they have to sell while keeping abundant all the things they have to buy. But it is a doctrine that is always publicly false. It can never be applied all round the circle. For its application would mean economic suicide. It does not necessarily follow that every political proposal is under all conditions unsound. There may be times when an increase in debt is a minor consideration as against the gains achieved with the borrowed funds. But we ought to make sure in each case that due study has been given to both action and reaction, and this is seldom done.

Thus the exploitation of capital by labour can at best be merely temporary; it will quickly come to an end. Even though labour for a time will have a greater relative share of the national income, the national income will fall absolutely; so that labour's relative gains in these short periods may mean a Pyrrhic Victory; they may mean that labour, too, is getting a lower total amount in terms of real purchasing power. Yet Governmental policy, almost everywhere, tends to assume that production will go on automatically, no matter what is done to discourage it. One of the greatest dangers to production to-day comes from Government price-fixing policies. Not only do these policies put one item after another out of production by leaving no incentive to make it, but their long-run effect is to prevent a balance of production in accordance with the actual demands of consumers. This book is badly wanted and should find a ready welcome.

Electrical Testing for Practical Engineers. By G. W. STUBBINGS (London: Spon). pp. 261. Price 12s. 6d.

This book describes the type of testing which must commonly be carried out by the maintenance engineer of a factory or the installation staff of an electrical contractor. Proofs of formulæ and all mathematics, other than simple arithmetic, are omitted. The early chapters describe the common types of instrument, shunts and current transformers, simple test equipment and methods of carrying out basic tests such as the measurement of resistance by various methods, instrument calibration, continuity tests and insulation resistance measurements on dead and live circuits. Succeeding chapters cover the application of the above principles to the testing of wiring installations (with special reference to the I.E.E. Regulations), various three-phase circuits, current-transformer connections for simple protective gear, switchgear and relay operation, and finally insulation temperature rise and winding-fault location for machines and transformers. A good maintenance engineer should be able to locate and rectify unavoidable faults with a minimum of delay but a better engineer will foresee, and therefore prevent, possible faults by the periodic carrying out of routine tests and the keeping of careful records. Although the author might have placed rather more stress on the latter aspects he is to be commended on having produced a book which will undoubtedly be popular with and useful to practical engineers, both in their handling of faults and in the carrying out of simple acceptance tests on their plant. E. O. T.

Electricity Supply

Preston.—The Electricity Committee's scheme of supplying electricity on the basis of a weekly addition to the rent is to be extended to the Corporation's permament housing sites.

Ilford.—Consumers taking d.c. supplies through ampere-hour type meters are to be granted a rebate of 5 per cent. on the accounts for the March quarter, if an Electricity Committee recommendation is accepted.

Stourport.—The difficulties experienced during the journey by road of a 60-ton Stirling boiler drum from Glasgow to the Shrops., Worcs. and Staffs. E.P. Co.'s Stourport "B" station were described in our last issue. The photograph below shows the drum being pulled by two tractors at the end of its journey. On the right is a recent view of the station buildings, where the new boiler, delivering 525 000 lb. of steam per hour, at 1 275 lb. per sq. in. and a temperature of 975° F., is to be installed. It will be ready for steaming in about 15 months' time and will then, it is understood, be the largest in use in Europe.

Conway.—At a recent meeting of the Town Council it was announced that the electricity undertaking had received several large windfalls, including approximately £4 000 for bulk supplies. The reserve fund was now £14 000 in excess of that permitted and the excess was to be returned to consumers. On the accounts for the year ending September 30, a special discount of 20 per cent. would be allowed. This would absorb £6 000. Reductions in the tariff would be made from October.

Croydon.—As a result of protests to the electricity department, many factories and other firms in the area of supply are to receive an adjustment in charges. All the firms concerned pay a standing charge and they claimed that as a result of the restrictions earlier in the year they have not received full value for their money. After considering the representations made, the Ministry of Fuel and Power and the Electricity Commissioners, it is understood, have recommended that adjustments be made.

London.—Application has been made to the Electricity Commissioners by the County of London E.S. Co., Ltd., for consents to the laying of 33 kV transmission lines from the company's generating station at Creekmouth, Barking, to sub-stations at Chadwell Heath, Gidea Park, Brentwood and Shenfield, and also from the Chadwell Heath sub-station to the existing Barking to Ilford 33 kV cables in Whalebone Lane. These lines are required for the electrification scheme on the L.N.E.R. line from Liverpool Street to Shenfield and for general reinforcement of the supply system to meet increasing loads. The Metropolitan E.S. Co., Ltd., has applied for consent to the establishment of a three-core 66 kV impregnated gas pressure cable, together with control and pilot cables, between the Uxbridge

(Left) The 525 000 lb. per hr. Stirling boiler drum, towards the end of its journey to Stourport, and (right) a recent view of the station

sub-station and Chalvey, Bucks, a distance of 12 700 yds. The estimated cost is £185 000. The latter company has now received consents to the laying of three new transmission lines. These consist of a 25 kV cable from a sub-station at Hayes to the Heston and Isleworth electricity works at Hounslow, a 25 kV cable to connect the company's Perivale sub-station with the Willesden station of the London Power Co., Ltd., and a 6.6 kV cable between a sub-station at Chalvey, Bucks, and the area of supply of the Willesden Electrical Installation Co., Ltd., at Windsor.

Blackburn.—Consumption of domestic consumers, as shown by the accounts for the year ending March 31, rose by 46.8 per cent., from 22 712 096 units to 33 344 501 units, during the year. Units sold for all purposes increased from 99 448 310 to 114 986 820 kWh, or 15.2 per cent. Decreased sales were registered in assisted wiring and traction supplies. Exclusive of bulk, street lighting and traction supplies, points out Mr. R. H. Harral (borough electrical engineer and manager), units sold per head of population in the area of supply are now approximately 714, compared with 307 per head in 1939. The maximum demand for the year (December 10, 1946) was 38 060 kW, compared with 33 500 kW. The load factor similarly rose from 36.95 per cent. to 37.65 per cent. The average price per unit sold was 1.04d. (1.08d.). During the year revenue from sales of electricity was £490 885 (£440 819) and the total revenue £502 778 (£445 572). Deducting total working costs of £423 414 (£350 249), a gross profit of £79 364 (£95 323) remained, giving a net trading surplus, after payment of income tax, loan interest and redemption of debt, of £15 701 (£15 512). The total installed capacity of the undertaking is at present 95 000 kW. Directions have been issued for a further extension to the generating station, to be completed by September, 1950, comprising one 40 000 kW turbo-alternator, three 150 000 lb./hr. boilers and a cooling tower of 1.8 million gall./hr. capacity. It is estimated that the enforced reduction in supplies during the fuel crisis affected sales to the extent of four million units, with a corresponding drop in revenue of approximately £10 000.

The Batti-Wallahs' Society

THE guest-speaker at the monthly luncheon of the Batti-Wallahs' Society, held at the Connaught Rooms, London, on Thursday, July 31, was Maj.-Gen. Sir E. Bertram Rowcroft, who took for his subject "The Formation and Operation of R.E.M.E." He was head of the Royal Electrical and Mechanical Engineers from the formation of the Corps, in October, 1942, until January last, when he handed over the command to Maj.-Gen. S. W. Tope, who was also present. Other guests included Bay Sakim Oker and Bay Nezih Devres, from Turkey, who are visiting this country for the purpose of purchasing power station plant and equipment. Col. H. J. Wellingham, president, was in the chair and there was a large attendance.

Maj.-Gen. Rowcroft recalled that in consequence of the recommendation of the Beveridge Committee, men were taken from the R.E., the R.A.S.C., and the R.A.O.C., and welded into the R.E.M.E. He mentioned briefly some of the outstanding achievements of the R.E.M.E. in North Africa, where, he said, they "out-Rommelled" Rommel; Italy, North-west Europe, Germany and in the Far East, and, dealing with the electrical side of the Corps' work, said there was no doubt that the electrification of the Army, as well as other Services, was going ahead "like smoke." He thought that the electrical side would be equal in importance to the mechanical side in a few years time. In the late war they had to maintain the electrical equipment of the coast defence batteries, which was quite a big job. Then A.A. radar was of supreme importance and they could claim to have had a very big hand in the development and maintenance of that. In time radar would be used more and more in field formations. Finally, there were general electrification, and atomic matters, which they would have to handle in the future and which all would have a very large element of electrical controlling. So, he thought, it was right that "Electrical" should remain in the premier position in the initials of the R.E.M.E. Corps. The Corps was being maintained on an operational basis so that when the next war came, instead of having to build up the whole structure from zero when the guns were firing, they would start off with an active well-trained military body.

A cordial vote of thanks to Maj.-Gen. Rowcroft was proposed by Mr. S. W. Melsom.

Mr. M. Whitgift, hon. secretary and "Mate," announced that the next luncheon would be held on September 25, when the chief guest will be Mr. Edgar P. Angus, who will speak on "The City Livery Companies."

Industrial Information

Lamp Contract

A further contract for the supply of Atlas lamps to the Metropolitan Water Board has been accepted for the period ending March 31, 1948.

L.M.S. Contract

The L.M.S. Railway Company announce that a contract has been placed with Rashleigh Phipps and Co., Ltd., 2, Hanover Square, London, W.1, for lighting and inter-office telephonic communications at the head offices, Euston Station.

Fruit Bottling

Fruit bottling is the main theme of this month's "Cheerful Rationing" card, issued by the E.A.W., 35, Grosvenor Place, London, S.W.1. There is also a jam-making hint as well as recipes for salads, fruit salads, mock cream, cheese scones and tea cakes.

Electron Microscopy

The seventh Conference on Electron Microscopy will be held in the Physics Department, University of Leeds, on September 16 and 17. On this occasion the proceedings will be concerned with the application, rather than the construction, of the electron microscope. The conference will open at 10 a.m. on both days.

I.E.E. North-Eastern Students

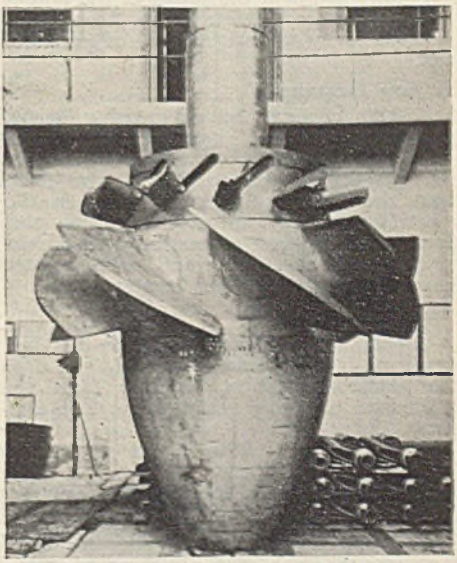
The I.E.E. North-Eastern Students' Section have been granted permission to visit the Morrison Busty Colliery, Annfield Plain, at 7 p.m. on August 13. The annual outing will take place on Sunday, September 28, when the party will set out from Newcastle Central Station at 9 a.m. and proceed by motor coach to Patterdale, via Alston, and will return by way of Carlisle. The twenty-third annual dance will be held in the Old Assembly Rooms, Newcastle, on Friday, November 7.

Seascan on R.M.S. "Queen Mary"

Before resuming her normal post-war service last week, the "Queen Mary" was fitted with Seascan radar made by the Metropolitan-Vickers Electrical Co., Ltd., who were pioneers in the development and manufacture of radar equipment before and during the war. The Seascan set on the "Queen Mary" is of the type that was put into service first in May, 1946, and has been installed in 32 ships. A description is given in a leaflet recently published by the company and referred to in our issue of July 25.

Water Turbine Devices

A new publication, No. HE/109, issued by the English Electric Co., Ltd., deals with two devices for water turbines, which have been developed by the company, and are in successful operation. They are the propeller runner with feathering blades, and the anti-racing hydro-brake. In the case



Propeller runner, with hydro-brake open, at the Liffey power station of the Electricity Supply Board

of the propeller runner, the feathering-blade operating mechanism is housed within the runner hub, thus eliminating complicated connecting mechanism between the blades and the servo-motor. This servo-motor, which operates the blades, is cylindrical with slots on the outside in the form of inclined grooves, which, when the cylinder moves vertically, actuate, through a simple and robust linkage, the moving feathering blades. Access to the operating mechanism is easy, as the runner hub cover can be lowered inside the draught tube, leaving the runner in its normal position. It is claimed that the design eliminates wear and backlash in operating mechanism, and provides a powerful safe control under all service conditions. The anti-racing hydro-brake substantially reduces the danger resulting from excessive runaway speeds. It consists of the incorporation of a number of slanting brake vanes immediately above the runner hub, which are normally retained flush with its outer circumference by springs or breaking pins within the hub. At a pre-determined speed—usually 50-60 per cent., above nor-

mal—these vanes are projected simultaneously into the vortex above the runner blading and, in combination with the latter, exercise a powerful braking effect.

Price Alterations

With reference to a paragraph under the above heading in our issue of July 25, relating to products of H.M.V. Household Appliances, we are asked to state that the only way in which the prices of the household appliances referred to have been affected is by the withdrawal of purchase tax.

A New Degreaser

A new concentrated degreasing agent, named "Degrosol," has been introduced by S. B. Jackson, Ltd., Windsor House, Victoria Street, London, S.W.1, who claim that there are innumerable tasks in the electricity supply industry in which this liquid can be used successfully, doing the work more effectively and with greater speed than by any other means.

The Nickel Bulletin

Among the abstracts given in the July issue of "The Nickel Bulletin," is data on electro-deposition, ranging from the technique of heavy nickel plating, to electropolishing, and electrolytic lapping and brush polishing. Free copies are obtainable from the Mond Nickel Co., Ltd., Grosvenor House, Park Lane, London, W.1.

Release of New Receivers

E. K. Cole, Ltd., announce that release of their model A33, "Radiotime," receiver, details of which have been published, will commence in three or four weeks time. Supplies will be allocated. The company have received notification that the "Radiotime" has been accepted for the "Enterprise Scotland, 1947," Exhibition. It is manufactured in the Ekco Rutherglen factory.

Reports from Germany

Among further reports containing scientific and technical intelligence from Germany, the following are now available at sales offices of the Stationery Office: B.I.O.S. 1108, Pottery Industry, including Electrical and Laboratory Porcelain (4s.); B.I.O.S. 1191, Thermo-plastic and Thermo-setting Resins. Interrogation of Dr. Eisenmann (Dynamit A.G., Troisdorf) (3s.); B.I.O.S., The Electro-Chemical Industry, Germany (5s. 6d.).

Caroline Haslett Trust

The first annual report of the Caroline Haslett Trust, which was established in October, 1945, for the furtherance of the electrical education of women, with special regard to the foundation of scholarships and travelling exhibitions, has just been issued. During the period covered by the report—October 9, 1945, to December 31, 1946—the Committee administering the Trust has consisted of Mrs. A. Rendell-Baker (E.A.W.), chairman; Mr. V. W. Dale (E.D.A.), Dame Caroline Haslett, Mrs. N. B. Jackson (E.A.W.), Mr. L. C. Penwill (E.C.A.), the Hon. J. R. Rea (B.E.A.M.A.), and Mr. O. A. Sherrard (C.B.E.). In 1945 circumstances prevented the public offer of scholarships tenable at any domestic science training college, and, with the co-operation of the principals, awards were made to four students who had already gained admission. In 1946 scholarships were awarded to six candidates, and a grant was made to another. A travelling exhibition, tenable in the U.S.A., was also awarded. The Committee look forward to the time when it will be possible to make a nation-wide offer of scholarships which, they believe, will be regarded as the hall-mark of achievement in domestic science.

Electrical Ironmongers

In connection with the forthcoming conference of the Lancashire and Cheshire Ironmongers' Association, to be held in Blackpool, it is proposed to hold a special session for electrical ironmongers at which an address will be given by Major Holloway, chairman of the Electrical Section of the National Federation of Ironmongers.

Suspension of Duty on Lamps

The United Kingdom Trade Commissioner at Dublin has reported that the Government of Eire has made an Order under the Supplies and Services (Temporary Provisions) Act, 1946, suspending from July 21, 1947, to March 31, 1948, the duty on electric filament lamps not exceeding 24-V.

Visit to Yorkshire

At the joint invitation of the Central Electricity Board and the Yorkshire Electric Power Co., the I.E.E. Transmission Section has made arrangements for members to visit Yorkshire for the week-end, September 13-14. The party will assemble during the evening of Friday, September 12, at the Granby Hotel, Harrogate, which will be the headquarters for the visit. The programme will include an inspection of part of the systems of the C.E.B. and the Yorkshire Electric Power Co.

Trade Publication Received

A leaflet produced by the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.2, introducing new Sunco decorative lighting fittings and table or desk adjustable standard lamps, all of which are illustrated.

Scottish Enterprise

Extension of Premises by Glasgow Firm

AN addition to Scottish electrical resources is provided by new works and offices of Edmiston, Brown and Co., Ltd., at Whitehill Street, Glasgow. The new premises comprise a machine shop with equipment to enable the firm to undertake the fabrication of most of the equipment used in electrical installation work for factories of various kinds, quarries, collieries, etc.

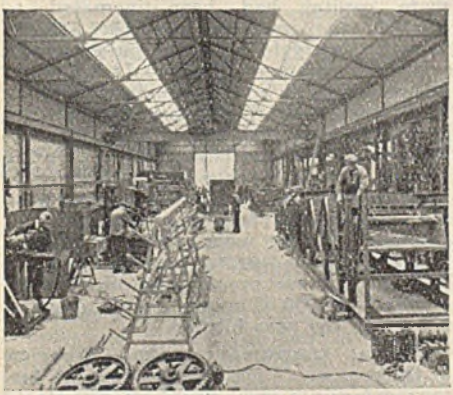
The offices, which are adjacent to the works, are well lighted, the main structure being of fabricated steel with brick panelling, and with at least 60 per cent. of the wall area taken up by steel-framed windows.

The artificial lighting is of the fluorescent type. The heating throughout the offices is by means of electrical convection units, each room being thermostatically-controlled.

It is interesting to note that the whole of the premises was designed and the structural work carried out by the firm's own staff within eight months, an achievement which must be regarded as outstanding in these days of restrictions. The premises have an overall floor space of 14 800 sq.ft., of which the workshop takes up 10 000 sq. ft., and the offices 800 sq. ft.

The associate firm of Clarmac Engineering Co., Ltd., specialists in the construction of quarry machinery and plant, will also operate from the new premises, Edmiston Brown, Ltd., completing the electrical equipment and installations relative to such plant. The latter were, incidentally, responsible for the electrical work in Glasgow's Kelvin Hall.

We reproduce below photographs of the machine shop and drawing office, which indicate the modern lines adopted in the design of the works. The illustration of the general exterior shows the convenient proximity of the offices to the works, the entrance to the latter being on the right.



Interior view of the machine shop

Fluorescent lighting in the drawing office

Frontage of the new Glasgow premises of Edmiston, Brown and Co., Ltd.

Company News

PETO SCOTT ELECTRICAL INSTRUMENTS, LTD.—Operatg. prft. to Mar. 31, £34 286 (£41 310); div. from subsid. nil (£1 100), tax £25 117 (£33 665), W.D.C. nil (£14), off new issue exes. nil (£1 177), net prft. £9 169 (£7 554), div. 25% (same), fwd. £13 433 (£10 451).

TELEPHONE MANUFACTURING CO., LTD.—Net prft. for 1946 stated at £21 783 (£272 495; this last figure was subject to E.P.T. assessment of approx. £200 000). E.P.T. recovery figure for 1946 will be approx. £34 000. Final div. 6½% (same), mkg. 9% (same).

ORIENTAL TELEPHONE AND ELECTRIC CO., LTD.—At the recent annual general meeting, a resolution was passed authorising the conversion of the issued ordinary shares of the company into ordinary stock, transferable in units of £1 each. The meeting was then adjourned until a date on which accounts for the year 1946 will be submitted.

BENN BROTHERS, LTD. (proprietors of THE ELECTRICIAN).—Gross prft. to June 30, £174 034 (£151 418), plus other inc. mkg. £184 628 (£162 669). After taxn. £27 962 (£55 041), etc., net prft. £81 702 (£50 367). To tax res. £5 500 (nil), jubilee pension fund £10 000 (£5 000), leasehold res. £1 500 (same), defrd. rprs. res. £12 050 (nil), goodwill and copyrights £10 000 (£5 637). Pref. div. £4 805 (same), fin. Ord. div. 20% (15%), mkg. 25% (20%) £35 557 (£28 446). Defrd. div. 5s. per share (4s.) £3 750 (£3 000), fwd. £23 422 (£24 882).

REVO ELECTRIC CO., LTD.—Prft. for yr. ended Mar. 31, after deprecn. £404 928 (£279 221), plus prft. 1946, adjustment contracts £24 333 (nil), and reg. fees £42 (£38), mkg. £429 303 (£279 259). To taxn. £262 662 (£196 616), dirs.' fees £2 000 (same), staff fnd. £3 190 (£3 423), prov. auxiliary power plnt. £30 000 (nil). lvg. £131 451 (£77 220). Fin. div. 12½% and bonus 10%, mkg. 27½% (20%, incldng. 5% bonus), gen. res. £50 000 (£25 000), stk. contins. res. £20 000 (£10 000), fwd. £91 746 (£85 880). Current assets £1 067 624 (£857 119), agst. current liabs. and provs. £359 163 (£342 258).

CAWNPORE ELECTRIC SUPPLY CORP., LTD.—The chairman, Mr. J. A. Scott-Moncrieff, said, in the course of his speech at the annual general meeting, that receipts of the company for the year were down by £25 006. The supply of electricity in bulk was less than in 1945, and so, also, was the supply for street lighting. Total units sold were about 3¾ per cent. less than in 1945. This would be the last full year of operation of the company, which was to be purchased by the Government of the United Provinces on September 15 this year. The terms of purchase were that the company was to be paid the fair market value of their lands, buildings, works and plant at the time of purchase. In the event of a dispute, the matter would be referred to an arbitrator nominated by the Government.

SYDNEY S. BIRD AND SONS, LTD.—In his statement to stockholders, the Chairman (Sir Ian Stewart-Richardson) said that the profit for the year, after reserving for E.P.T., had risen to £34 794, an increase of £5 262 over the previous 15 months. After providing for directors' fees, depreciation and income tax, there remained a sum of £15 579, to which had to be added the amount brought forward of £13 874, making a total of £29 453. Of this sum, £9 075 would cover the dividend of 30 per cent. already paid, and £10 000 would be added to a general reserve account, leaving £10 378 to be carried forward. During the trading year, the issued share capital had been increased to £55 000, the issue of a further £3 150 being necessary to cover the purchase of a subsidiary company, Prestico, Ltd. Certain full patent rights in this company, relating to a press tool which worked accurately in metal without previous measurements being necessary, had been granted. During the last 18 months, they had been seriously handicapped by lack of manufacturing space, and plans had been submitted for extensions to the main works at Enfield. In view of the capital expenditure now envisaged, it was proposed to offer the remaining £10 000 of unused shares to shareholders in the near future.

GENERAL ELECTRIC CO., LTD.—A review of the company's activities and recent factory extensions was given by Sir Harry Railing (chairman) at the annual general meeting. They had increased, and intended to increase further, their output of generating plant, he said, and of goods for transmission, distribution and traction work. Manufacturing capacity in telephone and radio transmission plant which was destroyed during the war had been replaced, and they had extended it by additional works in Coventry and Middlesbrough. The company had also started new works for cooking and domestic equipment at Swinton and Walsall, and had increased lamp and valve manufacturing capacity by taking over factories in Lancashire and on the north-east coast. A

large number of turbo sets had been ordered for home and abroad. A 37 500 kVA set at Hull and a similar set at Woolwich had been installed, and two of the four 35 000 kVA sets ordered for Meaford had been completed. Other comprehensive contracts for complete new stations included the Uskmouth power station at Newport and the Huncoat station at Accrington. The initial contract for Newport covered four 60 000 kW sets designed for hydrogen cooling, and that for Accrington two 30 000 kW sets. Repeat orders had been received for 30 000 kW sets for Haifa and Reading power stations in Palestine and for two 37 500 kW units for Johannesburg, and other orders were in hand for export to South Africa, India and Australia. A large number of transformers, including several 45 000 kVA units, were being made for the C.E.B., and the company had also developed new designs of air-break cubicle switchgear, which were being supplied to Meaford power station and the Birmingham Corporation.

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:—

Newport, Mon., August 12.—Rewiring of electrical installation in central library, museum and art gallery, Dock Street, Newport. Before tendering, qualified representative must visit site to learn Corporation's requirements. Specification from Borough Electrical Engineer and Manager, Electric House, Dock Street, Newport, Mon.; deposit, £1 1s.

Dundee, August 13.—Supply of multicore h.v. and l.v. p.i. cables. Particulars from City Electrical Engineer, Corporation Electricity Department, Dudhope Crescent Road, Dundee.

Farnworth, August 16.—Supply of electricity meters and one 1 000 kVA transformer. Specification from Electrical Engineer, Electricity Works, Albert Road, Farnworth, Lancs.

Skelton-in-Cleveland, August 18. — Supply and delivery of two three-phase static transformers, 50 cycles, with off-load tap-changing gear. Specification from Electrical Engineer, 147-9, High Street, Skelton-in-Cleveland.

Halifax, August 18.—Manufacture, delivery, laying and jointing of 33 kV underground cables and manufacture, delivery and erection of 33 kV metal-clad switchgear and control panels, etc. Specifications from Borough Electrical Engineer and Manager, 19/23, Northgate, Halifax; deposit, £1 1s.

Reigate, August 22.—Supply of: (a) six units, each comprising three oil-immersed, 11 kV, 300 A switches and six eight-way isolator and fuse units; (b) six 500 kVA, three-phase, 50 cycles, oil-immersed transformers. Specifications from Engineer and Manager, Electric House, Linkfield Corner, Redhill, Surrey.

Dover, August 25.—Supply and delivery of mercury discharge street lighting equipment. Specification from Borough Electrical Engineer, Electricity Offices, Ladywell, Dover.

Manchester, August 27.—Manufacture, supply, delivery and erection at various points on aqueduct between Thirlmere and Manchester of 15 sets of electrically-driven axial flow propeller type pumps (73 pumps in all), together with main switch and motor starting gear, etc., each set to deal with between 54 and 60 million galls. per day. Specification from Secretary, Waterworks Offices, Town Hall, Manchester, 2; deposit, £2 2s.

Halifax, September 1.—Manufacture, delivery and putting into service of two 20 MVA, 33/6.6 kV type "ON" main transformers and two earthing/auxiliary transformers. Specification from Borough Electrical Engineer and Manager, 19/23, Northgate, Halifax; deposit, £1 1s.

Stoke-on-Trent, September 10.—Manufacture, supply, delivery and erection of four 15 000 kVA, 33/6.6 kV, three-phase, 50 cycles outdoor static transformers, complete with "on-load" tap changers and control panels. Specification from General Manager, Electricity Department, 31, Kingsway, Stoke-on-Trent; deposit, £2 (in notes).

Birkenhead, September 15.—Supply, delivery and erection of one 80 kW mercury arc rectifier equipment for d.c. output 460/230 V, three-wire, to operate from 415/240 V three-phase supply. Specification from Borough Electrical Engineer, Craven Street, Birkenhead.

Iraq.—Supply of 12 slow or medium speed Diesel-driven generating sets, 440/500 V, d.c., compound-wound, rating about 100 kW, to suit engine builders' standard design. Specification from Crown Agents for the Colonies, Ref. W/Iraq 7750, 4, Millbank, London, S.W.1.

Commercial Information

Mortgages and Charges

NOTE.—*The Companies Act of* 1908 *provides that every mortgage or charge shall be registered within* 21 *days after its creation, and that every company shall, in its annual summary, specify the total amount of debt due from it in respect of mortgages or charges. The following mortgages and charges have been registered. The total debt prior to the present creation, as shown in the annual summary, is given—marked with an *—followed by the date of the summary, but such total may have been reduced.*

ARTERIAL AUTO ELECTRICS, LTD., London, E.C.—June 13, £3 500 (not ex.) charge, to Lloyds Bank, Ltd.; charged on 212, Burlington Road, New Malden.

H. AND R. DISTRIBUTORS, LTD., N., agents for electrical goods, etc.—June 12, £500 debenture, to J. Thornborough, London; general charge.

TYLER AND ORGAN, LTD., Newport (I.o.W.)., ironmongers and electricians.—June 20, two mortgages, to National Provincial Bank, Ltd., each securing all moneys due or to become due to the bank, respectively charged on 22, Union Street, Ryde (I.o.W), with fixtures, etc., and 95 and 95a, High Street, Newport (I.o.W.), with fixtures, etc. *£4 000. December 31, 1946.

ELECTRONS, LTD., London, W., sign and display workers.—May 23, £389 debenture, to R. F. Farnes, Southgate; general charge. *Nil. July 19, 1945.

SMALL POWER DYNAMO AND MOTOR CO., LTD., Manchester.—June 21, debenture, to Mosley Street Nominees, Ltd., securing all moneys due or to become due to Williams Deacon's Bank, Ltd.; general charge. *£400. July 10, 1946.

EASTLEIGH RADIO RELAY EXCHANGE, LTD. —June 10, debenture, to Lloyds Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *——. March 10, 1946.

ELECTRICAL AND RADIOLOGICAL INSTRUMENT CO., LTD., London, W.—June 19, £3 000 debentures, part of a series already registered. *£500. November 14, 1945.

ELECTRICALS, LTD., Newcastle-on-Tyne.—June 25, £1 600 (not ex.) mortgage, to Lloyds Bank, Ltd.; charged on 14, Claremont Place, Newcastle-on-Tyne. *Nil. May 9, 1946.

SMART AND BROWN (ENGINEERS), LTD., London, W.—June 26, series of £100 000 debentures, present issue £50 000; general charge (subject to etc.). *£175 000. January 13, 1947.

BRENTFORD TRANSFORMERS, LTD. (formerly BRITISH RADIO ELECTRICS, LTD.), London, S.E.—June 27, mortgage, to Swiss Bank Corporation, securing £1 739 19s. and any further advances; charged on two motor cars, wire winding machine, lathe and bandsawing machine and motor. *Nil. October 9, 1946.

CONCORDIA ELECTRIC SAFETY LAMP CO., LTD., Cardiff.—July 4, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *Nil. April 24, 1947.

G. HEWITSON, LTD., Hillingdon.—June 20. £1 500 (not ex.) charge, to Lloyds Bank, Ltd.; charged on 12, Hercies Road, Hillingdon.

Receiving Order

WILLIAMS, Thomas Richard Emlyn, Flat 17, Russell Mansions, 144, Southampton Row, W.C.1, lately trading as "Radio Corner," at 138, Gray's Inn Road, Holborn, W.C.1, radio engineer. Court: High Court of Justice. Date of Filing Petition: July 19, 1947. Date of Receiving Order: July 19, 1947. Debtor's Petition.

Adjudication

WILLIAMS, Thomas Richard Emlyn, Flat 17, Russell Mansions, 144, Southampton Row, W.C.1, lately trading as "Radio Corner," at 138, Gray's Inn Road, Holborn, W.C.1, radio engineer. Court: High Court of Justice. Date of Order: July 19, 1947. Date of Filing Petition: July 19, 1947.

Metal Prices

		Monday, Price	Inc.	August 4 Dec.
Copper—				
Best Selected ...	...per ton	£130 10 0	—	—
Electro Wire bars ...	„	£132 0 0	—	—
H.C. Wires, basis ...	„	£140 10 0	—	—
Sheet	„	£173 10 0	—	—
Bronze Electrical quality 1% *Tin*—				
Wire (Telephone) basis	per ton	£172 5 0	—	—
Brass (60/40)—				
Rod basis ...	... per lb.	1s. 1¾d.	—	—
Wire	„	1s. 6⅛d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)	...per ton	£8 19 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£34 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.	„	£21 15 0	—	—
Lead Pig—				
English	„	£91 10 0	—	—
Foreign or Colonial ...	„	£90 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	„	£412 10 0	—	—
Wire, basis ...	... per lb.	5s. 6¾d.	—	—
Aluminium Ingots	...per ton	£80 0 0	—	—
Spelter	...	£70 0 0	—	—
Mercury (spot) ... (*ex. warehouse*)	per bott.	£17 3 6	—	—

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

Members of the

CABLE MAKERS ASSOCIATION

The Anchor Cable Co. Ltd.
British Insulated Callender's Cables Ltd.
Connollys (Blackley) Ltd.
The Craigpark Electric Cable Co. Ltd.
Crompton Parkinson Ltd. (Derby Cables Ltd.)
Enfield Cables Ltd.
Edison Swan Cables Ltd. (The Edison Swan Electric Co. Ltd.)
W. T. Glover & Co. Ltd.
Greengate & Irwell Rubber Co. Ltd.
W. T Henley's Telegraph Works Co. Ltd.
The India-Rubber, Gutta-Percha & Telegraph Works Co. Ltd. (The Silvertown Co.)
Johnson & Phillips Ltd.
Liverpool Electric Cable Co. Ltd.
The London Electric Wire Co. and Smiths Ltd.
The Macintosh Cable Co. Ltd.
The Metropolitan Electric Cable & Construction Co. Ltd.
Pirelli-General Cable Works Ltd. (General Electric Co. Ltd.)
St. Helens Cable & Rubber Co. Ltd.
Siemens Brothers & Co. Ltd. (Siemens Electric Lamps and Supplies Ltd.)
Standard Telephones & Cables Ltd.
Union Cable Co. Ltd.

C.M.A. cable has been one of the most valuable British exports since the beginning of the electrical industry. In no other manufactured product is supreme British quality more carefully and thoroughly assured by continuous research into materials and processes.

We are exhibiting at the

ENGINEEERING & MARINE Exhibition . Olympia

STAND No. 5 . ROW "O"

Ground Floor . National Hall

CABLE MAKERS ASSOCIATION

HIGH HOLBORN HOUSE • 52-54 HIGH HOLBORN • LONDON • W.C.1

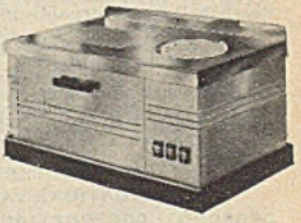
INDEX TO ADVERTISERS IN THIS ISSUE

What will the Kitchen of TOMORROW look like?

One thing is certain: the domestic electrical appliance will find an increasingly important place in the well equipped modern kitchen, and the principal factor the planners of this overcrowded age will bear in mind is the vital need for economy in space . . . . . To this end DIAMIX have also planned; and our range of electrical kitchen equipment is now in greater demand than ever before . . . . by the retailer with an eye to attractive display and ready sale; and by the housewife with limited kitchen space, but an unlimited urge to acquire the best.

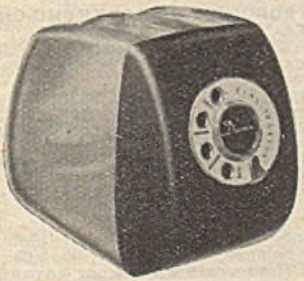
Please write or phone for New Season's catalogues of Toasters, Cookers, Thermostatic Irons, Fires and Boiling Rings.

Order these best selling lines now for immediate delivery.



The "Junior" Cooker (above)
Ideal for small home. 2 heat switch for oven and grill, separate control for ring. Chromium and pastel shades.

The "Push Button" Cooker (below)
Measures 16" × 11" × 12". Push button heat control for oven, grill and hotplate. Vitreous enamel finish.



The Automatic Toaster
Dial the desired crispness or colour and the toast is automatically ejected. Maroon plastic with chromium dial.

BRITISH **Diamix** LIMITED

METRUM WORKS, BEATTY ST., CAMDEN TOWN, LONDON, N.W.1 . EUS. 5951-2-3

CLASSIFIED ADVERTISEMENTS

TENDER

STOKE-ON-TRENT CORPORATION.

ELECTRICITY DEPARTMENT.

Four 15 000 kVA Transformers.

Contract No. 4 720.

TENDERS are invited for the manufacture, supply, delivery and erection of four 15 000 kVA, 33 000/6 600-volt, 3-phase, 50-cycle, Outdoor Static Transformers complete with "On-load" tap-changers and control panels.

General Conditions, Specifications and Tender Form may be obtained upon application to the General Manager, Electricity Department, 31, Kingsway, Stoke-on-Trent. Each applicant for the Specification must include a deposit of two pounds (£2) in currency notes, which will be returnable in accordance with the General Conditions.

Each completed Tender must be returned in the envelope provided, which shall not bear any name or mark indicating the sender, so as to reach the undersigned not later than Wednesday, 10th September, 1947.

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

HARRY TAYLOR, Town Clerk.

Town Hall, STOKE-ON-TRENT.

SITUATIONS VACANT

BEDFORD CORPORATION ELECTRICITY UNDERTAKING.

SWITCHBOARD ATTENDANT.

APPLICATIONS are invited for the position of Switchboard Attendant at the Council's Selected Generating Station in accordance with the N.J.I.C. Conditions of Employment at the rate of 2s. 8½d. per hour.

Applications, stating age, giving particulars of training and experience, together with copies of recent testimonials, should be forwarded to the undersigned suitably endorsed, not later than the 28th August, 1947.

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

Electricity Offices,
Prebend Street, BEDFORD.
23rd July, 1947.

CITY OF BIRMINGHAM EDUCATION COMMITTEE.

BIRMINGHAM CENTRAL TECHNICAL COLLEGE.

Principal: J. Wilson, B.Sc., B.Com., M.I.Mech.E.

Department of Electrical Engineering.

APPLICATIONS are invited for the post of Lecturer in Electrical Engineering up to Higher National Certificate standard. Candidates should hold an Honours degree or its equivalent and have had industrial experience.

Salary will be in accordance with the Burnham Technical Scale (£300 - £15 - £525), with additional graduate and training allowances. Commencing salary depends upon previous industrial and teaching experience.

The person appointed will be required to take up his duties on 1st September, 1947, or as soon as possible after that date.

Further particulars and forms of application may be obtained from the Principal, Central Technical College, Suffolk Street, Birmingham, 1, on receipt of stamped, addressed, foolscap envelope. Completed forms should be returned to him not later than two weeks after the insertion of this advertisement.

E. L. RUSSELL, Chief Education Officer.

SITUATIONS VACANT

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.

APPOINTMENT OF JUNIOR TECHNICAL ASSISTANT.

APPLICATIONS are invited for the position of Junior Technical Assistant. The duties relate principally to communication, control and supervisory equipment, but will also include other work of a technical character.

Applicants must have a sound technical training, and preferably possess technical qualifications admitting to corporate membership of the Institution of Electrical Engineers. They should have had experience in technical work relating to electricity supply, including automatic telephone equipment, lines and cables.

The salary will be in accordance with Class M, Grade 9a, of the National Joint Board Schedule, at present commencing at £478 per annum.

The appointment will be subject to the provisions of the Local Government and Other Officers' Superannuation Act, 1937, and candidates must have previous Local Authority service carrying a transfer value within the meaning of the Act, or otherwise be not more than 40 years of age. The selected applicant will be required to undergo a Medical Examination.

The conditions of service will be those of the National Joint Board and the practice ruling in the office of the Sheffield Corporation Electricity Department.

Applications on a form to be obtained from the undersigned are to be returned to me not later than the 29th August, 1947.

Canvassing or any communication with a member of the Council, either directly or indirectly, is prohibited, and will be a disqualification.

JOHN R. STRUTHERS,
General Manager and Engineer.

Commercial Street, SHEFFIELD, 1.
August, 1947.

COUNTY BOROUGH OF SOUTHEND-ON-SEA.

ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the following appointments from persons under 35 years of age.

The appointments are subject to the Local Government Superannuation Act, 1937, and the persons selected will be required to pass medical examinations.

(1) **Constructional Engineers (Mains and Sub-stations).**

Salary—Class G, Grade 6 (£540/550/561) of the N.J.B. Schedule.

(2) **Senior Demonstrator.**

Applicants should hold a Diploma in Domestic Science; the E.A.W. certificate in Electrical Housecraft will be an advantage.

Salary—A.P.T. 2 of the National Scales (£360 - £405), plus war bonus, at present £48 2s. per annum.

Further particulars of each of the above appointments and forms of application may be obtained from the Borough Electrical Engineer and Manager, Electric House, London Road, Southend-on-Sea.

Applications must be received at that address not later than 26th August, 1947.

Canvassing will disqualify.

ARCHIBALD GLEN,
Town Clerk.

Municipal Buildings,
SOUTHEND-ON-SEA.

SITUATIONS VACANT

COUNTY BOROUGH OF OLDHAM.

ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the post of SHOWROOM ASSISTANT (MALE). Applicants should be over 20 years of age, of good general education and preferably have some knowledge of electrical salesmanship. Previous experience in an Electricity Showroom will be an advantage.

Salary according to age and in accordance with the General Division of the scale of the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services, plus current cost-of-living bonus.

The appointment will be subject to the provisions of the National Scheme of Conditions of Service, the Local Government Superannuation Act, 1937, and to satisfactory medical examination.

Canvassing in any form will disquality, and candidates are required to disclose in their applications whether they are related to any Member or Senior Officer of the Council.

Applications, suitably endorsed, stating age, details of education and experience, and accompanied by copies of not more than three recent testimonials, should be addressed to the Chief Engineer and Manager, Corporation Electricity Department, Greenhill Offices, Oldham, and reach him not later than the first post of Monday, the 25th August, 1947.

H. CLARKE,
Deputy Town Clerk.

Town Hall, OLDHAM.
7th August, 1947.

CIVIL SERVICE COMMISSION.

APPLICATIONS are invited for posts at the Military College of Science, Shrivenham, near Swindon, Wilts., of permanent and temporary PRINCIPAL LECTURERS, SENIOR LECTURERS, and LECTURERS. Vacancies in one or more of these grades exist in the following subjects:—Ballistics, Mechanics, Machines, Materials and Structures, Heat Engines, Electrical Engineering. Applicants must have a University degree in an appropriate scientific subject with first or second class honours or an equivalent qualification. Experience in research or design as applied to military needs would be an advantage. The inclusive scales of salary are: Principal Lecturer, £840 - £1 125; Senior Lecturer, £610 - £800; Lecturer, £333 - £560. If, owing to the housing shortage, accommodation is unavailable, War Department quarters may be allotted at a fair rent until such time as other accommodation becomes available. Full particulars of the posts, together with a Statement of the conditions of service and the intentions of the War Office regarding the Military College of Science, and a form of application, may be obtained from the Secretary, Civil Service Commission, Scientific Adviser's Branch, 27, Grosvenor Square, London, W.1, quoting No. 1965. Application forms must be returned to him by 25th September, 1947. Successful applicants will be required to join for duty in October, 1947.

THE B.E.A.I.R.A. has a number of vacancies on its research staff for persons with qualifications in electrical engineering, physics, chemistry, or mathematics. Starting salaries vary from £275 p.a. to £600 p.a., exclusive of cost of living bonus (at present £59 16s. for males over 21) and superannuation in accordance with F.S.S.U. Appointments of a more senior character may be considered in the first two categories. Applications for further particulars should give a brief outline of qualifications and experience, and should be addressed to the Director, E.R.A., 15, Savoy Street, W.C.2.

METROPOLITAN BOROUGH OF ISLINGTON.

ELECTRICITY DEPARTMENT.

APPOINTMENT OF TECHNICAL ASSISTANT.

APPLICATIONS are invited from qualified engineers for the above appointment at a salary in accordance with Class G, Grade 5, of the National Joint Board Schedule, at present £601 13s. rising to £634 4s. per annum.

Applicants should possess a wide experience in the technical work connected with the development of all sections of an Electricity Supply Undertaking. Corporate Membership of the Institution of Electrical Engineers is essential, and preference will be shown to engineering graduates of a British University.

The person appointed will be required to prepare estimates, specifications and comprehensive technical reports covering a large amount of development work which must be undertaken, including loading and short circuit surveys and the study of alternative schemes for a superimposed 66/33 kV transmission system. Ability to investigate and report on the application of electricity to the air-conditioning and space heating of large buildings, including the use of heat pumps, will be an advantage.

The appointment, which is permanent, will be subject to the provisions of the Local Government Superannuation Act, 1937, and to a satisfactory medical examination. Candidates are required to disclose in writing whether to their knowledge they are related to any member, or holder of any senior office under the Council. Canvassing either directly or indirectly will be a disqualification. The Council are unable to make any arrangements for the provision of housing accommodation for the successful candidate.

Application forms for the above position may be obtained from the Engineer and General Manager, Electricity Department, 341/3, Holloway Road, London, N.7, and should be completed and returned to him, endorsed "Technical Assistant," not later than noon on Friday, 15th August, 1947.

W. ERIC ADAMS.
Town Clerk.

Town Hall, Upper Street, N.1.

BOROUGH OF LUTON.

APPLICATIONS are invited for the position of SWITCHBOARD ATTENDANTS. Applicants must have had sound experience in the control of high and low pressure switchboards and the operation of rotary converting plant.

Conditions of service and rate of pay will be in accordance with the National Joint Board Schedule, Class "G," Grade 9a, at present £343, rising to £358 per annum.

The successful candidate will be required to pass a medical examination and to contribute to the Corporation's Superannuation Scheme. Applications, giving age, details of training and experience, and accompanied by testimonials, must be delivered not later than Monday, 18th August, 1947, to C. T. Melling, M.Sc. (Tech.), M.I.E.E., M.I.Mech.E., Borough Electrical Engineer, Electricity Offices, St. Mary's Road, Luton.

Canvassing, directly or indirectly, will disqualify.

W. H. ROBINSON,
Town Clerk.

Town Hall, LUTON.
25th July, 1947.

WORKS MANAGER required by an old established leading firm of Instrument Manufacturers. First-class Time and Motion Study Engineer with sound Managerial experience preferred. Excellent opportunity for man prepared to cope with heavy demands of substantial expansion programme. South Wales.—Write in confidence, giving full details of experience and salaries earned, to Managing Director, Box L.F.T., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

NORTHAMPTON POLYTECHNIC,
St. John Street, London, E.C.1.
SENIOR ASSISTANTS.

APPLICATIONS are invited for appointment to posts as "Senior Assistants" in the following Departments of the Polytechnic:

Civil and Mechanical Engineering.
Electrical Engineering.
Physics.

The Polytechnic prepares full-time and part-time students to University Engineering degree and Higher National Certificate standards.

Salary will be in accordance with the revised Burnham Scales for Technical Teachers, viz.:

£600 p.a. by £25 p.a. to £750 p.a. plus London Allowance (£36 - £48) and a Training addition (£15 - £45) where applicable.

Further particulars and forms of application can be obtained from the Secretary.
29th July, 1947.

IMPERIAL CHEMICAL INDUSTRIES LIMITED.—Applications are invited for the positions of Shift Charge Engineers in the Company's Power Stations in Runcorn and Widnes. Applicants, who should be between 30 and 45 years of age, must have had a sound practical and technical training in mechanical engineering and good experience of the Shift operation of modern steam Power Station equipment including turbo-alternators and water tube boilers of not less than 10 000 kW and 50 000 lbs. steam/hour capacity respectively. Generous commencing salary. Applications, which must give the applicant's date of birth and full details of qualifications and experience, should be addressed to the Staff Manager, I.C.I Limited, General Chemicals Division, Cunard Building, Liverpool.

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NOTICES

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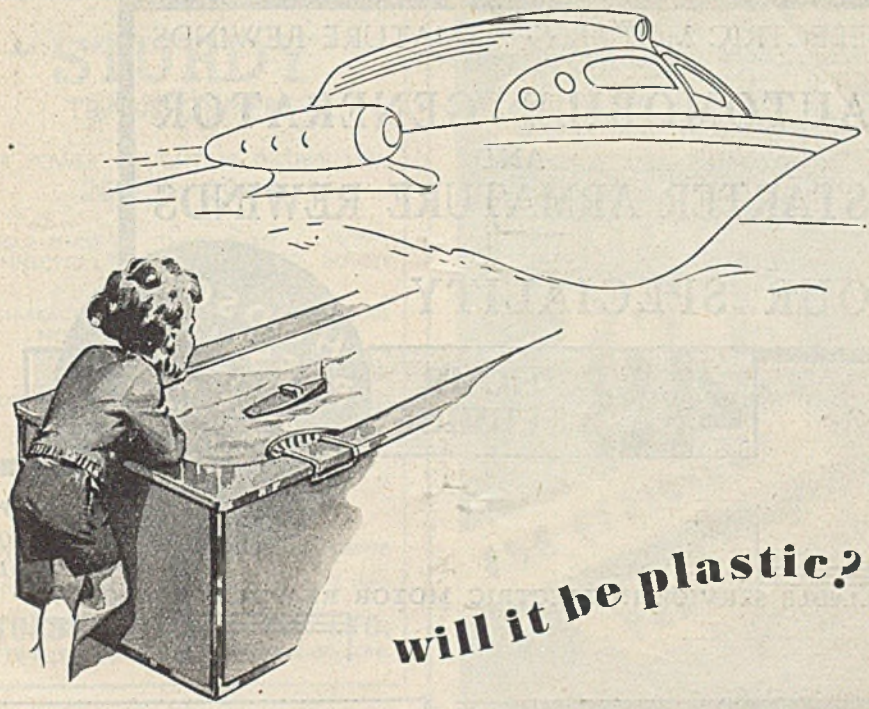

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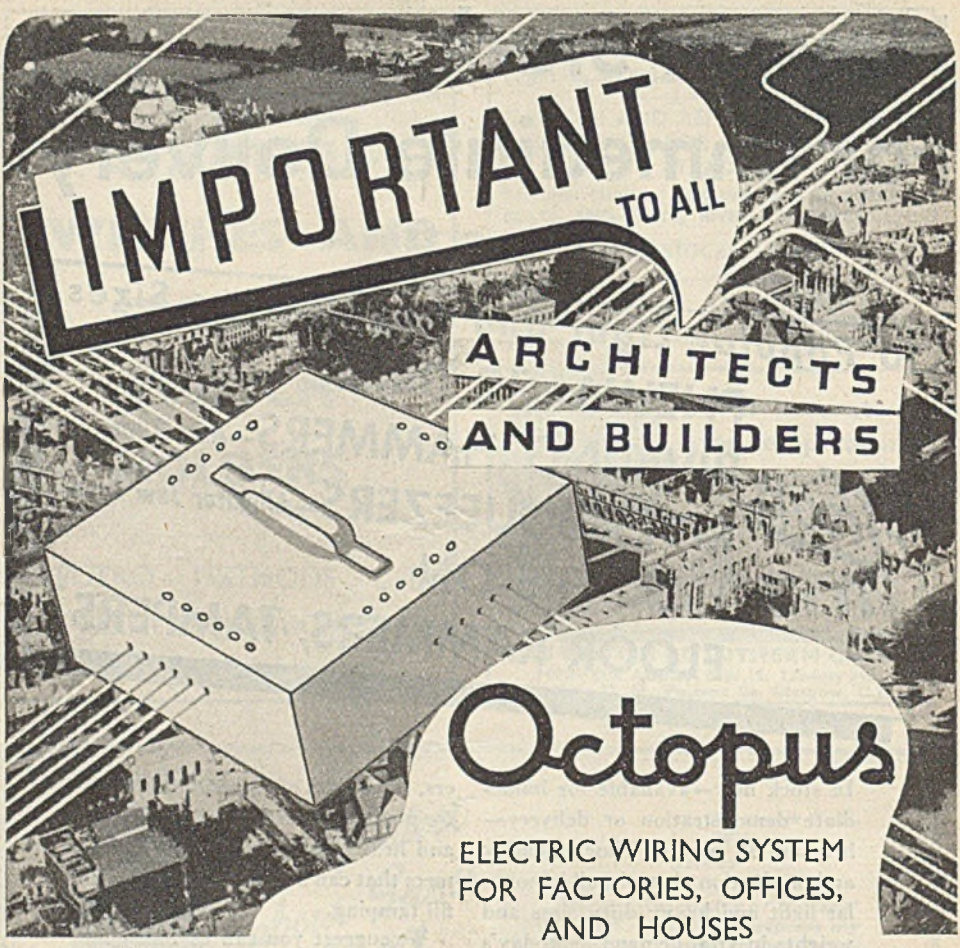

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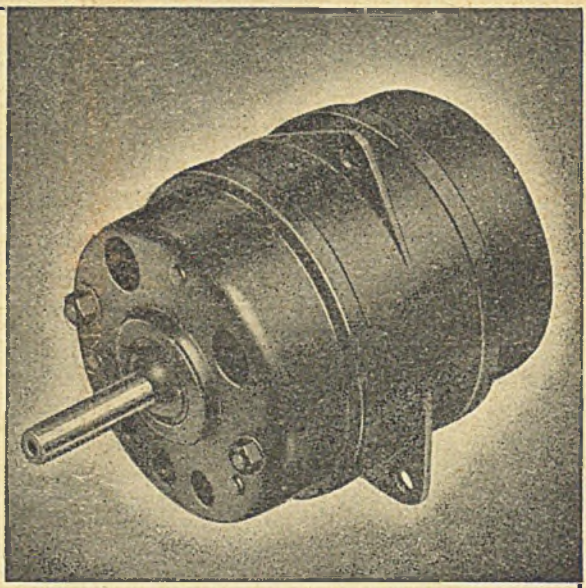

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