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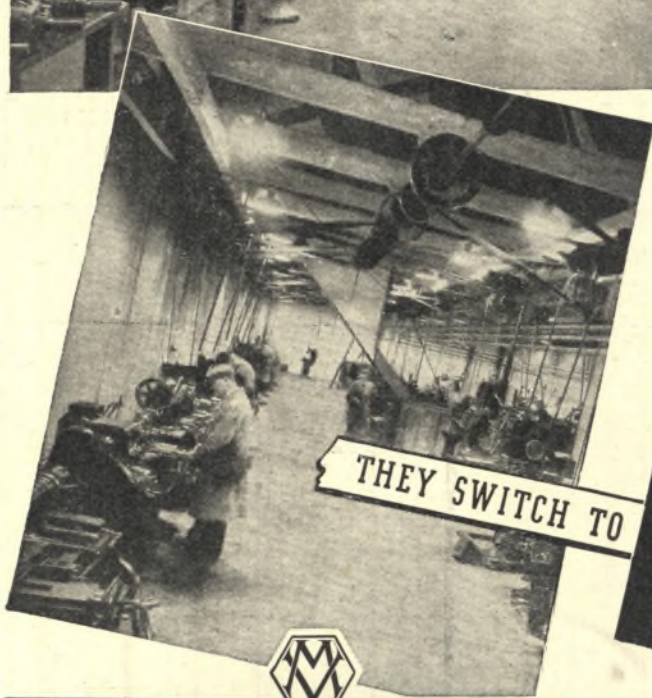
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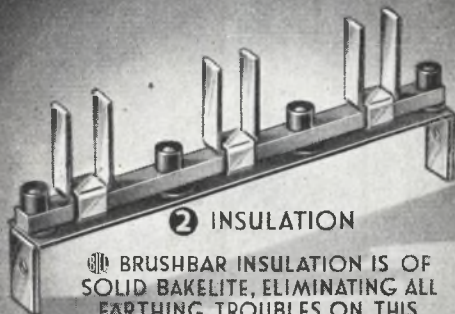
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B BRUSHBAR INSULATION IS OF SOLID BAKELITE, ELIMINATING ALL EARTHING TROUBLES ON THIS IMPORTANT COMPONENT. THIS SOLID INSULATION IS GREATLY SUPERIOR TO INSULATED METAL BARS AND HAS BEEN A STANDARD REFINEMENT ON **B** SWITCHES FOR OVER 20 YEARS.

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Armoured, H.T. To
B.S.S. 480

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Covered, Steel Tape
Armoured, L.T. To
B.S.S. 480

Twin, Shaped Paper
Insulated, Lead Cov-
ered, Single Wire
Armoured, L.T. To
B.S.S. 480

Single Core, Paper
Insulated, Lead Cov-
ered, Steel Tape
Armoured To B.S.S.
480

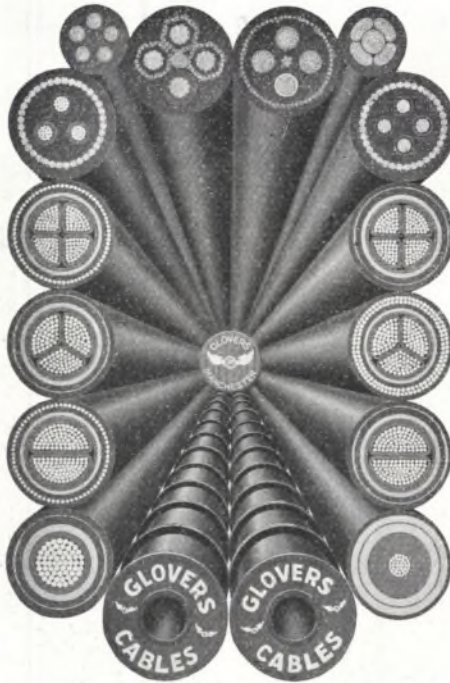
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Armoured, Trailing
Cable Type No. 21
B.S.S. 708

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Paper Insulated, Lead
Covered, Steel Tape
Armoured, L.T. To
B.S.S. 480

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Paper Insulated, Lead
Covered, Double Wire
Armoured, H.T. Non-
Bleeding To B.S.S.
760

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To C.M.A. 250 volts and 660 volts
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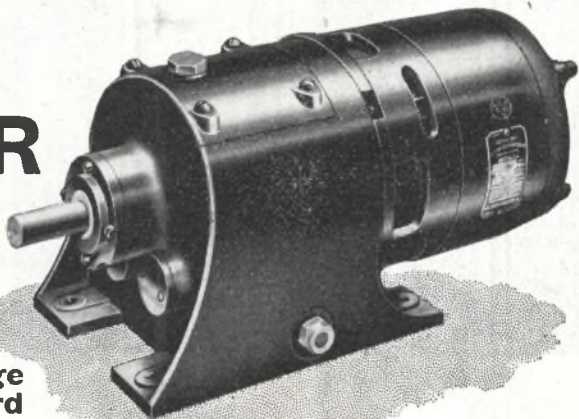
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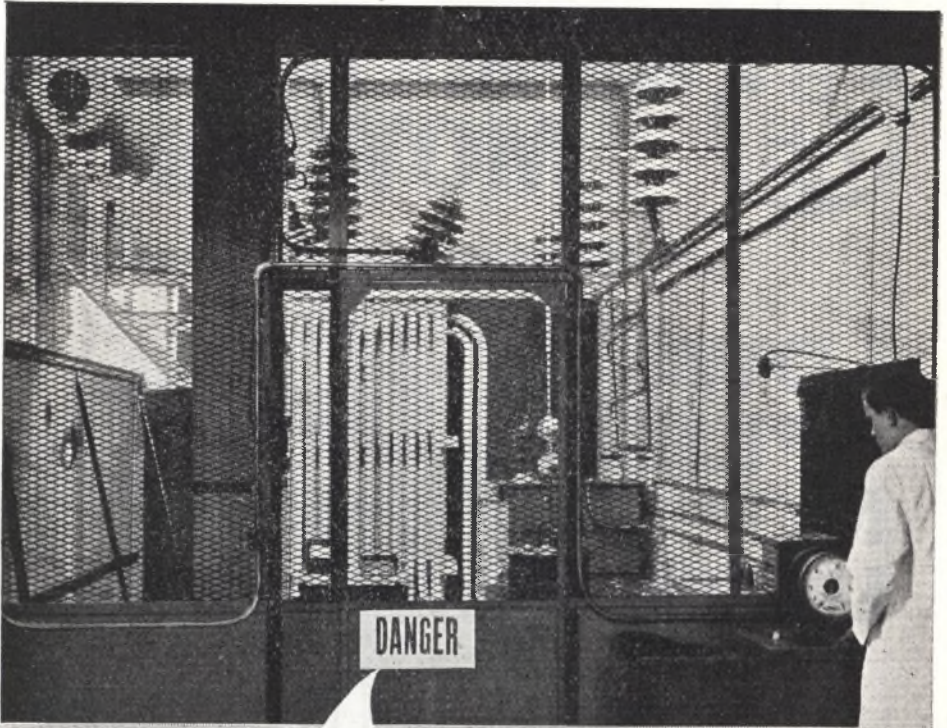
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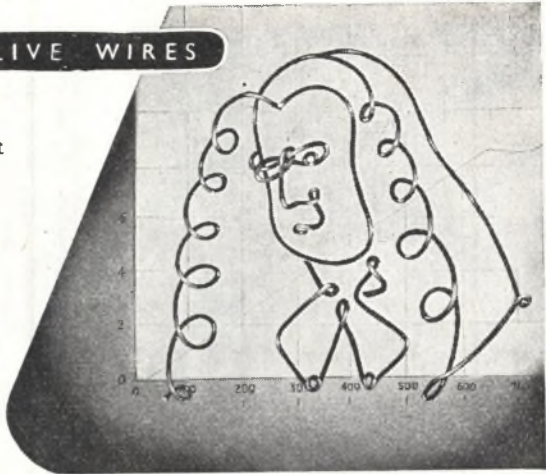
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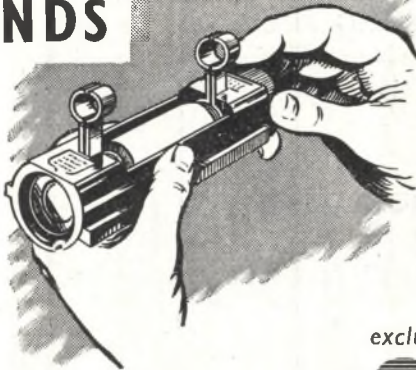


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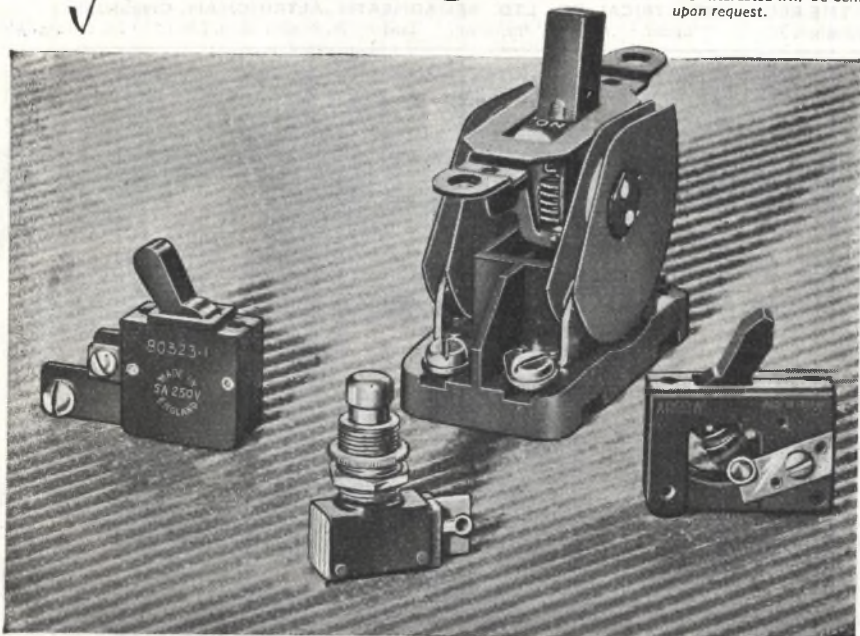
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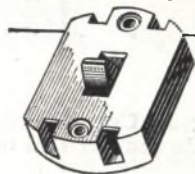
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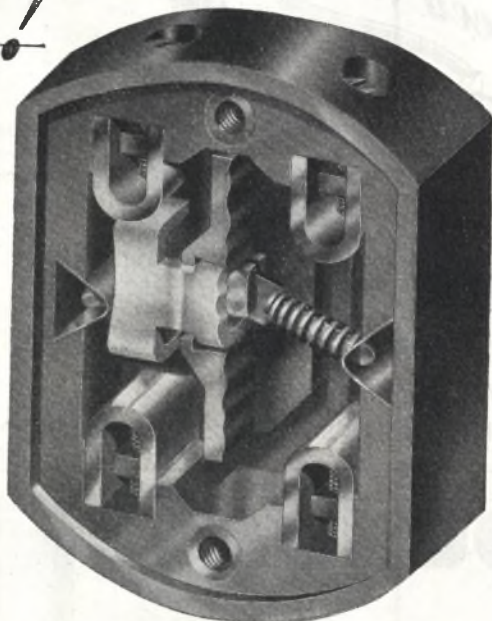
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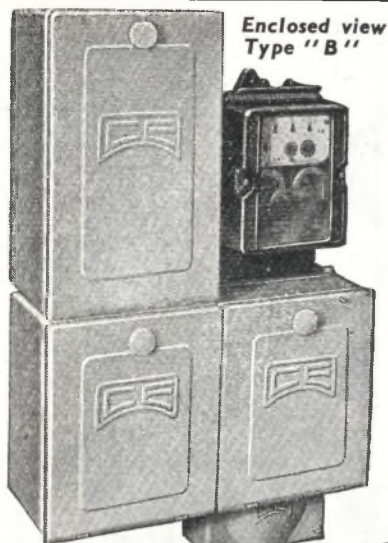
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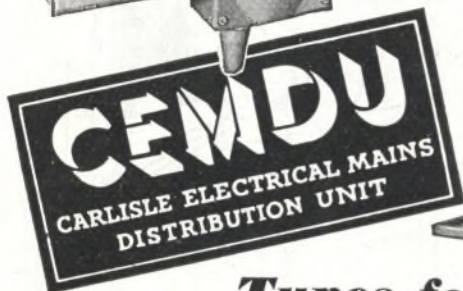
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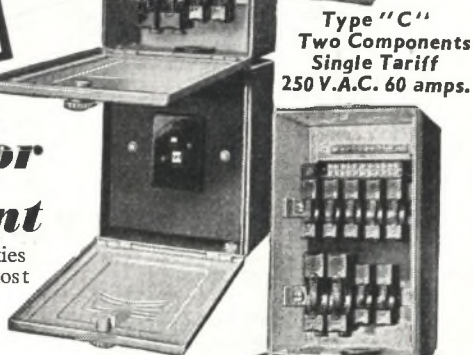
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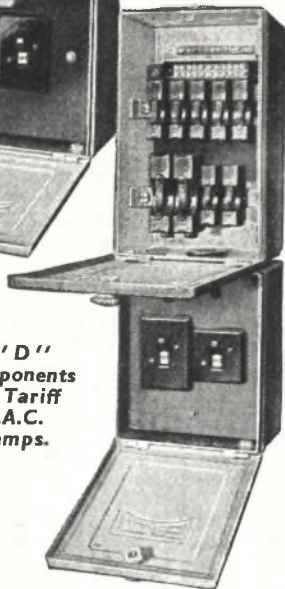
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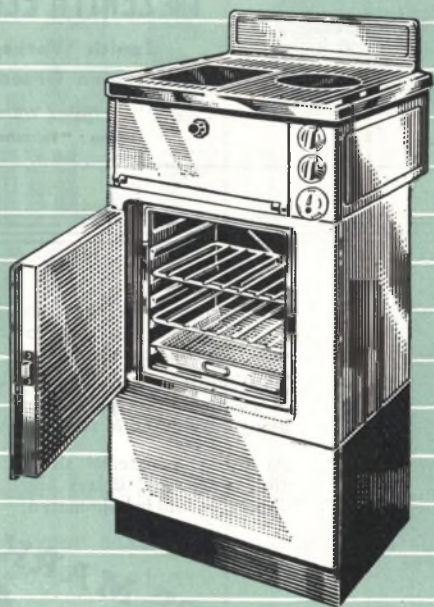
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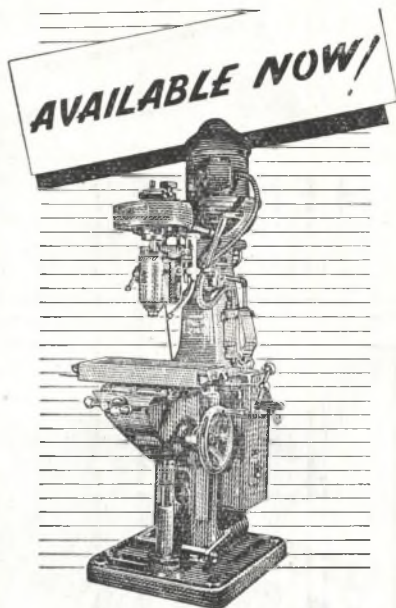
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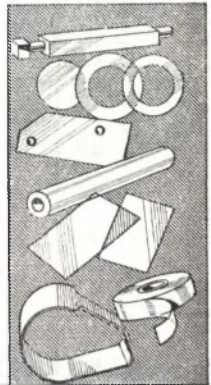
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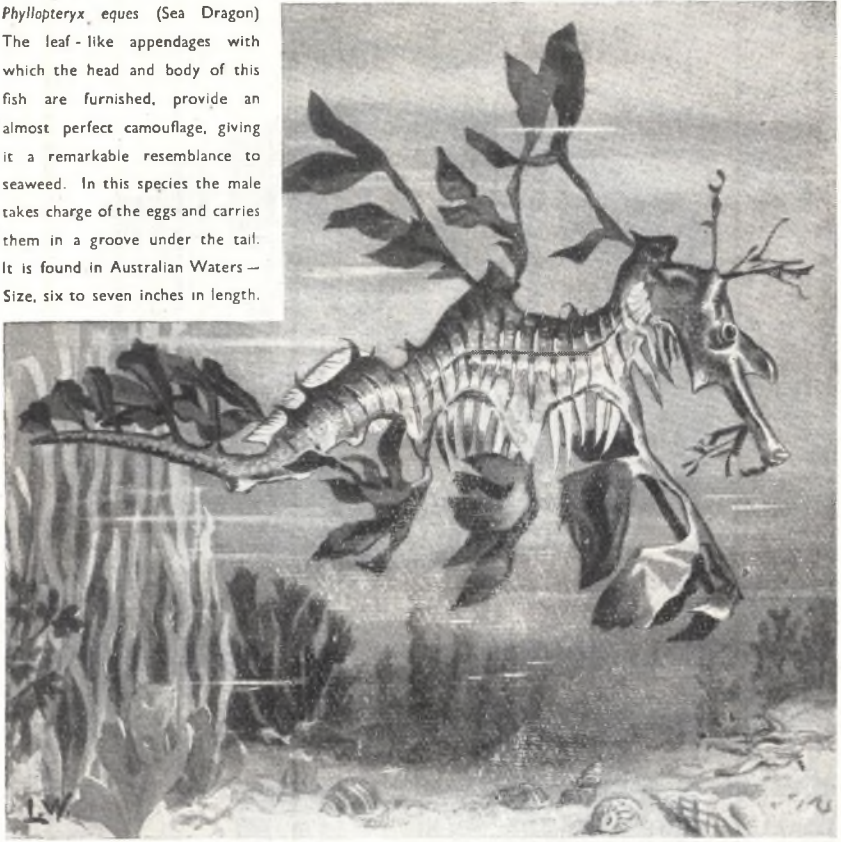


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CONTENTS

<i>Views on Current Affairs</i>	1491
<i>Portrait—Mr. John Hacking</i>	1494
<i>Generating Plant Standardisation</i> ...	1495
<i>About Transformers</i>	1496
<i>Purchase Tax Increases</i>	1500
<i>Electrical Personalities</i>	1501
<i>E.I.B.A. Ball</i>	1502
<i>Power Cable Standardisation</i>	1503
<i>The Dalton Budget</i>	1504
<i>I.E.E. Mersey and N. Wales Centre</i>	1505
<i>Building Exhibition at Olympia</i>	1506
<i>Contracts Open</i>	1507
<i>Variable Speed Control</i>	1508
<i>Answers to Technical Questions</i>	1509
<i>Industrial Information</i>	1510
<i>B.T.H. Laboratories</i>	1511
<i>London Medical Exhibition</i>	1512
<i>Company News</i>	1513
<i>Commercial Information</i>	1514

Heavy Plant

IN compliance with a Ministry of Supply Order made last week, future steam turbo-alternators for installation in this country will, in the case of capacities of over 10 000 kW, be standardised at 30 000 and 60 000 kW. The purpose of the standardisation, the details of which it is understood have been agreed by all parties interested, is to speed up the production cycle required for building and commissioning a new power station, and to cut down by anything from six to nine months the time needed for the construction of a turbo-alternator.

Orders for the extensions scheduled in the programmes for the current year and 1948/49 have, of course, already been placed and the effect of the standardisation Order will, therefore, not be felt to any appreciable extent until 1950. It is the intention of the Ministry to apply standardisation measures to other items of heavy plant, and it is possible that by the time 1950 is reached the principle will have already been applied to boilers, steam and water pipes, valves and flanges.

Plant under 10 000 kW capacity and for overseas orders is exempt from the standardisation regulation; nor does the measure impose any uniformity of detail. Each manufacturer will continue to use his own particular design, provided the plant conforms to the functional standards specified, interchangeability of castings, parts and components as between makers not being a necessary condition of the Order.

When announcing the standardisation details outlined above, the Minister of

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Supply did so in a way which seemed to suggest that he believed standardisation in the generation field to be something new. In order that he may view the future in proper focus, therefore, his attention is drawn to the fact that, according to the 1946 report of the Central Board, of the 6 114 200 kW of new plant arranged for installation from the beginning of that year to the end of 1950, 3 018 500 kW was—in order to speed up production—standardised for operation at 600 lb./sq. in. pressure, 2 340 000 for operation at 900 lb./sq. in., and 305 000 at 1 200/1 400 lb./sq. in. For the same reason, a large degree of standardisation has also already been achieved in the design of the associated boiler plant; including boiler units for operation with the generating plant referred to above. Further evidence of standardisation already achieved, and with which the Minister should prime himself, will be found in the paper which Sir JOHNSTONE WRIGHT delivered at the Centennial Meeting of the Institution of Mechanical Engineers, an abstract of which appeared in *THE ELECTRICIAN* of July 11 last.

Experimentation and Exports

THE capacity of 30 000 and 60 000 kW was decided upon for inclusion in the Control of Turbo-Alternators Order as a result of general practice in recent years, and though standardisation at these figures may assist the earlier commissioning of new plant than otherwise in the present austerity conditions, its merit as a permanency may be questioned. The generation side of the manufacturing industry has made and is still making a valuable contribution to export trade by building heavy plant for shipment overseas. The superior technical merit of this plant over that produced by other countries, is the result of the experimentation carried out in conjunction with the supply industry before standardisation became necessary to reduce the time factor of the building cycle. Manufacturers will for the next few years be denied by the Order the opportunity of much of the development work previously enjoyed, and technical experimentation will thus be slowed down. Under the standardisation methods hitherto operated by the Central Electricity Board, on the other hand, experimental work was permitted

to be carried out, though on a reduced scale. A similar measure of flexibility with respect to technical research should be included in the Order at the earliest possible date.

Purchase Tax Increases

SO far as the Budget proposals concern the electrical industry in particular, the chief items relate to increases in purchase tax. Since, however, most of the appliances are already in short supply, added taxation is unlikely to have any appreciable effect upon sales. Raw material allocations to manufacturers of such things as space heaters have been cut to a very low level since the fuel crisis last February and this, coupled with commitments in the export drive, has resulted in few reputable makes of these appliances finding their way to the market. Water heaters and other domestic equipment have been equally difficult to come by for a year or more, and increasing the purchase tax on them seems, therefore, pointless. The reason which suggests itself as being responsible for the increased taxation on electrical appliances, is the fact that their utilisation can be linked up with the need for economy in the domestic consumption of electricity. What has been overlooked, however, is that the demand is in no sense being satisfied and that the low level of material allocations to manufacturers is already restricting growth of the space and water heating loads, more than any increase in the purchase tax could hope to do. As absorbers of "inflationary purchasing power" domestic electrical appliances can only be a disappointment until the manufacturing industry is allowed more materials with which to make them, and, in the absence of any such prospect, the added taxation—if we must have it—would be better transferred to commodities more readily available.

Tax-Free Advertising

A MORE constructive proposal in the Supplementary Budget than that increasing purchase tax on domestic appliances, is the continuance of the allowance as an expense against profits, of expenditure on advertising in such journals as *THE ELECTRICIAN*. The important place held by the technical journal in the efforts being made for economic recovery is already known to the industry, and the

special treatment accorded in the Supplementary Budget proposals is in support of that position. The announcements of manufacturers and others in **THE ELECTRICIAN** are unquestionably an essential part of the national drive for economic stability, and the proposal of allowing expenditure upon them to continue to rank as a trading expense is an official recognition well deserved.

Economy in Consumption

WHETHER or not the local fuel economy committees have yet had time to influence the domestic consumption of electricity, it is as yet too early to say. It is, however, significant that the total units sent out from the generating stations of authorised undertakings during October were less by 16 million, or 0.5 per cent., compared with the same month last year. Since the end of October the ban on space heating has been removed, daylight saving has been abandoned and it will not therefore be until the end of the current month that the results of any true economy are likely to show themselves. The figures for October are, however, promising, and so long as consumption can be kept below that of last year some relief, at least, will be given to our over-worked generating capacity.

Coal Output

OFFICIAL circles have widely publicised the fact that during the first three weeks of this month coal output exceeded four million tons a week, and that there is, in consequence, a chance of the 197 million target for the year—set by the Minister for Economic Affairs—being reached. Reviewing the figures objectively, however, shows that the target of 197 million is itself short by 23 million tons of the estimated requirements of industry, and since coal consumption by the gas and electricity supply industries is already substantially the same as this time last year, despite the milder winter, it may be even more before the year is out. Power station stocks on November 1 amounted to 4 197 million, or six winter weeks' supply, but by November 8 the volume was reduced to 4 182 million. By comparison with the same period last year these figures are undoubtedly good, but bearing in mind the crisis which developed in February, contrasting this year's coal stocks with those of last

year is no guarantee that power stations will find six winter weeks' reserve sufficient for their needs. In any case, there is little reason for easy optimism.

A Wagon Crisis ?

WHILE the recent coal output figures give rise to some confidence that a wholesale stoppage of industrial activity this winter from this cause may be avoided, the possibility of a considerable loss of production by reason of another shortage—that of railway wagons—becomes increasingly likely. **SIR STAFFORD CRIPPS**, the new Chancellor of the Exchequer, disclosed on Tuesday that there are to-day over 54 000 fewer wagons in operation than at the corresponding date last year; nearly 200 000 are under or awaiting repair; and, although the present rate of production of new stock is 2 650 a month, the rate of deterioration of existing stock is outstripping both repair and replacement. It is officially estimated there will, this winter, be at least a million tons more coal to be transported by rail than last, and over four million tons more iron and steel. The resulting deficiency of wagons will be in the region of 100 000. When low stocks of almost every material are a feature common to most branches of industry, the maintenance of continuous and regular deliveries becomes of paramount importance, and the danger of disruption which may result from transport bottlenecks need not be stressed.

A Canadian Fuel Problem

SUPPLY problems are not apparently confined to this country, for in addition to the difficulties being experienced in the U.S.A. and referred to last week, the Ontario Hydro-Electric Power Commission also has its troubles. In that system supplies are to be rationed in order to meet the demand provided by the fullest possible industrial production, but unlike conditions here the domestic consumer will not have to pay the price. Instead, the necessary economy is to be brought about by a black-out of outdoor and ornamental lighting, a prohibition of sign and shop window lighting, of illumination advertising and some commercial heating. If, as we understand to be the case, these simple restrictions will reduce the load to the requisite level, the standard of lighting in Ontario must be one which we have almost forgotten.

Portrait—Mr. John Hacking

A PPOINTED a deputy chairman of the British Electricity Authority in August, Mr. John Hacking was born at Burnley, Lancs, in December, 1888. After serving an apprenticeship with a firm of motor manufacturers in Leeds, from 1905 to 1908, during which time he was an evening student at Leeds Technical Institute and at Leeds University, he joined the staff of the North Eastern Electric Supply Co., Ltd., as a junior assistant. After two years he was sent to one of the company's waste heat stations and later became assistant district engineer in Sunderland and Newcastle. For about 18 months he gained experience in the company's construction department as assistant engineer.

In 1913 Mr. Hacking left the North Eastern E.S. Co. and joined the consulting engineering firm of Messrs. Merz and McLellan, with whom he had a varied experience extending over 20 years. From 1913 to 1915 he was engaged in Newcastle on work in connection with Argentine railway electrification schemes, and in 1915 he went to the Argentine as assistant to the firm's representative supervising the construction work in connection with the electrification of the Central Argentine Railway and the Buenos Ayres Western Railway. The scheme in each case involved a power station, substations, track equipment and rolling stock.

At the beginning of 1923 he returned



to England and was for two years chief assistant in the traction department in the London office of Messrs. Merz and McLellan.

In 1925 Mr. Hacking became liaison officer for the firm in connection with the overseas' contracts and visited the U.S.A., South Africa (in connection with the Natal main line railway), and Bombay (in connection with the electrification of the Great India Peninsula railway and the Bombay-Baroda railway). From 1929 to 1933 he supervised for

Messrs. Merz and McLellan the construction of the grid in Mid-East and North-East England for which they were consultants. In 1933 he paid another visit to India, becoming later in the year head of the electrical department of the firm in Newcastle. Mr. Hacking joined the Central Electricity Board in 1934 as deputy chief engineer and was appointed chief engineer as from August 1, 1944.

He is a member of the Institution of Electrical Engineers and is at present one of the vice-presidents, having served on the Council for the past four years. Last

winter he was nominated by the Institution to deliver the Faraday Lecture, in which he dealt with the generation and wholesale distribution of electricity, reviewing the probable expansion of the industry over the next decade and touching on possible developments in the application and utilisation of the gas turbine and atomic energy.

Mr. John Hacking has been chief engineer of the Central Electricity Board since August, 1944, after roughly ten years' service as deputy chief. He is one of the two deputy chairmen of the British Electricity Authority and his wide experience includes over 20 years with Messrs. Merz and McLellan, for whom, as consultant, he supervised the construction of the Mid-East and North-East England Grid Schemes.

Generating Plant Standardisation

Control Order Covering Production of Turbo-Alternators

THE Control of Turbo-Alternators (No. 1) Order, 1947, which came into force on November 13, standardises the production of steam turbo-alternators over 10 000 kW to 30 000 and 60 000 kW sets described in the Schedule, except for sets ordered prior to November 1, 1946, or produced under licence, or for ships or for export.

The Order, which has been made by the Minister of Supply, aims at shortening the time needed for the production of turbo-alternators by six to nine months, and it is the first step in standardisation measures which the Ministry of Supply is planning.

OPERATIONAL DETAILS

The Schedule provides that a 30 000 kW set shall, when in full running order and supplied with steam at a pressure of 600 lb./sq. in. and a temperature of 850°F., (a) have a maximum continuous rating of 30 000 kW measured in each case at the terminals of the alternator (or, if the set is a cross-compound or a double-rotation set, at the terminals of its two alternators); and (b) be incapable of using any of the supplied steam for any purpose other than (1) driving the turbine, (2) operating a bled steam make-up evaporator, and (3) pre-heating the feed water, by means of bled steam from the turbine at not more than five stages, to a temperature of not more than 345°F. when the bled steam make-up evaporator (if any) is out of service, and all the steam delivered to the turbine is—except for that bled for heating the feed water—exhausting to a condenser forming condensate of a temperature of not more than 95°F.

A 60 000 kW set shall, when in full running order and supplied with steam at a pressure of 900 lb./sq. in. and a temperature of 900°F., (a) have a m.c.r. of 60 000 kW and also its most economical rating at that output, measured in each case at the terminals of the alternator (or, if the set is a cross-compound or a double-rotation set, at the terminals of its two alternators); and (b) be incapable of using any of the supplied steam for any purposes other than (1) driving the turbine, and (2) pre-heating the feed water, by means of steam bled from the turbine at not more than six stages, to a temperature of not more than 385°F. when all the steam delivered to the turbine is—except for that bled for pre-heating the feed water—exhausting to a condenser forming condensate of a temperature of not more than 95°F.

Speaking at a Press conference on the subject, Mr. G. R. Strauss, Minister of Supply, said that owing to the three-year production cycle required for building and commissioning a new generating station, orders for the major items of plant to be installed during 1947, 1948, and 1949 had already been placed. For this plant action had been limited in the main to progressing the orders and ensuring that manufacturers obtained the necessary materials and labour to enable them to keep to the production time-table. Standardisation, as outlined in the Order, did not mean uniformity of detailed design as between manufacturers. It was mainly functional. Each manufacturer would continue to use his own particular design, provided the sets produced conformed to the functional standard specified.

The Ministry was already reviewing programmes to fit in with the Statutory Order giving effect to the standardisation, and it would be effective for nearly all the 1950 programme. That was only a beginning. It had been found that boilers could be standardised, for example, in diameter, length and thickness.

In 1938, 766 000 kW was installed and the average for the four pre-war years was 533 000 kW. In the years following 1948 they hoped to instal three times as much as the pre-war average.

Replying to questions, Mr. Strauss said that the direction by the Central Board as to where orders for generating plant should be placed had now been made statutory. The overall potential production capacity of the plant manufacturers was of the order of 3 million kW a year, and works and manufacturing capacity were being extended. Production between 1949 and 1952 would be 1½ million kW a year, and the 3 million kW capacity would be reached when the shortage of skilled labour had been overcome.

TIME-EXPIRED PLANT

Sir John Kennedy, chairman of the Electricity Commissioners, said that after 1952, in addition to the growth of load, there would be an enormous amount of time-expired plant due for replacement. In power station extensions, it might be necessary, in the case of one last set, to licence steaming conditions that were different from those now standardised in order to conform to existing conditions, but if, for instance, four new sets were needed, they would be of the standard size.

About Transformers*

by G. O. CASTELL, M.I.E.E.

THE cooling of an oil immersed transformer is usually understood to mean that part of the equipment by which the heat generated in the windings and the

of cooling is that designated ON, in which both the oil and the ambient air circulate naturally under the thermal head provided by the transformer itself. ON cooling can be economically applied to transformers with an output of 15 MVA when designed with a temperature rise in accordance with B.S.S. 171, that is a temperature rise of 50° C. in the oil and 60° C. when measured by the rise in resistance of the copper.

In the smallest sizes, the area provided by a plain sheet steel tank will be sufficient to dissipate the losses; transformers of from 50 to 5 000 kVA output, are usually accommodated in tanks with external

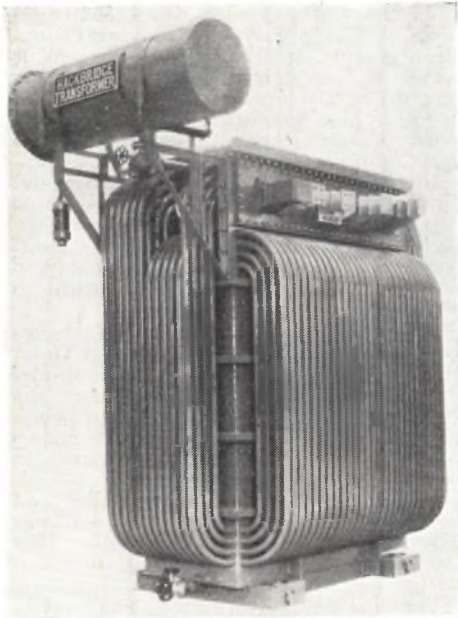


Fig. 1.—4 000 kVA transformer with ON cooling provided by four rows of tubes

core is transferred from the oil to the ambient air or the cooling water.

There are six recognised systems of cooling, and defined in B.S.S. 171, they are as follows:—

Oil circulation	Cooling	Designation
1. Natural, thermal head ...	Air, natural	ON
2. Natural, thermal head ...	Air, blast ...	OB
3. Natural, thermal head ...	Water ...	OW
4. Forced	Air, natural	OFN
5. Forced	Air, blast ...	OFB
6. Forced	Water ...	OFW

Sometimes two or more methods are used in combination, thus a transformer may employ one form of cooling when delivering up to a certain output, and then to obtain a greater output additional cooling of a different form may be brought into use either automatically or by hand.

The most simple and trouble-free form

* Parts I, II, III, IV, and V, of this series were published in "THE ELECTRICIAN" of August 15, 22, October 3, 17, and 31, respectively.

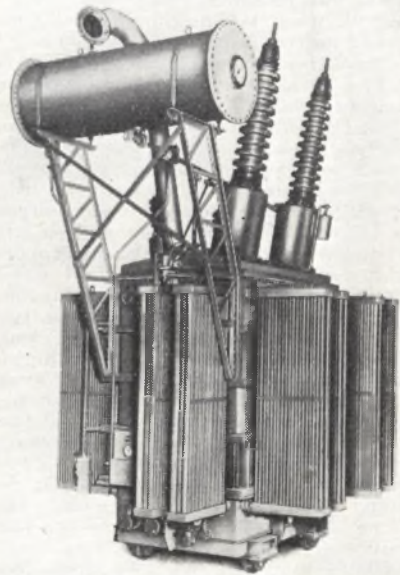


Fig. 2.—6 656 kVA single-phase transformer with ON cooling provided by detachable radiators

radiating tubes, through which the oil circulates, welded to their periphery, Fig. 1. As the size of transformer increases and more cooling surface is required, the tubes are disposed in two, three or four rows; it may be noted here that while the addition of a row of tubes increases proportionately the area available for the dissipation of heat by convection, it adds little to the radiating surface; therefore, the total heat dissipation is by no means in-

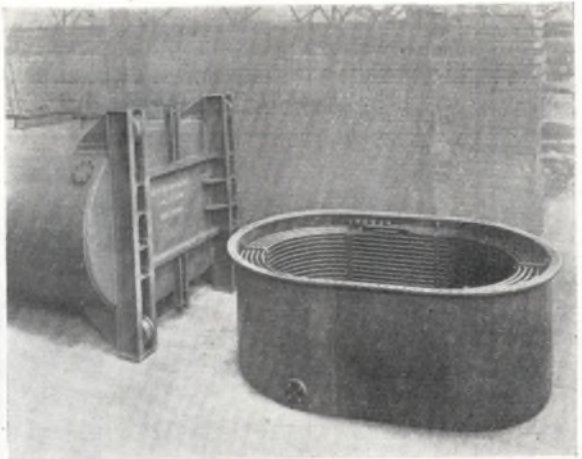
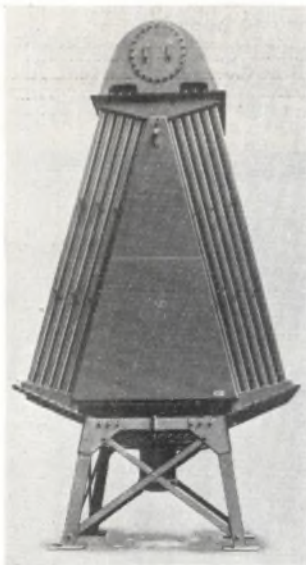


Fig 3 (left).—Separate cooler of inverted vee form, fitted with fan and baffles for OB cooling; without these it could be used for ON cooling. Fig. 4 (above).—Water cooling tubes mounted in tank lid ready for assembly on main tank body

creased in proportion, and for this reason it is rarely economical to use more than four rows of tubes. Difficulties in cleaning and re-painting are a further argument against the use of tubes in many rows. Still larger transformers have cooling provided by detachable radiators as illustrated in Fig. 2. Valves both top and bottom enable each radiator to be removed and replaced without lowering the oil in the main tank, a valuable asset during transport and also during cleaning and re-painting operations. Radiators can be supplied with two valves top and bottom, one situated on each side of the flange. The radiators can thus be removed without emptying any oil whatever, but this refinement is an expensive luxury, and it is usual to tolerate the necessity of emptying

the radiator itself, the average content of which would be 50 gal. When a growing load is anticipated, transformers can be supplied fitted with radiators sufficient to deal with only part of the rated output, but with flanges and valves added to accommodate further radiators as the load demand increases. The saving in first cost is not large, but if a close estimate of the load

curve can be made, it is sometimes considered worthwhile.

Transformers of over 10 MVA, or of smaller size if the fitting of an on-load tap changing gear, or large cable boxes, restricts the tank area available for cooling equipment, are usually provided with a separate cooling unit. These take various forms, generally consisting of cooling tubes welded top and bottom into common headers, and built into banks with the tubes vertical, or in a vee formation, or as in Fig. 3 in an inverted vee.

If a transformer site has a reliable water supply which is cheap and comparatively clean, such as might be expected at a hydro station, water cooling, OW, provides a simple and efficient method of dissipating the transformer losses. Transformers

have been installed and operated successfully, notably in the Scandinavian countries, with cooling systems designed to make use of contaminated water, and even sea water, but the special materials required and the precautions necessary do not seem to be justified unless unusual conditions forbid the use of other methods.

The equipment for water cooling con-

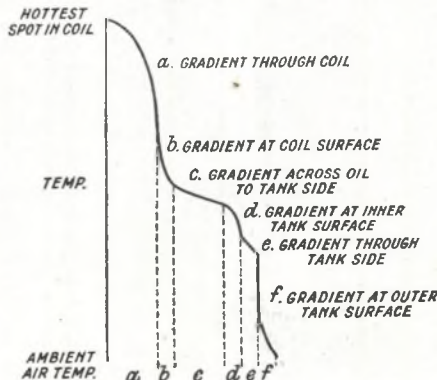


Fig. 5.—Thermal details of an ON transformer

sists of a spiral nest of tubes through which the water flows, situated in the hottest part of the oil, that is at the top of the tank. The water tubes should consist of seamless copper, tested to a pressure many times that to which they will be subjected in service; they are lead unbroken through the tank and all joints, valves and meters are situated outside; thus any chance of water leaking into the oil can be regarded as negligible. The cooling system is arranged to be self-draining, so that in the event of a shut-down occurring during cold weather, there is no chance of a freeze up. In Fig. 4 is shown the cover of a single-phase 1 800 kVA transformer, with the water cooling coil in position, all ready for bolting to the main body of the tank. It is interesting to note that this transformer was one of a number manufactured for export to Canada, and in addition to a cooling system, a heating system consisting of resistance mats had to be included in the tank to prevent the oil from freezing during periods of light load in the winter.

The transfer of the heat from the centre of the core or windings under ON cooling, takes place in several distinct stages. In Fig. 5, this is depicted diagrammatically, without attempt to obtain a scale. The part of the curve (a) is a conduction drop through various thicknesses of insulation which are included in the coils. It can be controlled by efficient ducting of the windings, but there is an economical limit to the value to which this gradient can be reduced. (b) Is a temperature drop across a thin film of the oil held in close contact with the surface of the coils. (c) Is a small temperature difference across the oil to the tank side. There is another drop (d) at the inner surface of the tank and tubes, though this is normally considerably less than (b). The conduction drop (e) through

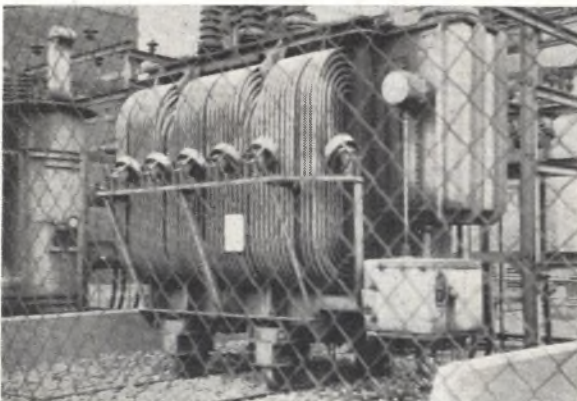


Fig. 6.—A crude example of German OB cooling pre-war

the tank wall and whatever paint or protective coat may be applied to it, is very small, and finally there is a considerable temperature drop (f) across a thin film of air in contact with the outer cooling surface of the tank. It is in the regions

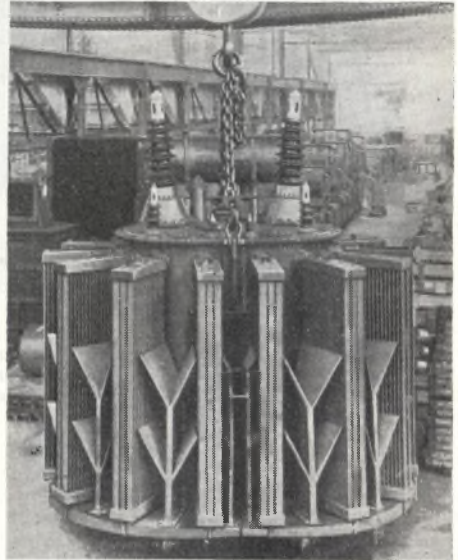


Fig. 7.—OB cooling by common blower feeding air to cooling tubes through trunking and nozzles

(b) and (f) and to a lesser degree (d) that an advantage can be gained by forced circulation of the air and the oil, for by breaking up the film held at the surface of the coils or tank, the temperature gradient at these places can be greatly reduced. This means, that for the same overall temperature difference between the hottest copper, and the ambient air, the other parts of the thermal circuit can be increased in value, which permits a greater loading on a given transformer or a reduction in size both of transformer and cooling equipment for a given output.

The most obvious method of applying artificial cooling is to take an ON transformer and force the external air circulation over the existing cooling surfaces by means of a blower or fan; this is in effect often done. Fig. 6, shows this type of cooling OB, in its most elementary form; a number of small fans have been fitted so as to blow

on to the tubes of a standard tubular type tank.

This example is of German practice of shortly before the outbreak of war, and the author knows of no British manufacturer employing this method. It is suspected that the transformer shown failed to deliver its rated output within the specified temperature rise, and that this method was used to satisfy the customers' demands, but this is not known for certain. Small fans have been fitted to individual radiators, or quite commonly one fan between each pair of radiators on such a transformer as is shown in Fig. 2. In this case it is also common practice to incline the radiators together at the top so that each pair makes an inverted vee with the fan situated in the opening at the bottom. Sometimes one large blower is used and the air stream carried through a trunking and directed on to the cooling surfaces through nozzles, such an arrangement is illustrated in Fig. 7.

The inverted vee cooler is peculiarly adaptable to OB cooling; a fan situated beneath the cooler and a few simple baffles, arranged as illustrated in Fig. 3, to ensure that all the air is directed over the cooling surfaces constitutes a very efficient assembly.

The transformer with OB cooling has such a large inherent ON rating that it

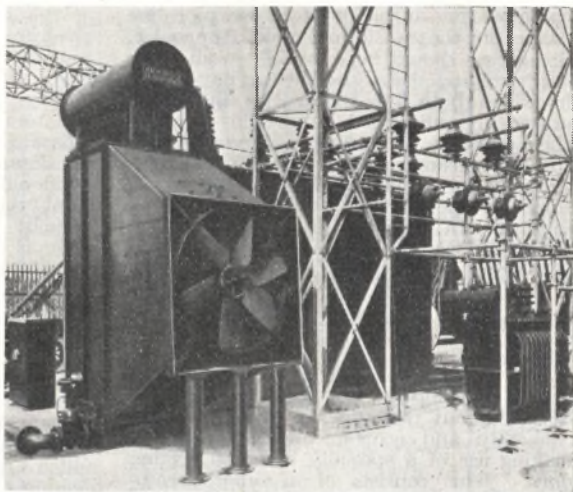


Fig. 8a.—The rear of the OFB cooler illustrated on the right below

is usual to take advantage of this fact by arranging for the forced draught to be switched in, generally automatically, only when the loading reaches a certain predetermined value or when the temperature reaches the certain predetermined figure.

In the first case, the additional cooling is controlled by relays operated from the secondaries of current transformers connected in the secondary lines, and in the second case operation is effected by electric contacts, on a thermometer, set to close at the desired temperature. Thus is effected a saving in running costs, maintenance and a reduction in noise, as the periods of light load, when the fans or blowers will be inoperative, often correspond with the hours of darkness, when the resulting noise would be most objectionable; this latter is an important consideration. If a transformer is expected to run for long periods at loads approaching its rated output, as is the case of many generator transformers, the added expense and complication of relays and contactors is not justified; in this case the fans are controlled by switches interlocked with the main circuit-breakers.

Transformers of the ON type which have separate cooling units can be converted to a forced oil circulation by ac-

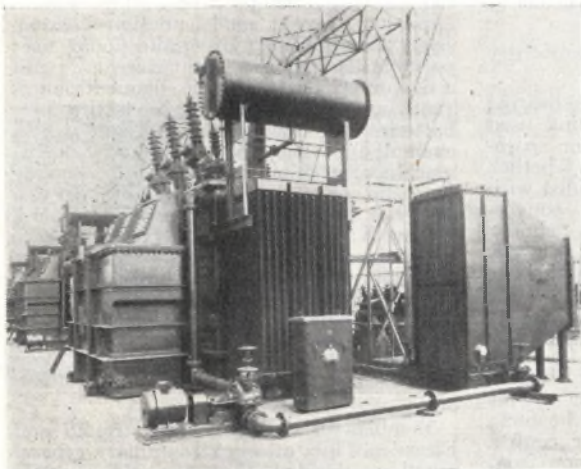


Fig. 8.—Transformer fitted with ON/OFB cooling. ON up to half load, after which the OFB cooler on the right is brought in by relays operated by the secondary current

commodating an oil pump in the pipe line connecting the transformer tank to the cooler. Some care should be exercised in choosing the pumping unit; the best type is that in which both the pump and the motor are totally submerged in oil. This obviates the possibility of air being introduced into the oil stream at this point, which was one of the troubles which appeared in some of the earlier OFN cooled transformers. In addition, if it is desired to obtain an ON rating from the transformer and bring in the pump as the load rises, it is necessary to use a special type of pump which will permit a free circulation of oil when the pump itself is not in operation.

If a fan is added to the cooler of the above transformer, an OFB cooling is obtained, but this type of cooling is most efficiently and economically obtained by making use of a specially designed cooling unit. This consists of a radiator composed of comparatively small bore tubes, often finned in a manner resembling those used in an automobile radiator of standard design, through which the oil is pumped; forced draught is provided by a fan built into the cooling unit. Such a cooler has no ON rating as the resistance

of the radiator to the flow of oil is too great for the natural thermal head of the transformer to produce any useful circulation. If an ON rating is required, it is usually provided by fitting detachable radiators to the main tank or a small separate ON cooler, sufficient to deal with the losses resulting from about half the rated output of the transformer at which point the OFB cooler is automatically brought into operation. Appreciable noise is one of the disadvantages of this type of cooling.

Finally, forced oil circulation can be applied to a water-cooled transformer to obtain OFW cooling. The oil is pumped through a nest of small bore tubes housed in a jacket through which the cooling water flows and carries the heat away to waste. All the precautions against a leak developing must be taken; in addition an added safeguard can be obtained by making the oil pressure within the cooler higher than the corresponding water pressure, so that in the event of trouble, oil will find its way into the water and not vice versa. An OFW transformer can have no ON rating.

(To be continued.)

Purchase Tax Increases

THE main effect of the Supplementary Budget of interest to the electrical industry is the raising of purchase tax on all goods to which it formerly applied. Those appliances previously exempt remain untaxed. The increased rates are as follows:—

From 100 to 125 per cent.: Electric dry shavers.

From 66½ to 75 per cent.: Space heating appliances and apparatus of a kind used for boiling or cooking and also for space-heating, electric fires and heaters, whether fixed or portable; fireplaces provided with electric radiator panels; electric convectors; air conditioning and similar appliances operated by electricity; electric towel rails and heaters; instantaneous water heaters; immersion water heaters with loading not exceeding 3 kW; electric storage water heaters not exceeding 30 gal. capacity; fireguards and other furniture incorporating heating elements; boiling rings and hot plates adaptable for use for space heating; circulator water heaters; water boilers for tank storage or central heating; lawn mowers for operation from electric mains.

From 33½ to 50 per cent.: Washing machines, ironers and wringers; fans with

motors not exceeding $\frac{1}{10}$ H.P.; food mixers of a capacity up to 12 qts. and attachments; vacuum cleaners; warming pads; vibrators; electro-medical appliances, such as ultra-violet lamps, infra-red generators, radiant heat lamps and other similar apparatus, except models designed exclusively for hospital or professional use; portable lamps and hand torches (with some exceptions); electric filament lamps (not exceeding 250 W); electric dry batteries of all kinds (except where exempted); hair waving and drying machines; wireless receiving sets of the domestic or portable type, and valves, batteries and accumulators suitable for use therewith; television receivers of the domestic or portable type; wireless receiving units of public address apparatus; car radios; electric clocks and clocks incorporating illuminated or other advertisements; domestic and decorative lighting fittings.

Members of the Manchester Radio and Electrical Club, at an extraordinary general meeting, decided that the club should affiliate to the Radio Industries Club, London, and change its name to Radio Industries Club (Manchester Area).

• 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.

SIR EDWARD APPLETON, F.R.S., secretary of the Department of Scientific and Industrial Research, has been awarded this year's Nobel Prize in physics for "his contribution in exploring the ionosphere, the electrically conductive strata in the upper atmosphere of the earth." Sir Edward has been secretary (administrative head) of the D.S.I.R. since 1939 and his work was fundamental in the development of



SIR E. APPLETON

radar. Other awards received by him this year include the U.S. Medal of Merit (highest U.S. civilian award) for early work on radar and for services in promoting Anglo-American scientific collaboration during the late war, and the Cross of Freedom of Norway. He was also made an Officer of the Legion of Honour, France.

MR. W. USHER, Town Clerk of Halifax for the last seven years, has been appointed deputy legal adviser to the B.E.A. He has wide experience in local government administration, including electricity undertakings.

MR. C. W. MARSHALL, technical and research engineer to the Central Electricity Board since 1927, has been appointed deputy chief engineer for research under the British Electricity Authority. Mr. Marshall is 57 years of age. He is a B.Sc. (Eng.) and from 1916 until May, 1927, when he joined the engineering staff of the C.E.B., he held the position of chief technical assistant in the Glasgow electricity department. He was with



MR. C. W. MARSHALL

the Glasgow Corporation for 14 years. Mr. Marshall has made a special study of modern methods of generation, transmission and distribution of electricity in

this country and abroad and has published books dealing with generating stations, protective gear and battery vehicles. He is a member of the I.E.E. and was chairman of the Measurements Section of the institution for the 1940-41 session.

SIR JOHN DALTON has been appointed a director of Central London Electricity, Ltd., and London Associated Electricity Undertakings, Ltd.

MAJOR HARRY RICHARDSON, deputy chairman, has been appointed chairman of the London Power Co., Ltd., following the death of Lord Lytton, and Mr. Clarence Parker has been appointed deputy chairman. Sir John Dalton has been made a director of the company.

MR. C. R. WESTLAKE, general manager and engineer, Finchley electricity department, leaves for Uganda by air today, November 21, to take up the temporary position of electrical adviser to the Uganda Government. It is proposed that when legislation has been passed, setting up the Uganda Electricity Board, he will become its first chairman. Mr. C. Bradley, who is at present Mr. Westlake's deputy at Finchley, has been appointed acting general manager and engineer. He has acted in a similar capacity on two other occasions during Mr. Westlake's absence in East Africa.



MR. C. R. WESTLAKE

MR. F. W. MOCKETT, superintendent of the Caton Road power station, Lancs., has received a clock, a fountain pen, a quilt and an inscribed album to mark his retirement. The presentations were made at a meeting at the Wheatsheaf Hotel, Lancaster, by the Mayor (Ald. J. L. Dirkin), chairman of the Electricity Committee.

MR. G. W. ESSEX has resigned from the position of national negotiations secretary to the Electrical Power Engineers' Association to take up an appointment in the labour relations department of the B.E.A. Before joining the secretarial staff of the E.P.E.A. in 1921, Mr. Essex served as an engineer with several north-

eastern electricity undertakings, including the Cleveland and Durham Co., Sunderland Corporation and the old Newcastle and District Co.

MR. JOHN DAVIS has been appointed to the board of Cinema Television, Ltd.

PROF. J. F. JOLIOT, of Paris, has been awarded the Royal Society's Hughes Medal for contributions to nuclear physics.

MR. PERCY W. DUNN has been elected chairman of the Junior Institution of Engineers and Messrs. G. W. Tookey and S. J. Crispin have been elected vice-chairmen.

MR. G. H. WALKER has joined Ekco-Ensign Electric, Ltd., as an illuminating engineer. He commenced his duties on October 27, operating from the Preston sales office.

Having cancelled their third annual dinner and dance, because of rationing restrictions, the J. and P. Staff Association held a dance and cabaret at the Cafe Royal, London, on Friday, November 7. Among the 260 members and guests who attended, were Mr. G. Leslie Wates, chairman and joint managing director; Mr. W. Glass, joint manager director; and Mr. R. W. C. Reeves, a director of the company; Mr. D. Hutton, secretary, and Mr. M. Bradley, works manager, of British National Electrics, Ltd., the domestic appliances section of the company; and most of the branch managers.

LORD CITRINE, chairman of the British Electricity Authority, has suggested that Bolton Corporation should not appoint a new electrical engineer. For more than twelve months the Town Council refused to make an appointment at a salary of £1 900 and advertised the post at £1 600, but it was boycotted by electrical engineers' associations. Two months ago the council decided to advertise at £1 900. In view of Lord Citrine's suggestion the advertisement has been cancelled until the Electricity Committee has discussed the position. In a letter to Mr. John Lewis, M.P. for Bolton, Lord Citrine points out that under the Electricity Act, 1947, the duties of chief engineers of undertakings cannot continue as at present and says that nothing in the nature of a long-term contract should be entered into.

MR. B. N. MACLARTY, of the B.B.C. engineering staff, has been appointed a deputy engineer-in-chief of Marconi's Wireless Telegraph Co., Ltd., Chelmsford, and will be concerned mainly with broadcasting transmitters, television and associated equipment. He is one of the early pioneers of British broadcasting, and was a member of the section of the engineering staff of the Marconi Company which, under the leadership of Captain P. P. Eckersley,

started broadcasting from the experimental station 2MT at Writtle before the formation of the B.B.C. in November, 1922. Mr. MacLarty has been a member of the engineering staff of the B.B.C. since 1926, and has been responsible for the design and construction of all radio, electrical and mechanical equipment. His work was recognised by the award of the O.B.E. He is a member of the I.E.E.

MR. LEON C. DESOUTTER, engineer, chairman of Desoutter Brothers, Ltd., left £408 179 (duty paid £214 659).

Obituary

MR. A. S. McWHIRTER, formerly works manager of McWhirter and Sons, Ltd., Glasgow, on November 16, aged 60 years. He specialised in the installation of motors and switchgear and also the repair and rewinding of motors and generators up to 500 H.P. He was a full member of the I.E.E. and of the Institution of Engineers and Shipbuilders in Scotland.

Electrical Industries' Ball

THE Electrical Industries' Ball in aid of the E.I.B.A., at Grosvenor House, London, on the second Friday of this month attracted a gathering of 550, and the funds of the association will benefit by over £400. The guests were welcomed by Mr. Walter Riggs, president of the association.

Loyal greetings were sent to the King, who is patron of the association, and the following reply was received: "The King sends his warm thanks to the President, Council and members of the Electrical Industries' Benevolent Association for the loyal terms of their message, which His Majesty, as patron, greatly appreciates."

Dancing to the music of Billy Ternant and his Sweet Rhythm Orchestra, was continued until 1.30 a.m., with intervals for a buffet supper and a cabaret by Sherkot, the Three Avalons, and Sylvia Welling.

Nineteen prizes, including a refrigerator, were presented to holders of lucky programmes. The donors of the prizes were:

H. J. Baldwin and Co., Ltd. (electric blanket); Belling and Co., Ltd. (grill-boiler); Berry's Electric, Ltd. (electric fire); Crompton Parkinson, Ltd. (travelling bag); English Electric Co., Ltd. (electric plate warmer); Falco Electric Appliances, Ltd. (electric fire and an iron); Ferranti, Ltd. (electric fire); Frigidaire, Ltd. (refrigerator); John Godden (Stoke), Ltd. (electric blanket); Hague and McKenzie, Ltd. (electric kettle); T. M. C. Harwell (Sales), Ltd. (electric clock); Hotpoint Electric Appliance Co., Ltd. (electric iron and kettle); the Metropolitan-Vickers Electrical Co., Ltd. (electric table lamp); Parnall (Yates), Ltd. (wringlet); Regentone Products, Ltd. (radio receiver); Reyrolle and Co., Ltd. (vacuum cleaner); and Ultra Electric, Ltd. (radio receiver).

Power Cable Standardisation

REDUCING PRESENT MULTIPLICITY OF TYPES

A REVIEW of the development and present scope of British Standard specifications for insulated power cables was given by Mr. W. H. Lythgoe (W. T. Henley's Telegraph Works Co., Ltd.) in a paper on "Standardisation of Power Cables," read before the I.E.E. Transmission Section on November 12.

It was concluded that after taking into account the wide diversity of uses for such cables the present multiplicity of standards was not justified, and that considerable reduction of the alternative constructions now included was desirable for economical production and in the best interests of the electrical industry as a whole. Furthermore, some types not hitherto included were now sufficiently standardised to warrant their addition to the existing ranges.

MR. J. W. LEACH (Central London Electricity) thought that standardisation should not take place until the development of experience had led almost to a common practice. In addition to the ten standard sizes of conductor suggested in the paper, he would like to see the retention of 0.15 and 0.25 sq. in. for 6.6 and 11 kV, for which they were in great demand.

MR. R. N. BERRY (C.E.B.) suggested that considerable simplification could be obtained immediately by deleting a large number of the existing standards and retaining only those with a larger application. When new standards were drawn up, however, it was essential to consider current practice and developments abroad as well as in this country. If British cable-makers were to compete in foreign markets they must manufacture to foreign specifications, so that the adoption of more universal standards would be a real step forward. There was no reason why 33 kV solid-type cables should not be standardised immediately, and there was a good case for standardising oil-filled cables for 33, 66 and 132 kV.

MR. K. H. TUSON (Mackness and Shipley) stated that standardisation was not necessarily a good thing from the point of view of the user. He would like to see some figures to show what saving in the costs of labour it was reasonable to expect from standardisation. If certain sizes were omitted, users might have to employ one size larger, and therefore the cost of installations would go up and more materials would be used. He suggested that the best way of achieving greater standardisation was by a price differential. If cables of certain sizes were appreciably cheaper

than intermediate sizes, users would soon bring about standardisation to the manufacturers requirements.

MR. C. C. BARNES (C.E.B.) suggested that for 22 and 33 kV the use of small conductor sections should be avoided, since the same quality of insulation could not be achieved as with a larger copper section, and small conductors aggravated jointing and termination problems. For 22 kV he suggested a conductor cross-section of not less than 0.06 sq. in., and preferably 0.1 sq. in., and for 33 kV not less than 0.1 sq. in. and preferably 0.2 sq. in.

MR. P. M. HOLLINGSWORTH (Johnson and Phillips) emphasised that the whole-hearted co-operation of cable users was essential to success in standardisation. He hoped that when aluminium sheathing came to be standardised a more scientific basis would be adopted than appeared to have been used for lead.

MR. D. T. HOLLINGSWORTH said that the labour cost of cable was about 15 per cent. of the total cost, so that any reduction in labour costs as a result of standardisation would not materially affect the overall cost of the cable.

MR. C. T. SUTTON (Enfield Cables) suggested that before coming to standardisation the simplification of cable constructions and designs should be studied, and he stressed that great savings would be possible if the layout and method of installing cables were given as much consideration as, say, the installation of a turbine.

MR. K. L. MAY (Edmundson's Electricity Corp.), expressing dismay at finding that as a user he was one of those responsible for there being 18 000 standard types of cable at present, said that figure alone justified some action being taken. He believed that some engineers hesitated to employ an arc suppression coil on cable networks with an earthed neutral, but their experience had been that it could safely be used.

MR. G. S. BUCKINGHAM (Pirelli) suggested that the sizes of flexible conductors might well be standardised, and, supported the inclusion of 33 kV cables in the next revision of B.S.480. In this respect he pointed out that the thicknesses of dielectric at present recommended were based on electric stress, but if an oval conductor was used there would be a concentration of stress at the rounded ends of the conductor. It would seem, therefore, that extra layers of insulation should be put on oval cables.

THE DALTON BUDGET

by SIR ERNEST BENN

THE Dalton Budget made no attempt to deal with wages, work, output and all those major issues now blazoned on the hoardings of the country in the form of threats, appeals and targets. That failure transcends in importance any of the alterations in the details of taxation. All will agree that this Government has succeeded in giving to the wage earner a sense of security which, however desirable, has its repercussions. There remains that solid core of all virtues of endeavour summed up in the phrase "the British working man," but there has also arisen around that solid core a definite tendency, which none can deny, to fall back on security while accepting no responsibility for its provision. In this way the gravity of the plight in which the nation finds itself has been obscured from the knowledge and understanding of large sections of our people. It is because of Mr. Dalton's disinclination to deal with subsidies and thus failing to abandon the present inflationary tendency, that his retirement in favour of Sir Stafford Cripps will, in some quarters at least, be welcomed.

For the moment the Stock Exchange is on the horns of a most difficult dilemma. Mr. Dalton's affection for cheap money which colours the whole of the Budget was an inflationary influence and put up the prices of industrial stocks and shares in spite of heavier taxation. The arrival of Sir Stafford Cripps with his preference for austerity and deflation—a much more healthy point of view—may very well result in a general fall in Stock Exchange values.

The Budget does nothing whatever towards helping to solve the difficulty of an adverse balance in our overseas payments. The reduction of a debit of £700 000 000 to half the figure still leaves us in the position of the bankrupt, an unhappy position for a buyer; while because no steps are taken to reduce our costs at home, we still suffer serious handicaps as a seller. In this connection the flat refusal to reduce Government expenditure, except in regard to the means of defence, gives grounds for the gravest apprehensions.

In all his Budget speeches Mr. Dalton has emphasised the danger of too much money chasing too few goods. In his retirement he may find satisfaction in the knowledge that he has made the public understand that vital point. His

Budget on the best of estimates reduces the amount of money in the pockets of the people, as a whole, by a mere 4 per cent., most of it taken from sources other than the actual pockets of the common people. These unfortunates are therefore left with Treasury notes of ever lessening reputation with rather less than ever to buy. The Budget bears all over it the mark of the T.U.C. which is rapidly becoming the centre of power. Had Mr. Dalton plucked up the courage of a Joseph Chamberlain, who won considerable popularity by the bold, frank and perfectly truthful statement "Your food will cost you more," he would have served the true interests of the nation better.

In Parliament

B. E. A. Responsibilities.—The British Electricity Authority is not a functional board, and its members were not appointed as heads of departments. The three full-time members of the Authority besides the Chairman are specially concerned with administration, technical and operational matters and labour relations respectively. (MR. H. GAITSKELL, Minister of Fuel and Power.)

Generating Capacity.—The potential output capacity of serviceable generating plant under the control of the C.E.B. was 10 317 000 kW on July 1, 1947, and 10 717 000 kW on November 1, 1947. New power stations are under construction or under consideration at the following sites: Meaford, Braehead, Cliff Quay, Kingston, Birkenhead, Croydon, Rye House, Brunswick Wharf, Poole, Carrington, Wigan, Skelton Grange, Staythorpe, Usk Mouth, Huncoat, Tilbury and Carnarthen Bay. The list does not include extensions or reconstructions of existing stations. The net increase in output capacity under the control of the C.E.B. is expected to be about 300 000 kW in 1947 and about 1 000 000 kW in 1948. The output capacity in the early months of 1948, when the heaviest strain will be imposed on the power stations, may fall short of maximum potential demand—without allowing for staggering—by one to two million kW, according to the state of the weather. (MR. H. GAITSKELL, Minister of Fuel and Power.)

Mersey and N. Wales Centre

Work of the I.E.E. on Codes of Practice

HOW the ramifications of the I.E.E. had been extended to enable it better to serve the community and the electrical industry was explained by the president, Mr. Percy Good, at the annual dinner of the Mersey and North Wales Centre, held at Liverpool, on Monday.

The Institution, he said, was the keystone in the electrical industry arch and was an essential factor in the life of the industry. Membership now approached 90 per cent. of the electrical engineers in the country and included many in Dominion and overseas countries. Membership had nearly doubled and now stood at over 31 000. Strong membership, however, was not the sole criterion of effectiveness; it must register in the quality of the service engineers could give in the many industries which relied on electrical methods. Many technical committees had been set up to deal with subjects important to the nation and to the industry. They numbered between 55 and 60 and some of them were doing work of outstanding merit. The I.E.E. had adopted an advanced policy in matters of education and had more important functions than to regard its examination work purely for the purpose of its own membership. It recognised that an industry so highly technical must be equipped with people effectively trained; the well-being of the industry depended on it. That would be seen in the three reports of the committee which

had been sitting under Sir Arthur Fleming.

The I.E.E. codes of good practice represented the minimum conditions to secure safety and were designed to indicate what was the standard of good work. With 14 or 15 other associations, the I.E.E., under the aegis of the Ministry of Works, was working on a code dealing with buildings and was concerning itself with wiring questions. Another activity in which the three major institutions (Civil, Mechanical and Electrical) were engaged, was in conjunction with the B.S.I., for codes of practice for anything which went into plant and machinery. All this work must yield long term benefits to industry. The model general conditions of contract were also being brought up to date.

Mr. J. O. Knowles said it was because the I.E.E. was national, but not nationalised, that it commanded such widespread allegiance. For two generations electricity had made life easier and pleasanter for everybody and it would continue to do so.

The Lord Mayor of Liverpool (Ald. W. T. Lancashire, J.P.) commended the work of the I.E.E. in standardising electrical equipment, particularly of plugs, sockets and switches. Lack of standardisation was one of the bugbears of those engaged in the building trade.

Speeches were also made by Mr. P. C. Barnes, chairman of the Centre, who presided, Mr. R. Varley and Lieut.-Col. R. Shields.



Group taken at Reece's Restaurant, Liverpool, on Monday, showing some of the members of the I.E.E. Mersey and North Wales Centre and their friends, at the annual dinner

Building Exhibition at Olympia

REVOLUTIONARY developments in constructional methods and materials as well as in the design of homes and industrial structures, arising from the need for economy and the demand for higher standards of efficiency in heating, lighting and other amenities, are reflected in the displays and demonstrations staged at the twenty-second Building Exhibition. This opened at Olympia, London, on Wednesday, November 19, and will be open daily until December 4. It has the support of five Government Departments and the L.C.C., each of whom has an exhibit, and all sections of the building industry. The 371 exhibitors exceed by 20 the number who participated in the exhibition of 1938.

The display of electrical equipment by Richard Crittall and Co., Ltd., and associated companies, includes a simplified channel conduit system, made by Channel Conduits, Ltd. It is of ribbed pressed steel with a pickled finish, which is proof against the weather, in varying widths according to the number of conductors to be accommodated, and the lid, which has a snap fitting, is easily removed in sections, thus permitting modifications to wiring after installation. On the same stand the Dulrae Manufacturing Co., Ltd., are demonstrating their low, medium and high temperature radiant warming systems for homes and factories. All these systems contain wired elements in sandwich form, giving out black heat and are thermostatically controlled.

A new method of installing electric wiring by utilising flexible plastic conduits with Bakelite fittings, and boxes, is introduced by Flexible Non-Metallic Conduits.

Featured on the stand of British National Electrics, Ltd., the domestic appliances section of Johnson and Phillips, Ltd., is the Charlton "Twin" dual-purpose electric water heater, which provides a constant supply of 6 gall. of hot water for domestic purposes or 20 gall. for baths. It is incorporated in a complete hot water system. Other models of the range of Charlton electric storage water heaters are displayed. A wide choice of Sadia automatic electric water heaters is displayed by Aidas Electric, Ltd., including the well-known U.D.B. for installation under the draining board, and the latest models, which work by both coal and electricity.

Central heating by oil-electric radiators, with independent unit control, is demonstrated by Hurseal, Ltd., who also apply the same principle to electrically operated drying cabinets and towel rails. Coa Products also present an oil-filled thermostati-

cally controlled electric convector radiator under the name of "Dimplex," which is employed for central or unit heating. Refrigerators designed to be built into kitchen fittings are exhibited by Electrolux, Ltd., who introduce two new models of 1½ cu. ft. capacity.

Loudspeaking inter-com. equipment is shown and demonstrated by the Fleming Electrical Corporation of Great Britain, Ltd. Among exhibitors of portable electric tools are Kango Electric Hammers, Ltd., E. R. Cole, Ltd., and Interwood, Ltd. Decorative lighting fittings for fluorescent and filament lamps are to be seen on the stand of Uva Products, Ltd. The main exhibit of English Clock Systems, Ltd., is a prefabricated tower housing a set of Westminster chime bells.

On their stand the British Electrical Development Association have three groups of display panels of particular interest to architects and builders. Information and advice are given.

Electricity Generation

RETURNS rendered to the Commissioners show that 3 725 million units of electricity were generated by authorised undertakers in Great Britain during October, 1947, as compared with the revised figure of 3 735 million units in the corresponding month of 1946, representing a decrease of 10 million units, or 0.3 per cent. During the past ten months of 1947 (i.e., up to the end of October) the total number of units generated by authorised undertakers was 34 164 million, as compared with the revised figure of 32 934 million for the corresponding period of 1946, an increase of 1 230 million units, or 3.7 per cent. The total number of units sent out from the generating stations of authorised undertakers during October, 1947 (i.e., units generated less units consumed in the stations by auxiliary plant and for lighting, etc.), was 3 512 million, as compared with the revised figure of 3 528 million in the corresponding month of 1946, representing a decrease of 16 million units, or 0.5 per cent. During the past ten months of 1947 (i.e., up to the end of October), the total number of units sent out from the generating stations of authorised undertakers was 32 222 million, as compared with the revised figure of 31 062 million for the corresponding period of 1946, an increase of 1 160 million units, or 3.7 per cent.

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:—

Wallasey, November 27.—Supply and delivery of 33 kV and pilot cable. Specifications from Borough Electrical Engineer and Manager, Electric House, Wallasey Road, Wallasey.

Downpatrick, December 1.—Electrical installations in 76 houses. Specification from County Architect, Irish Street, Downpatrick.

Woolwich, December 1.—Supply of meters during year beginning January 1, 1948. Specification from Borough Electrical Engineer, Electric House, Powis Street, Woolwich, S.E.18; deposit, £1 ls.

Kettering, December 3.—Supply and delivery of one five-panel, 11 kV, three-phase, 50 cycles, 150 000 kVA duplicate bus-bar (off-load method of selection) hand-operated, metal-clad switchgear. Specifications from Borough Electrical Engineer, Rockingham Road, Kettering; deposit, £1 ls.

Bedwelty, Glam., December 4.—Supply

of 11 kV switchgear, transformers, h.t. and l.t. cables and house service meters. Specifications from the Electrical Engineer, Showrooms, Blackwood, Mon.

Heston and Isleworth, December 6.—Supply and delivery of: (a) approximately 3 000 yds. 22 kV, three-core, .25 sq. in. underground cables; (b) approximately 18/22 kV straight-through joints; (c) three-panel 11 kV, 250 MVA truck type switchboard (extension to existing switchboard) with erection. Specifications from Borough Electrical Engineer and Manager, 11, Staines Road, Hounslow.

Risca, Mon., December 6.—Supply, delivery and erection of oil-cooled static transformers, h.t. and l.t. switchgear, complete sub-station kiosk and l.t. cable. Specifications from Electrical Engineer, Electricity Department, Risca, Mon.

Edinburgh, December 19.—Supply of meters for period from May 29, 1948, to May, 28, 1949. Specification from Engineer and Manager, Dewar Place, Edinburgh, 3.

Plymouth, December 20.—Supply, delivery and erection of six circulating water pumps and motors. Specifications from City Electrical Engineer, Armada Street, Plymouth.

Welding Research Association

IN introducing Dr. H. G. Taylor, the recently appointed director of research, to members' representatives at a meeting of the British Welding Research Association in London on Tuesday, November 18, Sir William J. Larke, president, said they looked forward with confidence to the progressive development of the association along lines which would ensure control of the programme within the limits of the financial resources available. Financial resources must be increased if the association was to render to the metal constructing industries that service which they were confident it could render.

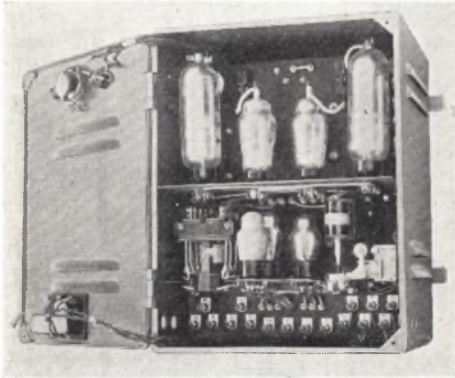
Dr. Taylor said that at present they had twenty-one investigations actively in progress, of which seventeen related to arc-welding or arc-welded products, three to resistance welding, and one to combined gas and arc-welding. Sixteen of the researches were experimental, and five were of the paper-work type, such as preparation of recommendations for specifications and codes of practice. Of the sixteen experimental investigations, eight were internal and were being carried out at the

association's laboratories at 29, Park Crescent, London, W.1, and at Abington; six were co-operative, being conducted at members' works; and two were extramural, being done at Cambridge and Birmingham Universities. Those researches were directed by research committees composed of technical experts appointed for their individual expert knowledge. In order to avoid overlapping of research work the association would foster co-operation with the research departments of members with the British Iron and Steel Research Association, the Aluminium Development Association, the British Non-Ferrous Metals Research Association, the E.R.A., the N.P.L., and with other bodies. They hoped to establish a liaison with the Motor Industry Research Association, and with the newly-formed Production Engineering Research Association, and to take part to the fullest extent possible in the international co-operative work supported by the Institute of Welding. They also looked forward to the most friendly relations with the welding sections of the B.E.A.M.A.

VARIABLE SPEED CONTROL

ELECTRONIC EQUIPMENT FOR INDUSTRIAL PROCESSES

THE new factory of Machine Tool Electrics Ltd., at London Road, Leigh-on-Sea, is largely engaged in developing the application of industrial electronics to variable-speed drives. This technique of current rectification is not entirely new, but the impetus which it received as the result of the development of radar and r.d.f.



Close-up of panel for 1 H.P. electronic variable-speed drive equipment

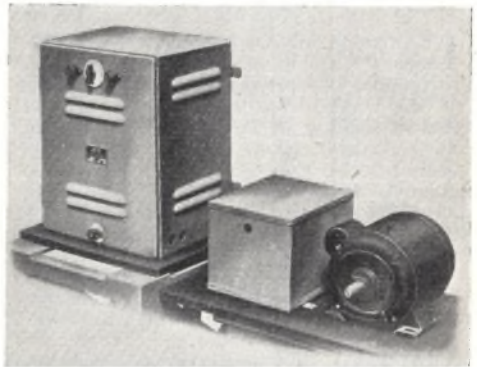
equipment during the war, did much to remove the prejudices against the use of any equipment incorporating the thermionic valve.

The applications of electronics in industry are many, but one of the most important is the provision as and where required, of an infinitely variable-speed range for the control of machine tools, textile and hosiery machinery, baking machines, paper-wrapping equipment, etc. Electronic control has also found a place for itself where a variable drive is required for production belt-conveyor systems or overhead trolleys. One of the chief advantages of using electronic control for this purpose is that the variable drive can be obtained without the use of bulky equipment such as additional motor generators and the like. Furthermore, the whole equipment is static in operation, and can be arranged to cover a much wider range than is obtainable with the Ward-Leonard drive. It is also possible to obtain considerably greater power at the lower speeds than can be derived from rotary rectifiers. Inching, dynamic braking and reversing can be incorporated where these features are required.

In the majority of cases the speed range required has been in the neighbourhood of

10 or 15 to 1, and this requirement is satisfactorily met by using a d.c. motor, which takes its supply direct from a.c. mains through a hot-cathode mercury-vapour rectifying equipment which is grid controlled. This method of rectification lends itself conveniently to either a constant torque output, readily obtained by the regulation of the armature voltage or a constant horse-power characteristic which is achieved by the regulation of the shunt field. Alternatively, these two methods may be combined to control a motor above and below its base speed.

The choice is available of employing either a single-phase full-wave rectification, or a three-phase half-wave rectification, but this is usually determined by the size of the actual motor to be driven. For example, a 1 H.P. d.c. motor with a speed range of 300/3 000 r.p.m. can be driven quite conveniently from a single-phase a.c. supply, using full-wave rectification with armature voltage regulation to give a constant torque characteristic if required. When this is the case and constant torque is wanted, the supply to the shunt field is kept at constant pressure by means of two small mercury-vapour rectifiers, while the armature derives its power from two larger rectifiers, the output of which is varied over wide limits by utilising the grids to



1 H.P. electronic variable-speed drive unit compared with the 1 H.P. motor it is to control. The mains transformer is shown as a separate item

chop the wave of the anode supply, and thus control the period in each cycle during which the valve fires.

The actual speed regulation is achieved by making use of a small potentiometer to

vary the d.c. bias which is superimposed on the a.c. bias applied to the grids of each valve. This controls the rectifiers and thus regulates the speed of the driving motor. A static current-limiting device is also incorporated which makes the use of additional resistances to limit starting currents unnecessary.

The standard equipment manufactured is designed to work from any 50 cycles a.c. supply, while the input transformer has multi-tappings to accommodate various incoming voltages. Use is also made of a static governing device, which holds the speed of the working motor constant to within a very small percentage between no-load and full-load.

The electronic units can be built suitable for housing in sheet metal cabinets for floor or wall mounting, or if desired, can be made for fitting into machine castings,

provided that suitable ventilation is available, and there is no danger of fouling by liquid or corrosive fumes. The mains transformer, which usually forms part of the complete equipment, can be housed separately if this is required. In the same way the control unit, which comprises merely a set of push buttons, a small potentiometer and motor switch, can be built as part of the complete unit, or can be mounted at a convenient distance to give remote control.

In addition to the development and manufacture of industrial electronic equipment, the same firm are specialists in the design and manufacture of automatic multi-motor control equipment, which consists basically of continuously rated air-break contactors, magnetic over-current relays and magnetic or thermal timing devices.

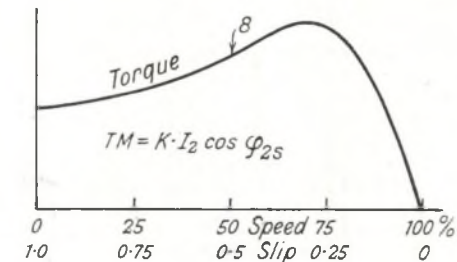
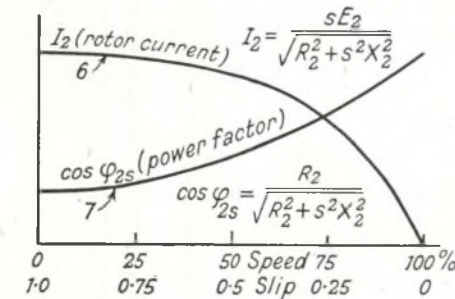
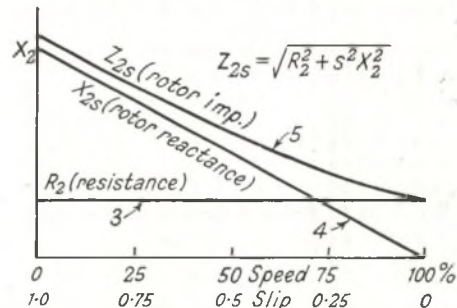
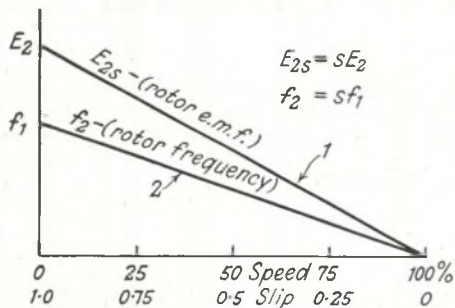
Answers to Technical Questions

We publish below the answers to a selection of questions which have been sent to us by readers. The co-operation of students and others in making this feature one of general interest is invited

How do the various currents and voltages in the rotor of a three-phase induction motor change as the motor runs up to speed?

The basis underlying the operation of the three-phase induction motor is the rotating

field set up by the magnetising current in the stator and which rotates around the air gap at synchronous speed ($n_1 = f_1/p$ revs. per sec., where f_1 is the supply frequency and p the number of pairs of poles). For a simple investigation of the motor this field



may, if the applied voltage is constant, be assumed constant and independent of the speed; actually, due to the resistance and leakage reactance drop in the stator winding it increases as the motor speeds up.

At starting, when the rotor is stationary, this rotating flux cuts the rotor conductors and sets up in them an e.m.f. given by

$$E_2 = \sqrt{2} \pi f_1 T \Phi \text{ volts per phase}$$

where Φ is the flux per pole in webers

T is the effective turns per phase.

As the rotor speeds up the speed at which the rotating field cuts the conductors decreases to $n_1 - n_r$ revs. per sec. and the e.m.f. induced decreases accordingly; $n_1 - n_r$ is proportional to the fractional slip " s " so that the e.m.f. at any slip s is therefore $E_{2s} = s E_2$ as shown by the curve 1 overleaf.

The frequency of the rotor e.m.f. depends on the rate at which the conductors move past alternate North and South poles of the field. At starting this is, of course, the same as for the stator conductors and the rotor frequency is then equal to the supply frequency. As the motor speeds up the frequency also falls proportionately to the slip as shown in curve 2.

The resistance of the rotor winding is, neglecting small indirect effects, constant. The inductance may also be assumed constant although this is less accurate since it depends on the permeability of the iron in the leakage

flux paths. Assuming it to be constant, however, the rotor reactance ($= 2 \pi f L$) is proportional to the frequency of the currents and therefore to the slip, i.e. $X_{2s} = s X_2$, where X_2 is the standstill, or supply frequency, reactance. The impedance is thus $Z_{2s} = \sqrt{R_{2s}^2 + s^2 X_2^2}$ ohms and curves of each of these quantities are as shown by curves 3, 4 and 5.

The rotor current is $I_2 = \frac{s E_2}{Z_{2s}}$ amps.,

i.e. the ordinates of curve 1 divided by those of curve 5 and is as shown by curve 6. It should be noted that the current does not drop much from its standstill value until over half speed is reached.

Power factor is $\cos \varphi_{2s} = \frac{R_{2s}}{Z_{2s}}$, i.e. the ordinates of curve 3 divided by those of curve 5 and is given by curve 7.

The torque is proportional to the power component of the rotor current, assuming a constant flux, i.e. to $I_2 \cos \varphi_{2s}$, and is therefore obtained by multiplying the ordinates of curves 6 and 7, giving curve 8, which is the well-known speed-torque curve for the motor. As mentioned at the outset the above curves are determined on the assumption of a constant flux. If the effect of stator resistance and reactance is allowed for the curves are, however, of similar general shape.—E.O.T.

Industrial Information

Energy for Seismic Surveys

The Chloride Electrical Storage Co., Ltd., have received an order from the Anglo-Iranian Oil Co., Ltd., for a number of standard Exide 6 V batteries for use in conjunction with seismic recorders on refraction survey work.

B.E.A.M.A. Price Adjustment Formulæ

For purposes of calculating variations in (a) rates of pay, the rate of pay for adult male labour at November 8, 1947, shall be deemed to be 110s.; (b) costs of material, the index figure for intermediate products last published by the Board of Trade on November 8 is 234.1 and is the figure for the month of October, 1947.

Old Cornish Beam Engine Saved

British Timken, Ltd., Fischer Bearings Co., Ltd., have sent £25 to the Cornish Engines Preservation Society for the endowment fund for the preservation of the old beam engine which worked on East Pool Mine near the main Truro-Penzance road, and has been secured by the society. Mr. John Pascoe, the deputy chairman of the two companies mentioned,

and a member of the Council of the Cornish Engines Society, appeals to Cornishmen in the engineering industries, to help the Endowment Fund. Subscriptions may be sent to him at British Timken, Ltd., Cheston Road, Aston, Birmingham.

Arbitration Award

Mr. W. A. Royle, borough electrical engineer of Sunderland, succeeded in his claim, before the Arbitration Court, against Sunderland Corporation for a salary increase based on the output of the electricity undertaking. Mr. Royle at present receives £1 850 per annum and the A.M.E.E., of which he is a member, claims salary based on output of electricity undertakings. Last year Sunderland electricity department beat all records with an output of 105 361 055 units.

University College Calendar

The calendar of University College, London, for the 1947-48 session has now been issued. In the Faculty of Engineering, the lecture courses in electrical engineering

cover electrical technology, electrical power and machinery, electrical power, telecommunications, and electrical machinery. In the laboratories the students learn the practical application of the principles taught in the lectures. In addition, there is a special course of four lectures, primarily for architecture students, on the principles of illumination and the electrical installation in buildings.

Christmas Decoration Outfits

Two types of Osram decoration outfits—the standard and the de luxe—are now available in limited quantities. The standard set consists of twelve 20 V, 3 W M.E.S. coloured lamps connected in series and wired ready for attachment to the nearest lampholder by means of the standard b.c. adaptor provided. One spare lamp is included. The de luxe set comprises similar lamps wired in series on braded flex. Fixing heads are included, and a combined b.c. 2-pin plug adaptor is provided. An extension device permits up to 20 sets to be run off a 5 A point.

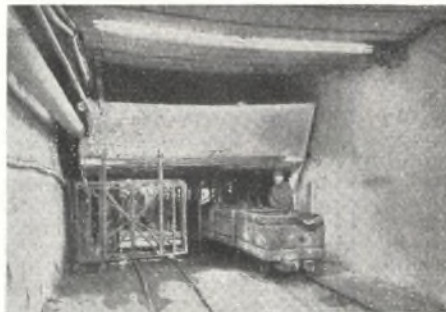
Geneva Tariff Agreement

Among the concessions obtained by the United Kingdom in the Geneva agreement on tariffs are the following: China, electric dynamos; Commonwealth countries, electrical and motive power machinery. Schedules giving details of the new tariff rates will be available for consultation at the Export Promotion Department of the Board of Trade, 35, Old Queen Street, London, S.W.1, chambers of commerce at London, Glasgow, Birmingham, Manchester, Bradford, Bristol, Cardiff, Derby, Huddersfield, Hull, Leeds, Leicester, Lincoln, Liverpool, Luton, Newcastle-on-Tyne, Middlesbrough, Northampton, Norwich, Nottingham, Oldham, Portsmouth, Preston, Sheffield, Southampton, Stockport, Stoke-on-Trent, Swansea, Walsall, Wolverhampton, Aberdeen, Dundee, Edinburgh, Belfast, and at the following regional offices of the F.B.I.: Newcastle-on-Tyne, Leeds, Bradford, Sheffield, Nottingham, Leicester, Cambridge, London, Reading, Bristol, Birmingham, Manchester, Liverpool, Glasgow.

Fluorescent Lighting in a Colliery

Fluorescent lighting has been introduced at the pit bottom of Chislet Colliery, Kent. The installation was planned by the British Thomson-Houston Co., Ltd., as part of a general scheme to improve conditions in the mine. Corrosion resisting and dust-proof Mazdalux F809 fittings, with single Mazda 80 W, 5 ft., fluorescent lamps, are installed. The fittings are made of Perspex, with two rubber end covers which permit the air within the fitting to expand and contract without "breathing" the

surrounding atmosphere. The auxiliary gear, except for the starter switch, is mounted remote from the fitting and assembled in a sheet steel box, with through cable entries, fixed to the wall. The fittings are mounted laterally on the roof at heights varying between 10 and 12 ft. On each side of the cage, two are placed in line; the remaining fittings are spaced at average intervals of approximately 20 ft., but this distance is gradu-



The cage at the pit bottom in Chislet Colliery illuminated by Mazda 80 W 5ft. fluorescent lamps in Mazdalux fittings

ally increased as the main haulage road is approached in order to lessen the difference between the new and the old lighting. The roof and sides have been white-washed and the average level of illumination is in the region of 6 lumens per sq. ft., but is considerably higher in the immediate vicinity of the cage.

B.T.H. Laboratories

SATURDAY, November 8, was made an "Open Day" at the research laboratories of the British Thomson-Houston Co., Ltd., at Rugby, for relatives and friends of the staff. The event was one of a series planned by the Social Committee, and some 400 visitors took advantage of the opportunity to inspect, under the guidance of the members, many of the laboratories, covering an area of approximately four acres.

Demonstrations of glass blowing attracted much attention, as did the generation of high powers at radio frequency by a magnetron; the projection of a television picture by cathode-ray tube; fluorescent lamps and fluorescent powders; and the crystal rectifier, with some of the possible methods of its application to broadcast receivers. Demonstrations of the application of valves of the more conventional types to miniature radio receivers also proved very popular.

London Medical Exhibition

ELECTRO-MEDICAL apparatus is very much in evidence at the London Medical Exhibition which opened in the New Hall of the Royal Horticultural Society, Westminster, on Monday, and will close at 6.30 p.m. to-day.

The "Metallic 300" short-wave therapy equipment demonstrated on the stand of Philips Electrical, Ltd. (electro-medical section), Century House, Shaftesbury Avenue, London, is a radio-frequency generator for medical use, employing a silica oscillator valve, developing an output of 300 W and operating at a frequency of 50 Mc/s. On the same stand another interesting demonstration is given with the "Philiostat" electro-therapeutic unit which provides currents for galvanisation, electrolysis, muscle-reaction testing and muscle stimulation. The "Cardiotron" electro-cardiograph illustrates a method of detecting and recording the cardiac potential. Also on show are "Biosol" and "Triosol" units for ultra-violet, infra-red and radiant heat treatments.

The new "Ophtharm" displayed by Theodore Hamblin, Ltd., 15, Wigmore Street, London, W., has been specially designed for ophthalmic diathermy, and is of the spark-gap type. The output is said to be adequate for every type of patient and every degree of tissue resistance encountered in ophthalmic operations.

Electrical deaf aids of the latest types are exhibited by the Telephone and Microphone Co., Ltd., 11, Victoria Street, West-

minster, and the Multitone Electric Co., Ltd., 22-27, St. John Street, London, E.C.1.

The Kromayer lamp for the focal application of intense ultra-violet radiation is presented in an entirely new form by Hanovia, Ltd., Slough, Bucks. While retaining the familiar essentials of a concentrated mercury arc which is water-cooled and can thus be applied in contact, the unit embodies an entirely new form of burner which is self-starting, and claimed to be of great intensity, uniform in output, proof against leakage, and immediately replaceable. Water cooling is provided from a self-contained pump assembly, so that the entire unit is mounted on a mobile trolley. The lamp is made for all normal types of electricity supply. In addition to various types of ultra-violet and infra-red lamps, there is shown the fluorescence lamp with a Wood's glass filter for the diagnosis of skin diseases.

Among the instruments displayed by Light Laboratories, 31a, Shanklin Road, Brighton, are the skin thermometer, which operates on the principle of the resistance bridge and measures small and quick changes in temperature, and the "Dermohmmeter," for skin resistance measurements, employed for the diagnosis of peripheral nerve injuries and for the examination of sympathectomy for regeneration and diagnosis. The resistance range covered is 27 000 ohms to 13.5 megohms.

Electronics in Armature Testing

AN interesting account of some modern electronic developments formed the subject of the paper delivered by Mr. F. R. Unwin and Mr. A. W. Corneck at the joint meeting of the Association of Supervising Electrical Engineers and the Institution of Engineers-in-Charge, held on Tuesday evening at Magnet House, Kingsway, London. Mr. F. Winstanley was in the chair, and the meeting opened with a short address by Sir Harry Railing, chairman of the General Electric Co., Ltd.

In the course of their survey, the authors referred to cathode-ray armature testing. The old method was by "stepping round"—measuring the resistances between each pair of adjacent commutator segments. The cathode-ray apparatus, however, recorded all the individual resistances at the same time, with the armature revolving whilst under test. The armature was mounted in a chuck, and high frequency power was supplied to the commutator by

two brushes. Two additional brushes were used to pick up a voltage, which was amplified and applied to the vertical deflection plates of a c.r.o., the time-base of which was synchronised to move the spot once across the screen for each revolution.

Applied to the vertical plates was thus a series of voltage impulses proportional to the voltage between the segments. The combined effect was a series of vertical lines across the screen, there being an equal number of lines and segments, and the length of the lines was proportional to the resistance between each pair of segments. If all the lines were of equal length the armature was good, while a very long line represented an open circuit and a short circuit showed as a dot. A fault could thus easily be identified to its particular segment. The time taken to test an armature completely by the electronic apparatus was about one minute, against 15 minutes by "stepping round."

Company News

CELESTION, LTD.—Net pft. for yr. to Mar. 31 £29 329. To pref. div. arrears (already pd.) £13 261, net fin. div. 50% on pref. and ord. £16 877, fwd. £33 513.

BURCO, LTD.—Net pft. to Sept. 30 £50 429 (£41 521). To gen. res. £28 500 (£10 000), div. equalistn. res. £2 000 (nil). Div., as previously announced, 35% (same, includg. 15% bonus); fwd. £20 224 (£20 507).

DICTOGRAPH TELEPHONES LTD.—Cons. net pfts. and sub. for yr. Aug. 31 £35 935 (£20 514) after providing £50 000 for dirs.' fees, tax, employees' pension and bonus funds (£28 429 which did not include employees' bonus fund). Final div. 10% (7%), mkg. 16% (11%) for yr.

OLIVER PELL CONTROL, LTD.—Trdg. loss to Mar. 31 £26 146. E.P.T. recoverable £34 000. To int. £2 670, dirs.' fees £450, deprecn. £4 348, employees' funds £1 115, lvg. net loss £729. Brot. in £9 590, plus option money on shs. of subsid. £1 250. To pref. div. 1½ yrs. to Dec. 31, 1945, £2 475; fwd. £7 635. Prev. yr. trdg. pft. £7 286, plus E.P.T. recoverable £12 750. To int. £1 903, dirs.' fees £450, spec. remun. to dir. £250, deprecn. £4 896, employees' fund £1 264, tax £6 000, lvg. net pft. £5 273. To pref. div. 2 yrs. to June 30, 1944, £3 000.

ATLAS ELECTRIC AND GENERAL TRUST, LTD.—In the course of his speech at the annual meeting, Mr. D. M. Touche (chairman) made a reference to the subsidiary company in Montevideo, the value of which, he said, had been grossly overstated

in the balance sheet for many years. They had, accordingly, transferred the sum of £1 500 000 from the capital reserve to the special reserve in reduction of its book cost, leaving it at a little over £1 700 000. The special reserve was not, even then, fully sufficient to provide for the loss which would arise on this item, but the margin should be a manageable one which the directors anticipated being in a position to provide for out of capital profits. Mr. Touche said that in view of the agreement for the sale of the tramway system in Montevideo, he did not propose to deal at any length with that undertaking; its gross receipts had increased slightly during the year while the power and fuel costs increased quite substantially. The net revenue declined from pesos 278 000 to pesos 153 000. The Chairman then reviewed the events leading up to the purchase of the undertaking by the Uruguayan authorities. The agreed purchase price was pesos 11 700 000, but they would continue to experience a certain measure of anxiety until the ratification of the agreement was an accomplished fact.

Metal Prices

	Monday, Price	November 17 Ino.	Dec.
Copper—			
Best Selected ... per ton	£130 10 0	—	—
Electro Wire bars ... "	£132 0 0	—	—
H.C. Wires, basis ... "	£149 10 0	—	—
Sheet ... "	£173 10 0	—	—
Bronze Electrical quality			
1% Tin—			
Wire (Telephone), per ton	£172 5 0	—	—
Brass (60/40)—			
Rod basis ... per lb.	1s. 1¾d.	—	—
Wire ... "	1s. 6¼d.	—	—
Iron and Steel—			
Pig Iron (E. Coast Hematite No. 1) ... per ton	£9 10 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... "	£35 15 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ... "	£22 15 0	—	—
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.	6s. 6¼d.	—	—
Aluminium Ingots ... per ton	£80 0 0	—	—
Spelter ... "	£70 0 0	—	—
Mercury (spot) ... per bott.	£16 0 0	—	—
<i>(ex. warehouse)</i>			

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

B.E.A. Meet Employees

A MEETING took place on November 14 between the British Electricity Authority and a Joint Committee representing the local authority chief engineers, the technical staff, the manual workers, and the administrative and clerical workers employed in the electricity supply industry, concerning the conciliation and consultative machinery to be established under the Electricity Act of 1947 to operate on and after the vesting date. Lord Citrine, chairman of the Authority, presided.

There was an amicable discussion, which, it is hoped, will lead to an early agreement on these matters after consultation with Area Boards, which is necessary under the Act, but which cannot take place until the Area Boards are appointed. In the meantime, informal discussions will be continued, so that there will be no delay in putting proposals before the Area Boards when they are established.

Commercial Information

County Court Judgments

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

BLAND, —. (male), 61, Londonderry Road, Stockton-on-Tees, electrical dealer. £12 14s. 1d. September 16.

KIERMAN AND JEFFREY (a firm), 141, Stanstead Road, Forest Hill, Kent, electrical contractors. £10 7s. 11d. September 10.

BOOTH, W. (male), Winchester Road, Bishop's Waltham, Hants, electrical engineer and contractor. £13 17s. September 25.

ELECTRONICS (CLAYTON), LTD., R/O, 140, Whalley Road, Clayton-le-Moors, Lancs., electrical dealers. £18 19s. 10d. September 25.

SULLY ELECTRICAL CO. (a firm), 509, Battersea Park Road, London, S.W.11,

electrical contractors. £31 16s. 5d. September 12.

ATTRACTA ELECTRICAL ENGINEERING CO., LTD. (D. S. Atkins, male, trading as), The Hermitage, Welwyn. £52 17s. 9d. Aug. 12.

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.

ARTICAIR REFRIGERATORS, LTD., London, W.—Sept. 19, mortgage and charge, to National Provincial Bank, Ltd., securing all moneys due or to become due to the Bank; general charge.

WM. G. WALTER (BATH), LTD., electrical engineers and wireless dealers.—Sept. 11, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *£9 742. Dec. 31, 1944.

Coming Events

Friday, November 21 (To-day)

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. "Transients in Transmission Lines," by T. W. McLean. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—London. "Patents from the Layman's Point of View," by L. H. A. Carr. 6.30 p.m.

I.E.E., MEASUREMENTS SECTION.—London. "Iron-Loss Measurement by A. C. Bridge and Calorimeter," by Prof. J. Greig. 5.30 p.m.

I.E.E., N. WESTERN STUDENTS' SECTION.—Visit to Telephone House, Salford. 7 p.m.

Monday, November 24

I.E.E., S. MIDLAND CENTRE RADIO GROUP.—Birmingham. James Watt Institute. "War-time Activities of the Engineering Division of the B.B.C.," by H. Bishop. 7 p.m.

ELECTRICAL POWER ENGINEERS' ASSOCIATION, MIDLAND TECHNICAL GROUP.—Birmingham. Grand Hotel. "Radio Frequency Heating," by E. T. Norris. 7 p.m.

I.E.E., N. EASTERN CENTRE.—Newcastle-on-Tyne. Discussion on the report, "Practical Training for Professional Electrical Engineers." 6.15 p.m.

BRADFORD ENGINEERING SOCIETY.—Technical College. "Individual Motor Drives for Textile Machinery," by G. H. Brook. 7.15 p.m.

I.E.E., N. MIDLAND CENTRE INSTALLATIONS SECTION.—Leeds. "Special Electrical Requirements of a Viscose Rayon Factory," by C. F. Freeman and H. V. Mather. 6.30 p.m.

RADIO INDUSTRIES CLUB OF THE MIDLANDS. Birmingham. Grand Hotel. Radio Industries Ball. 7.30 p.m.

I.E.E., WESTERN CENTRE.—Cardiff. South Wales Institute of Engineers. "Colliery Electrification," by G. Rutter. 6 p.m.

I.E.E., MEASUREMENTS SECTION.—London. Discussion on "Industrial Applications of

Inductor Alternators," opened by J. H. Walker. 5.30 p.m.

Tuesday, November 25

COVENTRY ELECTRIC CLUB.—"What You Will."

I.E.E., SCOTTISH CENTRE.—Glasgow. "Ultra-High-Speed Relays in the Fields of Measurement and Protection," by W. Casson and F. H. Last. 6.15 p.m.

I.E.E., N. WESTERN INSTALLATIONS GROUP.—Manchester. "Electrical Aspects of Overhead Travelling Cranes," by G. V. Sadler. 6 p.m.

I.E.E., N. MIDLAND INSTALLATIONS GROUP.—Leeds. "Special Electrical Requirements of a Viscose Rayon Factory," by C. F. Freeman and H. V. Mather. 6.30 p.m.

LUTON ELECTRICAL SOCIETY.—Technical College. "Earthing," by H. Midgley. 7.30 p.m.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS, LONDON CENTRE.—The I.E.E. "Hearing as an Essential Part of the Telephone Circuit," by Col. D. McMillan. 5 p.m.

Wednesday, November 26

INSTITUTE OF WELDING.—London. Connaught Rooms. Luncheon. 12.30 p.m.

I.E.E., LONDON STUDENTS' SECTION.—"Impulsing—The Heart of Automatic Telephony," by R. F. Howard.

Thursday, November 27

I.E.E., N. MIDLAND STUDENTS' SECTION.—Visit to Jowett Cars, Ltd., Idle.

Friday, November 28

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



C. J. 1947

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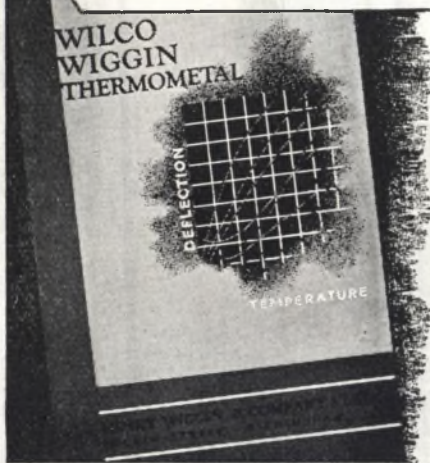
Also manufacturers of Electrolux Silent
Refrigerators



By Appointment
Suction Cleaner and
Refrigerator Manufacturers

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We have recently published an exhaustive booklet on thermometal calculations and applications. It contains charts showing the relation between deflection, force characteristics and dimensions for straight strips, U shapes, spirals and helices in the thermometals which we supply, namely Standard, Highflex 45, Morflex, Midflex 46, High-heat 47, Saflex, Ruflex and R24-R530.

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Our Technical Service Department will be glad to give advice on any unusual bi-metal problem not covered by this publication. Write to:

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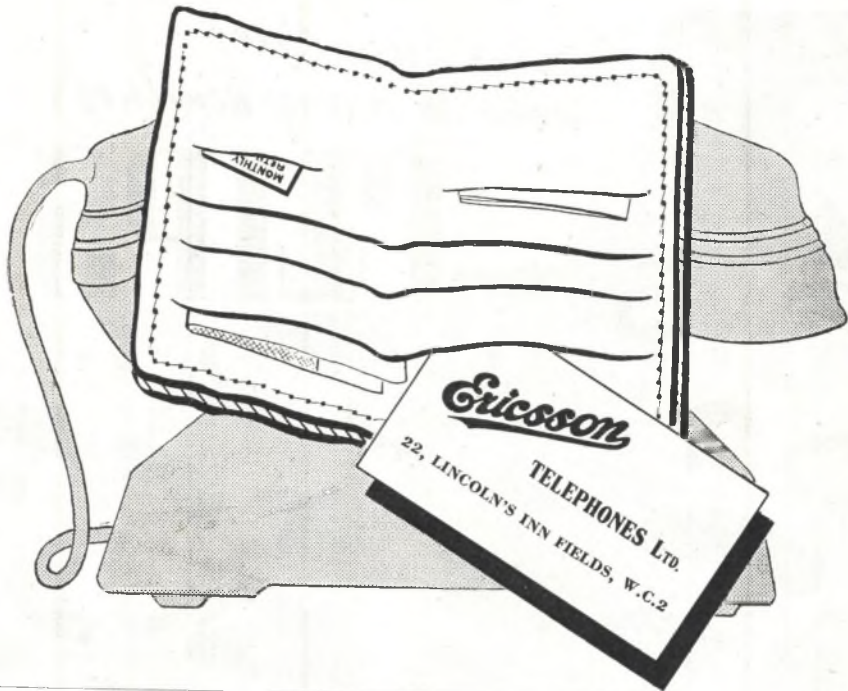
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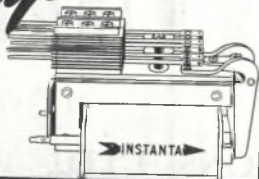
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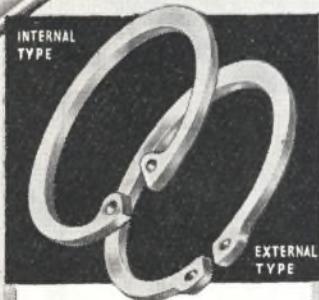
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A SIMPLE AND EFFICIENT RETAINING DEVICE *for* small diameter spindles



Engineers who have felt the need for a really small circlip will welcome the Twicklip which fits in a groove just like a Seeger Circlip and which is made in sizes from $\frac{1}{8}$ to $\frac{15}{32}$.

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THE GREEN, TWICKENHAM, MIDDX.

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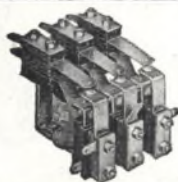
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YOU GET A WARM vote of thanks from your customers when you instal Sadia Water Heaters. They cost so little to run—and they entirely run themselves.

What is more, the Sadia goes on doing its job—without a hitch—year in and year out.

That's because every Sadia is as good as specialised skill can make it. You see, we have made nothing else but Electric Water Heaters for twenty-four years . . .

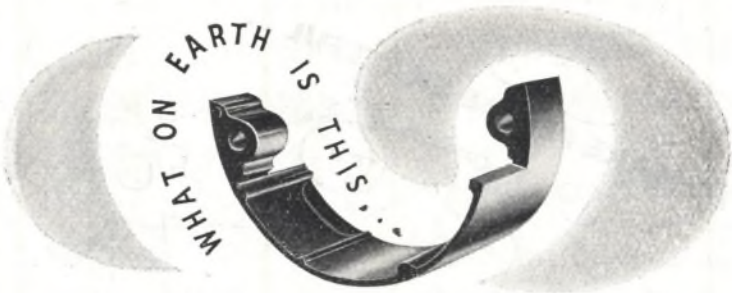
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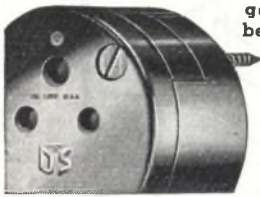
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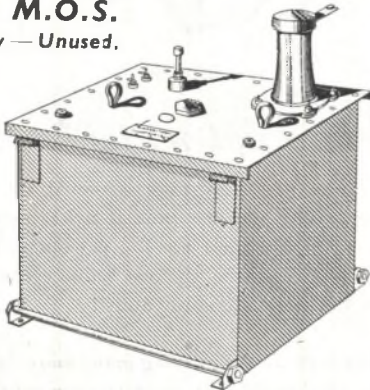


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Announcement of DS Plugs Ltd., Manchester - London - Glasgow.

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New — Unused.



THE METRO-VICK OIL-FILLED TRANSFORMER

Input 230 volts, 50 cycles, 4 kVA, output 18,000 volts. Size 3½ kVA, output 21,000 volts. Each transformer contains approx. 56 lbs. copper, 112 lbs. laminations, 13 gallons transformer oil. Total weight approx. 3½ cwts.

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A.C. and D.C. 1-500 h.p.
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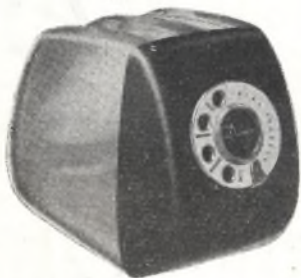
'Grams: ROLTHRED, B'HAM.

'Phone: CENTRAL 2881-2-3-4.

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.



The Automatic Toaster

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



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.

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Measures 16" x 11" x 12". Push button hear control for oven, grill and hotplate. Vitreous enamel finish.



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FOR USE IN:

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Prices subject to trade discount
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8 inch	65/6
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100/120, 200/250 Volts A.C.	

Fill in for full particulars: (E)

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It boils and it washes

An electrically heated
hand washing
machine at
a price which
will permit one
in every home



ELECTRIC WASHBOILER

Write for further particulars to:

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

SITUATIONS VACANT

BRITISH ELECTRICITY AUTHORITY. PUBLIC RELATIONS OFFICER.

APPLICATIONS are invited for the post of Public Relations Officer in the Secretariat of the Authority with headquarters in London.

A starting salary, commensurate with qualifications will be paid within a salary scale of £1,500, rising by annual increments of £50 to £2,000 per annum, subject to deductions for superannuation.

Candidates should have the ability to conduct a public information service, including press relations work, advertising, posters, films and pamphlets.

Applications, which will be acknowledged and treated as confidential, should be sent within 14 days to the Director of Establishments, British Electricity Authority, Portland Court, 170a, Great Portland Street, London, W.1. (358)

BRITISH ELECTRICITY AUTHORITY. CHIEF SAFETY OFFICER.

The British Electricity Authority invite applications for the post of Chief Safety Officer at a salary of £1500 per annum, rising by annual increments of £50 to £2000 per annum, subject to deductions for superannuation.

Candidates must have, in addition to a thorough knowledge of Safety Regulations in industrial or electricity supply undertakings, a wide experience of all forms of electrical equipment and apparatus and have carried out the duties of inspection of electrical and mechanical plant and equipment in a large-scale industrial organisation. Preference will be given to candidates within the industry. They should state age, qualifications, experience, present salary and personal references.

Applications, which will be acknowledged and treated as confidential, should be sent within 14 days to the Director of Establishments, British Electricity Authority, Portland Court, Great Portland Street, London, W.1. (378)

WOLVERHAMPTON AND STAFFORDSHIRE TECHNICAL COLLEGE.

Principal: W. E. Fisher, O.B.E., D.Sc.

The Governors of the College invite application for posts as ASSISTANT LECTURERS in the Mechanical and Electrical Engineering Department to fill vacancies due to steady expansion of work and promotion of other assistants. Applicants should have had industrial experience in mechanical or electrical engineering, and hold a Higher National Certificate or University degree, or be members of a professional engineering institution. Salaries on Burnham Technical Scale.

The basic salary scale is £300 to £525 per annum by increments of £15 yearly, with additions for degree or equivalent and for suitable theoretical training. The initial salary will depend on years of industrial experience after the age of 21, and on teaching and war service. An improved Burnham Scale is likely to come into operation in a few months' time.

The College is a large and progressive one, with modern buildings and equipment, and the Department offers a wide range of courses including National Certificate and Degree Courses, in day and evening. There are excellent prospects for advancement to higher and more remunerative posts.

Further particulars and forms of application obtainable from the undersigned.

F. LONSDALE MILLS,

Education Officer, Clerk to the Governors.
North Street,
WOLVERHAMPTON. (370)

SITUATIONS VACANT

CITY OF LINCOLN ELECTRICITY DEPARTMENT.

APPLICATIONS are invited from suitably qualified persons for the following positions:—

(1) SHIPT CHARGE ENGINEERS.

Candidates must have had a thorough technical and practical engineering training and be experienced in the operation of large steam turbo-alternators, switchgear, high pressure boilers and auxiliary plant in a modern generating station.

(2) POWER STATION DRAUGHTSMAN.

Candidates must have had a sound technical and practical engineering training, and be experienced in the design, construction and layout of modern mechanical and electrical power station plant, including pipework arrangements and details. Experience of building construction will be an additional recommendation.

The salary and conditions of employment for the appointments are in accordance with the National Joint Board Agreement, Class G, Grade 8, at present £467, rising to £476 per annum.

The selected candidates will be required to pass a medical examination and to contribute to a Superannuation Scheme under the provisions of the Local Government Superannuation Act, 1937.

Forms of application may be obtained from F. Newey, M.I.E.E., City Electrical Engineer and Manager, Electricity Offices, Brayford Side North, Lincoln, and must be returned to him, together with copies of not more than three recent testimonials, not later than November 29th, 1947, and enclosed in a sealed envelope appropriately endorsed. Canvassing, either directly or indirectly, will be a disqualification.

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

J. H. SMITH,
Town Clerk.

Corporation Offices,
Silver Street,
LINCOLN.
November 7th, 1947.

(355)

COUNTY BOROUGH OF PRESTON ELECTRICITY UNDERTAKING.

AMENDED ADVERTISEMENT.

APPLICATIONS are invited for the following positions from suitably qualified persons:—

INSTALLATION INSPECTORS. Applicants should have had a considerable experience in electrical installation work of all classes. A thorough knowledge of the I.E.E. Wiring Regulations and the ability to write clear and concise reports are essential. Possession of the Ordinary National Certificate in Electrical Engineering, or its equivalent, is desirable.

The conditions of service are those appropriate to the Corporation's weekly wage staff. The rate of pay is £5 per 44-hour week, plus bonus, at present £1 15s. 3d.

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

Applications, stating age, qualifications and giving full particulars of training and experience, accompanied by not more than two recent testimonials, and endorsed "Installation Inspector," to be forwarded so as to reach the undersigned not later than Saturday, November 29th, 1947.

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

G. A. ROBERTSON,
M.Sc.Tech., M.I.E.E., M.I.Mech.E.,
Borough Electrical Engineer.

40 and 41, Lune Street,
PRESTON.
November 14th, 1947.

(370)

SITUATIONS VACANT

CROWN AGENTS FOR THE COLONIES.

APPLICATIONS from qualified candidates are invited for the following post:—

CHARGEHAND ELECTRICIAN required by Sierra Leone Government Railway for two tours each of 18 to 42 months with prospect of permanency. (Salary (including expatriation pay) £600, rising to £690 a year. Commencing salary according to age and war service. Outfit allowance £60. Free passages. Candidates, 25-35 years of age, must have served an apprenticeship as an electrician, and have had four years subsequent experience, preferably with a railway company or firm making train lighting equipment, including maintenance and repair of all types of A.C. motors, 3-phase, 50 cycles up to 400 volts and/or workshop lighting 230 volts, single-phase. A knowledge of train lighting systems essential.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/17704 on both letter and envelope. (377)

Ref. No. ICI/X/34.

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

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

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

DRAUGHTSMEN.

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

Order No. D.31.

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

Order No. D.27.

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

Order No. D.28.

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

Order No. D.29.

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

Order No. D.227.

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

Order No. D.30.

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

Order No. D.239.

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

LM/RH.

November 4th, 1947. (329)

AN expanding Oil Company urgently require for their London Office Communications Engineer with experience in the installation and maintenance of automatic telephone exchanges and associated overhead and underground distribution networks, trunk lines, carrier current systems and radio services.

Applicants for the above appointment should write only for application form, giving a brief summary of experience, age, etc., to Box "S.R.," c/o J. W. Vickers & Co., Ltd., 7-8, Great Winchester Street, London, E.C.2. (359)

SITUATIONS VACANT

LONDON AND HOME COUNTIES JOINT ELECTRICITY AUTHORITY.

APPLICATIONS are invited for the following appointments. The persons appointed will be required satisfactorily to pass an examination by the Authority's medical adviser, and to become subject to the Authority's superannuation scheme, which applies generally the provisions of the Local Government Superannuation Act, 1937, including the provisions of that statute relating to transfer values.

The following conditions of service, salaries, etc., apply to the appointments:—

(1) **JUNIOR METER ASSISTANT:** Applicants must have attained a standard of technical education up to that of the Higher National Certificate. Duties include work in the Authority's Testing Laboratory and Meter Testing Department at Burford. Conditions of service and salary in accordance with N.J.B. Schedule, Class J, Grade 10, at present £355-£371 per annum.

(2) **ASSISTANT MAINS ENGINEER:** Candidates must have had extensive experience in the erection and maintenance of 11 kV and L.T. overhead lines and substations in a rural area. Possession of the Higher National Certificate in Electrical Engineering will be deemed an additional qualification. Conditions of service and salary in accordance with N.J.B. Schedule, Class F, Grade 8, at present £442 per annum.

(3) **MAINS ASSISTANT:** Candidates should have had experience in Mains Department work, and possess the Ordinary National Certificate or a higher qualification. Salary £276 per annum.

Applications, stating age, qualifications and experience, accompanied by copies of not more than three recent testimonials, must be sent by not later than December 4th, 1947, in the case of (1) to the Meter and Test Superintendent, Testing and Record Depot, Burford, near Dorking, Surrey, and in the cases of (2) and (3) to the District Manager, 56, South Street, Dorking, Surrey.

Canvassing, directly or indirectly, will be a disqualification.

A. L. BUNNELL.

5-6 Lancaster Place, Strand, W.C.2. Clerk to the Authority. November, 1947. (360)

METROPOLITAN BOROUGH OF ISLINGTON ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the permanent position of **SHIFT CHARGE ENGINEER** at the Council's Generation Station from persons who are not at present normally employed in agriculture or coalmining.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class G, Grade 8, at present £490 7s., rising to £499 16s. inclusive.

Applicants should have had a sound general education and technical training, and experience in the control and operation of steam generating plant and main switchgear.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination. Candidates are required to disclose in writing whether to their knowledge they are related to any member of, 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, which may be obtained from the Engineer and General Manager, Electricity Department, 341-343, Holloway Road, N.7, should be completed and returned to him, together with copies of recent testimonials, in appropriately endorsed envelopes, by not later than December 1st, 1947.

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

H. DIXON CLARK,
Acting Town Clerk.
(357)

Town Hall,
Upper Street, N.1.

DRAUGHTSMEN required by switchgear engineers, Experienced in contract work, protective gear diagrams or design.—Applications in writing, with full particulars, to: Ferguson, Failin Ltd., Manchester, 11. (84)

SITUATIONS WANTED

No. 1 **ELECTRICIAN** Officer, Merchant Navy, age 24, two years full charge of ship's electrical system (hospital ship), soon to be released, seeks post of responsibility with prospects, Assistant or Senior Maintenance Electrician. Experience general maintenance and engine room with turbo and Diesel engines.—Box L.H.M., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4. (298)

SALES BY AUCTION



By Order of the Minister of Supply.
Without Reserve.

M.O.S DEPOT No. 154, CASTLE COURT, WESTGATE STREET, CARDIFF
(Opposite Angel Hotel).
POWELL and POWELL

have received instructions to sell by Auction on the premises as above on

TUESDAY, WEDNESDAY and THURSDAY,
DECEMBER 2nd, 3rd and 4th, 1947,
approximately 1 000 lots of

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NOTICE is hereby given that the Swann Diploma Examination will be held at Centres on May 26th and 27th, 1948.

SUBJECTS: Electrical Installation. Electrical Maintenance.

Application forms and copies of regulations and syllabus may be obtained from the General Secretary, The Association of Supervising Electrical Engineers, 54, Station Road, New Barnet, Herts.

The latest date for receipt of application forms is March 1st, 1948.

A. BRAMMER,
General Secretary.
(363)

November 14th, 1947.

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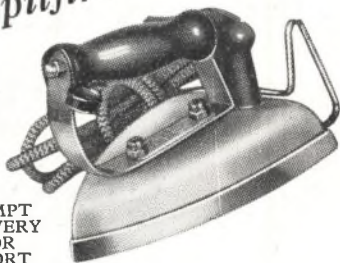
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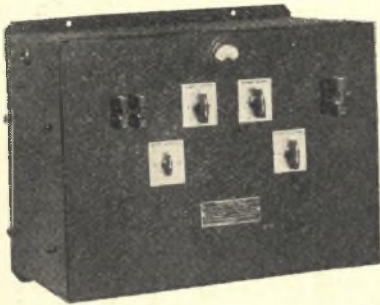
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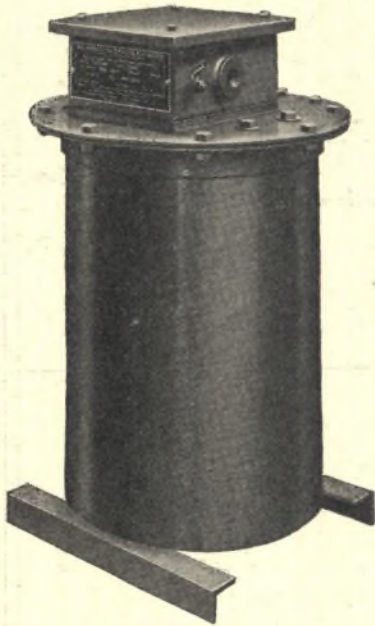
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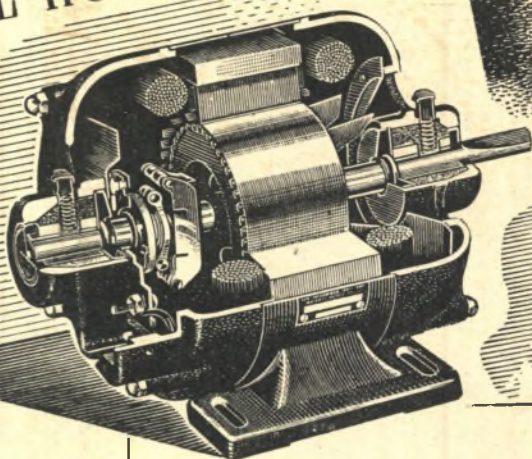
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