

2448/11

P.60/47/11

THE

ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

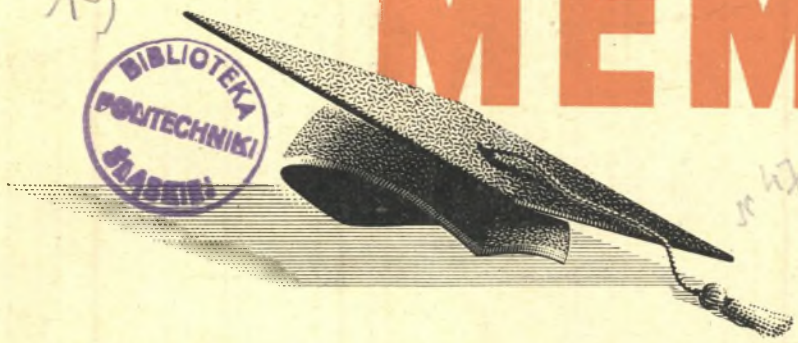
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MEM

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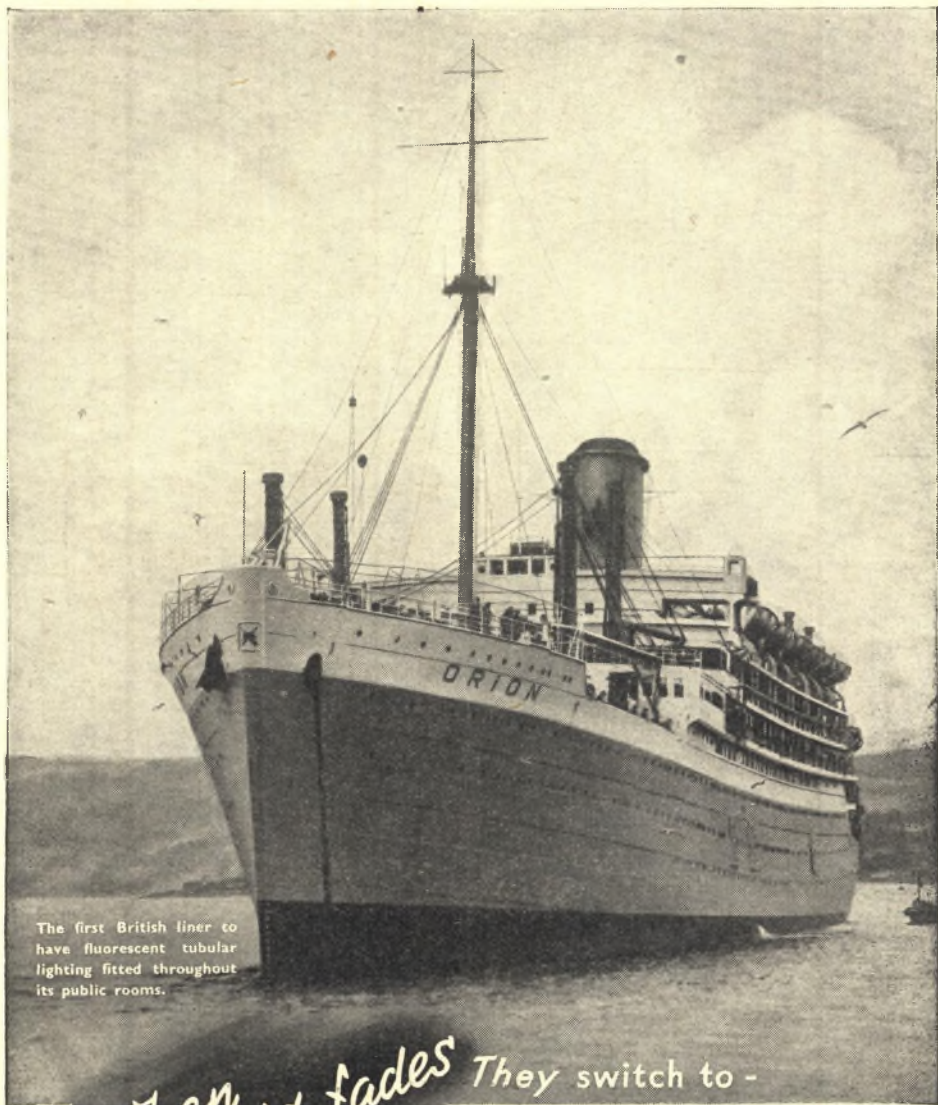
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New Switchgear and Motor Control Gear catalogues came into operation on 1st October. If you have not already applied for copies, please write now.



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The first British liner to have fluorescent tubular lighting fitted throughout its public rooms.

When daylight fades

They switch to -

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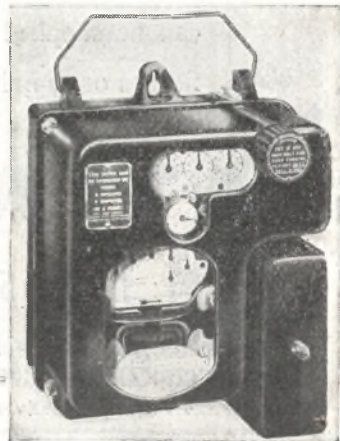


Chivalry

In olden times, chivalry was a feature of the jousts. In modern business, the spirit of chivalry will not overcome all our supply problems, but courteous and prompt attention to individual requirements will often help to speed deliveries. It is in this spirit of real helpfulness that we are making every effort to meet the present demand for Sangamo Weston electricity meters and time switches. You can rest assured that we shall continue to accord your needs every consideration and that we will do our best to assist you in spite of a difficult supply situation.

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Telephone: Enfield 3434 & 1242



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The ATLAS QUICKSTART Unit is a simple device, which not only ensures immediate lighting response without the annoying delayed starts usually experienced with fluorescent lighting, but keeps the tubes alight in spite of voltage variations. This unit can be supplied to incorporate in existing ATLAS fittings or supplied with new fittings.

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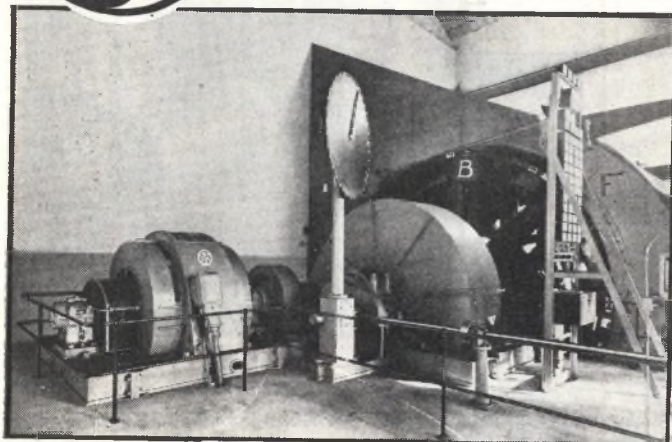
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A.C. EQUIPMENT at a SCOTTISH COLLIERY

Designed for winding
305 long tons per hour
from a depth of 1,845 ft.

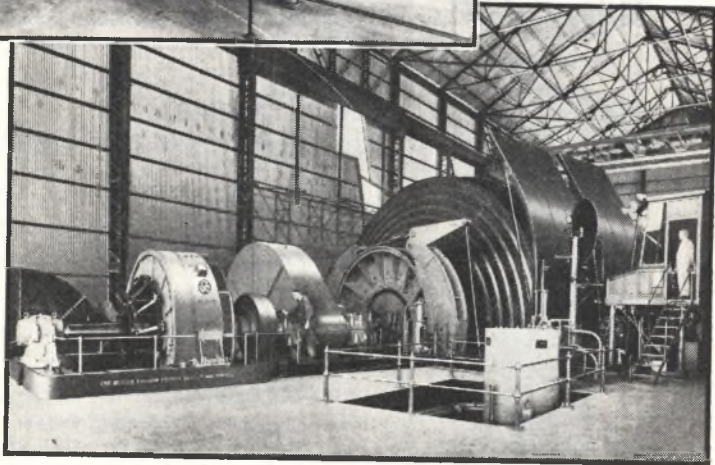
Motor : 1,950/3,900 H.P.
423 r.p.m. 6,600 volts.

Control :
Reversing Contactors
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Flywheel Motor
Generator Set with
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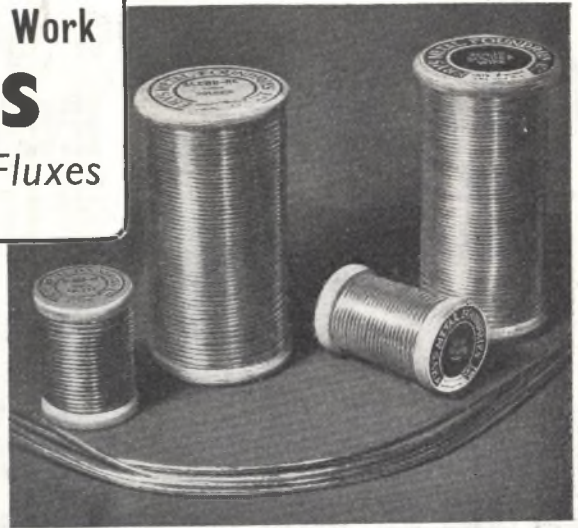
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A safe and efficient flux for electrical and radio soldering. Supplied in 2 oz., 8 oz. and 1 lb. tins.

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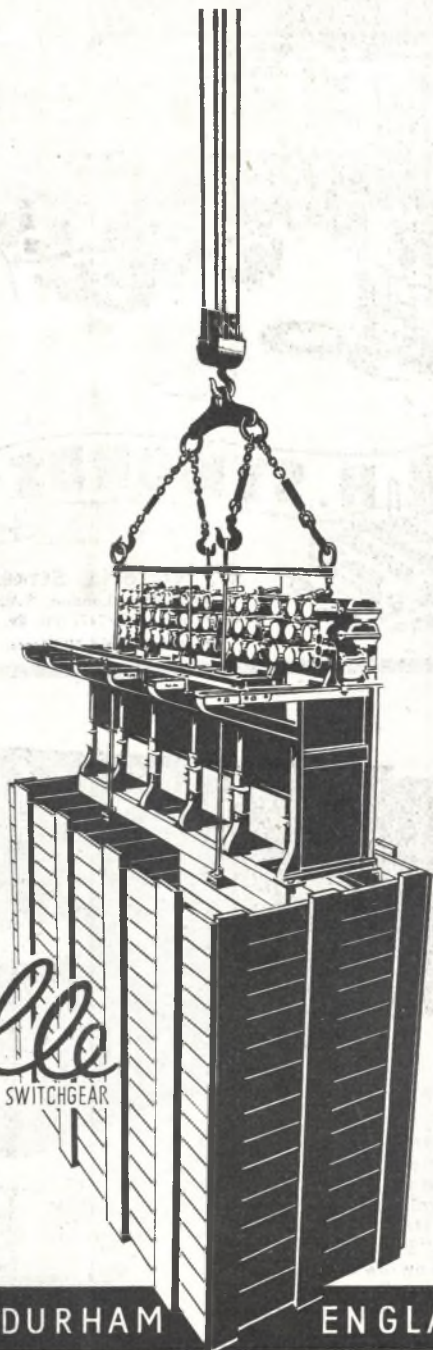
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A **G.E.C.** PRODUCT

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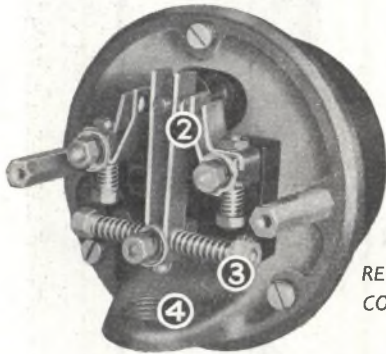
The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

Details that Distinguish ...

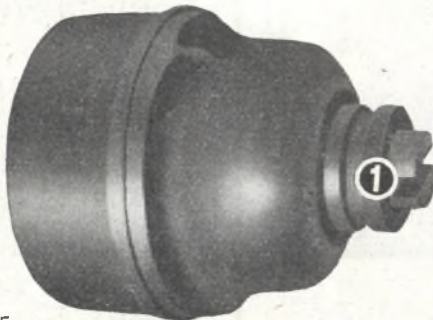
In the product of the Specialist there are details of design that distinguish it from its contemporaries.

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BRITISH ELECTRICITY AUTHORITY

APPOINTMENTS TO BE MADE IN THE GENERATION DIVISIONS

1. The British Electricity Authority desire to bring certain considerations to general notice concerning the making of the appointments for generation and transmission coming directly under the Authority. The Area Boards will be making their own appointments for distribution in due course. The Central Authority will be in active co-operation with them to ensure that the personnel of the industry are posted to the best advantage. The following deals only with the making of Central Authority appointments.

2. The organisation for generation and transmission under the Central Authority will comprise fourteen divisions, each headed by a Divisional Controller. These divisions will correspond geographically to the fourteen distribution areas under the Area Boards. The immediate need is to make the higher appointments in those divisions after full consideration of the claims of all concerned.

3. The Authority will shortly write to all Electricity Undertakings, requesting them to bring to the notice of their staffs the position as herein outlined so that all who wish to do so may make application direct to the Authority, supported by details of their experience and qualifications. Forms giving details of the proposed appointments will shortly be available on application to the Undertakings, or can be obtained directly from the Authority.

4. All such applications will be fully considered in relation to the appointments which will have to be made in advance of vesting date. These appointments will be comparatively few in number. The great majority of personnel within the industry will continue after vesting day in their present occupations under their existing contracts of service although, of course, they will automatically transfer to the employment

of either the Central Authority or the Electricity Board for the area in which they are employed.

5. All appointments will be made on appropriate scales of salary, but regard will be given to the possibility of continuing existing salaries where these may be in excess of the approved scales. Such personal emoluments would necessarily be limited to the individuals concerned and would not extend to future appointments which will be made within the approved scales. By way of indication, the Authority contemplate salaries for the Divisional Controllers (Generation and Transmission), ranging from £2,500 to £3,500 per annum, according to the responsibility of each post. The appointments below this level will be appropriately graded and fuller details will be given in the documents to be circulated as explained above. Where duties and responsibilities are analogous with the existing grades and scales these will be observed. In other cases the salaries will be regarded as provisional until final scales have been negotiated with such organisations as are appropriate.

6. Applications should be sent to the British Electricity Authority, Portland Court, Great Portland Street, London, W.1. They should indicate, in order of preference, the categories for which consideration is desired, viz., engineering commercial, financial, accounting, secretarial or legal. Only a limited number of appointments will be made and the present advertisement does not concern any posts carrying salaries below £800 per annum.

7. The Area Boards have not yet been formed, but it is probable that in due course they will issue notices similar to this. Applications in reply to this present notice will not prejudice those which may be made to the Area Boards at a later date.

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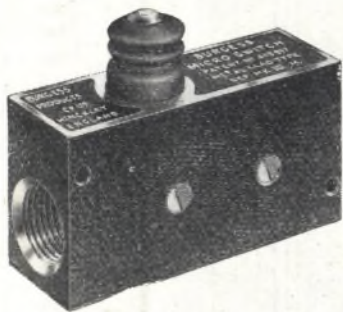
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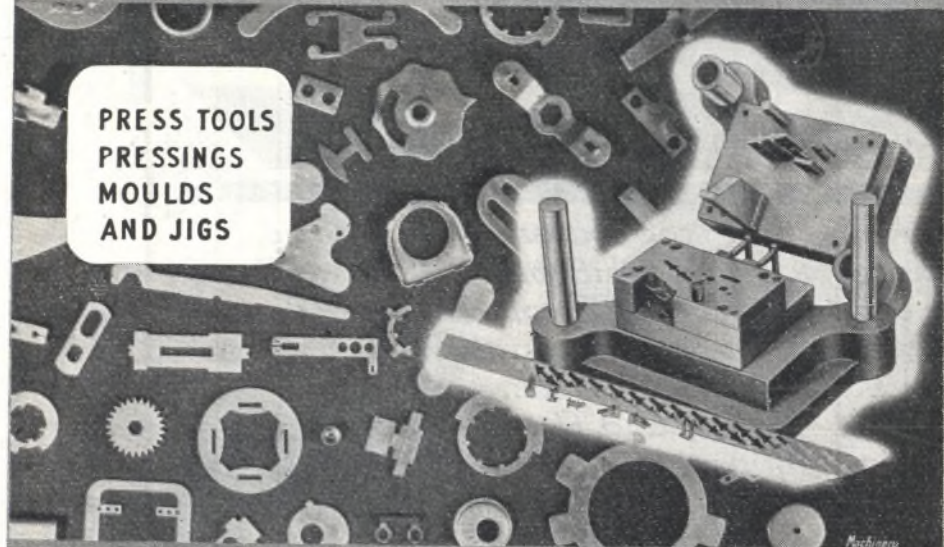


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No. 6

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But meanwhile . . .

“it's still worth while

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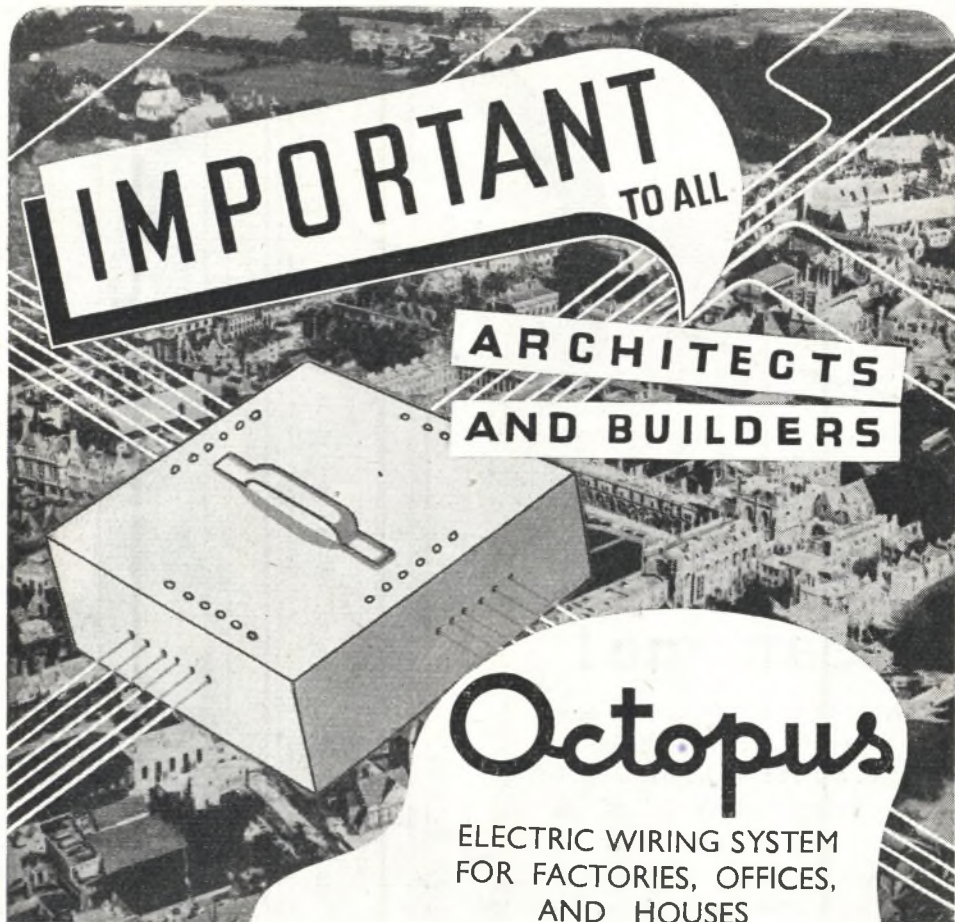
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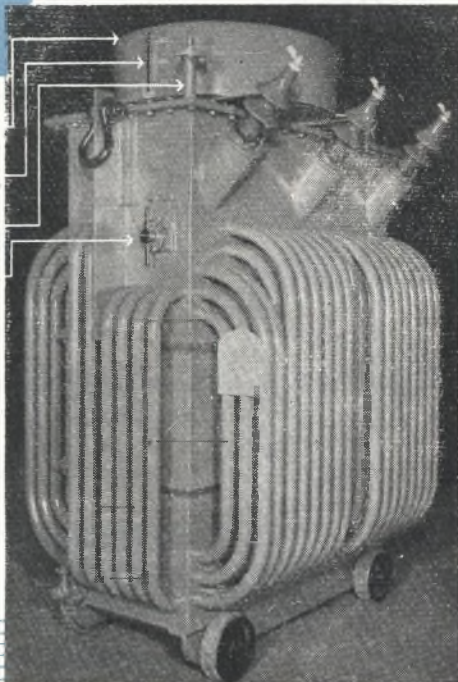
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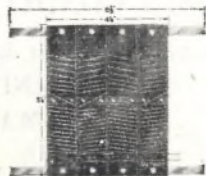
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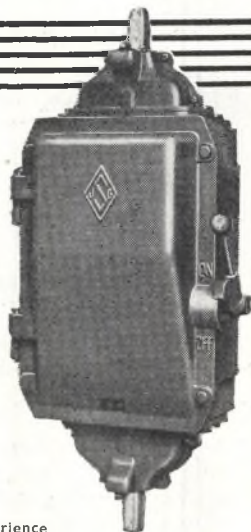
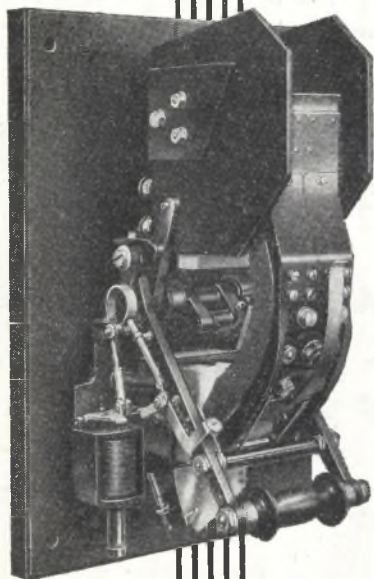
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M1



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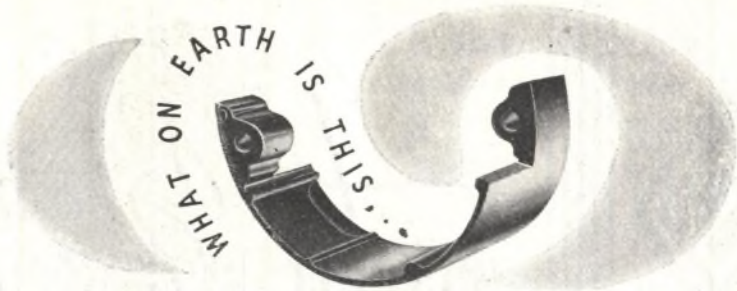
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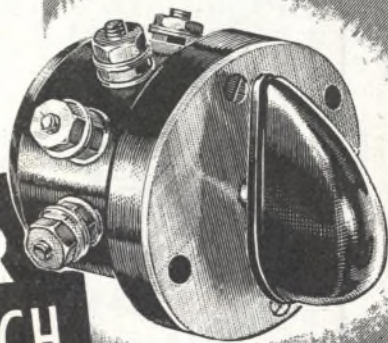



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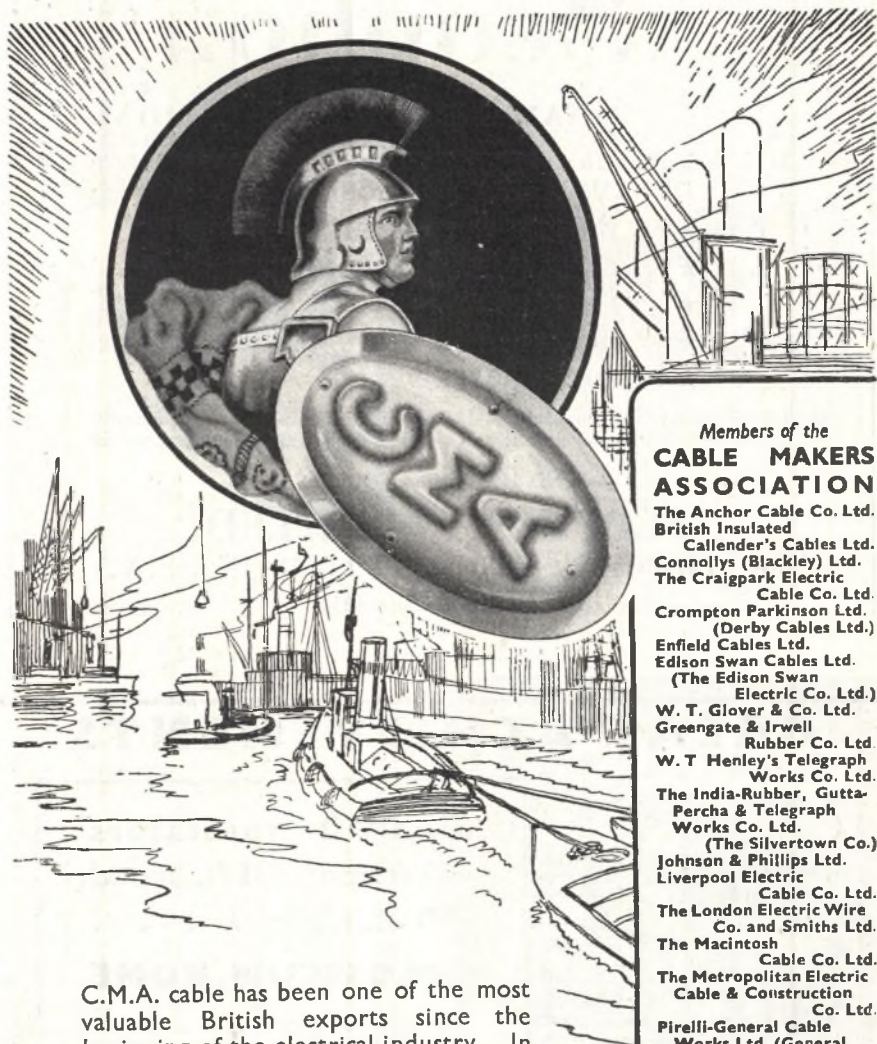
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THE ELECTRICIAN

ESTABLISHED 1861



Bouverie House - 154 Fleet Street - London EC 4

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

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

Publisher and Manager : JOHN VESTEY

Number 3625

5 DECEMBER 1947

Vol. CXXXIX No. 23

CONTENTS

<i>Views on Current Affairs</i>	1627
<i>Portrait—Mr. J. J. Gracie</i>	1630
<i>824 MW Deficit in 1951-52</i>	1631
<i>Short-circuit Testing</i>	1632
<i>Instrumentation Developments</i>	1635
<i>Output of Sydney Undertaking</i>	1636
<i>Results of Load Spreading</i>	1637
<i>Electricity Statistics</i>	1638
<i>Electrical Personalities</i>	1639
<i>Equipment and Appliances</i>	1641
<i>Correspondence</i>	1642
<i>Answers to Technical Questions</i>	1643
<i>The Batti-Wallahs' Society</i>	1644
<i>Electricity Supply</i>	1645
<i>In Parliament</i>	1646
<i>Contracts Open</i>	1647
<i>Industrial Information</i>	1648
<i>Company News</i>	1651
<i>Commercial Information</i>	1652

Exports and Materials

THE relationship between the allocation of materials and direct exports has become so close, that there has for some time been a danger of introducing unnecessary delay in the execution of orders. The danger lies in the position of component manufacturers and sub-contractors who make no personal export contribution, but, as suppliers to firms giving a high export performance, do so indirectly.

From the point of view of the electrical industry, the component manufacturers and sub-contractors most concerned include the makers of electric motors for textile machinery, and machine tools, ball bearings and so on, which may be incorporated by main contractors in plant destined for export in large volume. The makers of such components, though not in all cases making a direct contribution to the export drive, are obviously part and parcel of the effort being made by those manufacturing organisations which are—and restricting their allocation of materials can therefore, determine to a considerable degree the extent of the export drive as a whole.

In an attempt to clarify the position, the Chancellor of the Exchequer last week issued a statement on the subject, from which we understand that for components and common service items such as ball bearings, electric motors, etc., which are sub-contracted for subsequent incorporation in equipment for export and essential home consumption, material allocations will in future be determined by the Government's assessment, not of the direct or indirect

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export activities of the sub-contractor, but of the level of supplies necessary to meet the production programmes for both home and export needs. The allocation of materials so far as a sub-contractor is concerned will thus be determined by the production output of the main contractor, with a rise or fall in the allocation—according to whether the main manufacturer exceeds or fails to achieve his export target.

Coal Stocks

THE consumption of coal by electricity undertakings in the week ended November 22 was 625 800 tons, compared with 561 000 tons the week before. Stocks at 4 142 600 tons represented roughly six weeks' winter supply, compared with 3.4 weeks' at the same time last year. The latter figure—as everyone in the industry was in November, 1946, telling the then Minister of Fuel it would—subsequently led to the crisis last February and is therefore, of little value as an indication of the safety margin, if any, in the six winter weeks' stock now held. In pre-war days coal stocks at this time of the year were nearer twelve than six winter weeks' supply, and coupling the present rate of consumption with the dangers voiced by the railways with respect to wagon availability—the supply industry may yet have to face about January/February a problem as embarrassing as was that presented last winter. The Minister of Fuel has of late expressed a certain amount of optimism with regard to coal output, and though this may or may not be justified, it will depend upon the delivery of that output to the power stations and elsewhere, whether the next few months will be less of a worry to him than were to his predecessor those same months of last winter.

The White Paper

THE fears expressed in *THE ELECTRICIAN* of October 31 and November 7, with respect to the cuts in power station extension programmes, were confirmed on Monday with the publication of the White Paper. Actual details of the reduction in extensions will be found on p. 1631, and bearing in mind the fact that the original and conservative estimates of generating plant requirements in 1951/52 were scheduled at 2 306 and

1 617 MW respectively, cutting them to 1 500 MW for each of those years means a loss of 923 MW over the two years. In point of fact the White Paper puts the loss even higher and on present estimates of demand and ignoring any contributions from over-age plant, calculates that the deficit during the winter of 1951/52 will be not more than 824 MW; surely a figure with which few in the industry will agree. The fact that the generating capacity is already deficient by 2 500 MW and that industry in general is expected to increase its output in order to meet its export targets, suggests that for a good many years after those target figures have been reached, the supply industry will still be handicapped as a result of Government policy. In the circumstances, we repeat that the industry should publicise at every possible opportunity its inability to rectify the position on account of the ruling in the White Paper, and that if it were possible to adhere to the original power plant estimates, the anticipated inconveniences in 1950 and onwards would not occur. There is in these remarks no intention of obstruction, no political criticism, but in the interest of the good name of electricity, they should, we feel, be made. Public memory is short, and if in 1950 onwards, the restriction of electricity consumption still obtains, the industry will be blamed—when in point of fact it is no more than a helpless witness to the sowing of the seed of possible discontent.

Industrial Equipment

THE proposals in the White Paper also affect branches of the electrical industry outside the range of heavy plant, among which that of telephone communication ranks high. In this connection, building work will be mainly concentrated on exchanges at an expenditure value of about half that of pre-war, and the process of connecting new subscribers will be heavily restricted. This will mean that the present waiting list of 400 000 potential telephone users will steadily grow, and the conditions which obtained during the war years will be re-established. Work on the railways which is well advanced will not be postponed, and schemes like the Manchester-Sheffield and Shenfield electrification projects will proceed. The need for the

re-equipment of industry after the stagnant war years is great, and though it may be possible to meet the demand for output at the present time, the machines are each year demanding heavier maintenance. This raises production costs, which will finally find their way to the export markets, and while the latter may be able to carry them at the moment, increasing competition will make the importance of efficient plant of modern design and its relation to selling prices more critical. Any scheme which results in a reduction in capital equipment to something of little more than pre-war level, ignores completely the fact that we have five or more years leeway to make up.

Regional Area Boards

THE fourteen maps which define the area for which each Area Board is established under the Electricity Act 1947, are now available for inspection at the addresses given in this issue, and divide the supply industry into the framework it will assume on the vesting day. Sixteen of the present undertakings give supplies in territories which will be found to fall within the areas of more than one Area Board, and in these cases the decision has been made that the initial vesting will accord with the location of the greater part of the assets of each undertaking. After vesting date those parts of the sixteen undertakings which fall within other areas will be transferred in accord, and with the provisions of Section 19 of the Act. There are also three undertakings owning two or more units which will be in different areas, and provision has been made in these cases for all property, etc., of each undertaking to be initially vested in one Area Board, subject to later adjustment. The Area Board which will take over the largest number of municipal undertakings (63) will be the North Western, while the largest number of company undertakings taken over will be shared by the Southern and South-Western Boards with 26 each.

Load Spreading Results

THE first appreciable results of the load spreading arrangements developed by the Central Electricity Board have now become apparent, and some observations upon them are given in this issue. From these it will be noted that the overall

effect of the arrangements has been to reduce the day-time peak demand by some 500/600 MW, or about 11 per cent. of the current industrial demand. The figures which we give, together with the curves reproduced, were supplied by the Central Board and while the results are said to be promising, they are by no means as satisfactory as they might be. It is, perhaps, still too early to reach any positive conclusion on the response to the working arrangements, for with the exception of the last few days, the weather has been relatively mild. With the foggy and colder conditions of this week inducing an increased demand for space heating and lighting, however, it may be that the load curves for early December may offer a better indication of what may be expected in January and February.

Bankside and the L.C.C.

THE Town Planning Committee of the L.C.C. submitted to its Council this week approval of the plans and elevation of the new Bankside power station—following, we presume, the findings of the Royal Fine Art Commission, to the effect that the architectural solution of the problem set the designer is finely conceived. The Committee has pointed out that while the Commission was not asked to consider the suitability of the site and the possible atmospheric effect of the burning of oil fuel, it felt its duty to state that it considered the site selected inappropriate for a very large public utility structure, and the decision of the Ministers of Town and Country Planning and of Fuel and Power, one that struck at the roots of good zoning and town planning principles. Such remarks when the generating capacity deficiency stands at about 2 500 MW, seem to be divorced from any sense of realism, and suggest that the new station will hinder the development plans drawn up for the Southwark Embankment. The economic life of the new station will be no longer than that of any other and probably shorter than the time interval before the L.C.C. will be able, if ever, to put their improvement scheme into action. The need of the moment and for the next ten to fifteen years is more and more generating stations, and while that need persists reason suggests that plans of the type which the L.C.C. has in mind must wait.

Portrait—Mr. J. J. Gracie



ALIVERYMAN of the Worshipful Company of Makers of Playing Cards, Mr. J. J. Gracie is, among his other distinctions, a freeman of the City of London, a member of the Union Club, Birmingham, and a radio broadcaster on industrial subjects.

Born in Rangoon in 1898. Mr. Gracie was educated at Wallasey Grammar School, and after two years at Liverpool Central Technical College, spent three years at the Bedford Works of Short Bros., Ltd., later taken over by the Government as the Royal Airship Works, Cardington, and now an R.A.F. Training Centre.

During his last year with Short Bros., Mr. Gracie lectured in Electrical Engineering at the Bedford Evening Institute and obtained a studentship to take third year Electrical Engineering at the City and Guilds College, London.

In 1921 he joined the G.E.C. as a technical assistant in the Osram Lamp Works, Hammersmith, where he remained for 10 years. Problems of production, organisation and management attracted him from the start, and when broadcasting created a large demand for receiving valves in 1922 and 1923, he was transferred to the M.O. Valve Co., Ltd., to apply quan-

tity production methods to their manufacture, and remained there for several years, becoming production superintendent.

He was later transferred back to the lamp works as production superintendent, and left the G.E.C. in 1930 to join a firm of industrial consultants.

After six years of consulting work, Mr. Gracie decided to return to management once more, and rejoined the G.E.C. as director and general manager of Coldair, Ltd. This involved building and equipping a new factory on the Wembley estate, redesigning the product and setting up a sales and service installation, but just as the work was completed he was transferred to the Witton Engineering Works as commercial manager in 1938, in succession to the late Mr. H. N. Whitford, and responsible direct to Dr. A. H. Raifing (now Sir Harry), who personally controlled the Witton Works at that time.

In 1943, when Sir Harry became chairman of the G.E.C., Mr. Gracie was appointed joint general manager of the Engineering Works, with Dr. C. C. Garrard, and on January 1 of this year he was made general manager.

He is a director of Coldair, Ltd., and of J. T. Rothwell, Ltd., Accrington, and is chairman of the Parkhall Pottery Co., Ltd., all G.E.C. subsidiaries.

Mr. Gracie is Member of the I.E.E., a Fellow of the Institute of Industrial Administration, a Fellow of the Works Management Association, a Member of the Institution of Production Engineers, and President of the Birmingham Branch of the Institute of Welding. He has been a member of the Birmingham Education Committee for the last three years, and the Commercial College Advisory Committee for four or five years. He was an industrial member of the Midland Regional Board of the Ministry of Production during the war (1941 to 1945) and was an independent member of the "Working Party" for the Boots and Shoes Industry (1945 to 1946); he was in December last appointed Chairman of the local Employment Committee (Ministry of Labour). He is a member of the Business Training Committee (M.O.L.) for training ex-Service personnel for management, in the development of which he took an active part. He is a member of the Appointments Board of Birmingham University and a Life Governor.

In recent years Mr. Gracie has concentrated mainly on management subjects.

824 MW Deficit in 1951-52

Effect of Capital Cuts on Plant Extension Programmes

A GENERATING plant deficit of 824 MW during the winter of 1951-52, ignoring any possible contribution from plant over 25 years old, is officially forecast as a result of the cuts in capital investment announced in the White Paper (Cmd. 7268, H.M.S.O., 6d. net), published on Monday. Under the new plans, previous estimates for plant coming into service during the next two years are unchanged, at 1 150 MW in 1948 and 1 600 MW in 1949. In 1950 and 1951, however, the capacity of newly commissioned plant will be reduced from the estimated figures of 2 000 MW each year to 1 500 MW, representing a reduction on the estimates for the period 1948-51 of 1 000 MW. As a result of this decision, made necessary, states the White Paper, "in view of our critical economic situation, the great shortage of steel, and the urgent need to devote more capacity to export, the Government consider it necessary to accept the risks of load shedding which might arise."

In a review of previous estimates, the White Paper points out that to meet the very heavy arrears in new plant existing in 1945, the C.E.B. envisaged an increase in generating plant of 70 per cent. to be achieved in a period of seven years.

PREVIOUS ESTIMATES

The original programme approved by the Electricity Commission provided for an addition of 997 MW in 1947, rising to 2 167 MW in 1951. In July of this year, a revised forecast made in the light of difficulties due to problems of reconversion and delays in plant delivery, suggested that the output capacity of new installations be reduced to 518 MW in 1947 and 757 MW in 1948. New output capacity estimated as coming forward in later years consequently rose to 2 646 MW in 1951. In view of the serious gap existing between capacity and demand, however, the position was again reviewed in September, with the result that the rate of delivery was speeded up so as to increase the 1948 programme to 1 150 MW and thus reduce the arrears in later years. The output capacity of plant due to come into service in 1951 thus became 2 000 MW.

These estimates, continues the White Paper, still included a surplus of capacity for the later years and, although in normal circumstances this would have been desirable, the country can no longer afford to provide this margin. While the

need for installing as much plant as possible during the next three years remains as urgent as ever, the increase from 1950 onwards will be limited to 1 500 MW per annum, the remaining plant production capacity being turned over to exports. In this course, it is stated, there are serious risks, particularly if domestic consumption continues to rise as rapidly as in the last few years, but it must be observed that on present forecasts the position after the inclusion of the plant now planned will be very much better than in 1946 or 1947.

HYDRO-ELECTRIC SCHEMES

The North of Scotland Hydro-Electric Board's programme for an export capacity of 150 MW in 1949-50, rising to 465 MW by 1952-53, has been provisionally agreed, but will be subject to review if further steel economies become necessary. Although exports of power will be mainly to Central and Southern Scotland, which are at present better supplied with generating capacity than other parts of the United Kingdom, many of the steam stations there are already over-age.

For the construction of new station buildings, etc., under the revised plan, a building force of 14 000 (compared with 9 492 at June, 1947) is provided for, of which over 7 000 will be engaged on hydro-electric projects.

Among other reductions in capital expenditure announced in the White Paper, the estimated annual expenditure by the Post Office on new telephone buildings will be limited to £1½ million, about half the 1938-39 expenditure allowing for price variations. Duct work on long distance cables will continue, in order to keep pace with rising traffic, but the labour force employed on local subscribers' cables will be reduced to less than one third, and new connections will be restricted to essential services and industry. It is inevitable, therefore, that the present waiting list of 400 000 will steadily grow. A reduction in orders for new exchange equipment will lower efficiency.

Railway building and civil engineering work will proceed where it is essential to main industrial traffic or where the work is already far advanced. Projects to be continued include the Manchester-Sheffield electrification (£6 200 000) and the east-west extensions of the Central Line, L.P.T.B. and the L.N.E.R. Shenfield electrification (£17 000 000).

Short-Circuit Testing

High Power Equipment in the Nelson Laboratories

A GENERAL account of the Nelson Research Laboratories at the Stafford works of the English Electric Co., Ltd., was contained in our issue of November 14. Although necessarily short, the article will have served to illustrate that in respect both of the equipment installed and the concentration of many specialised research facilities on one site, the new laboratories are possibly unique.

Following our initial visit, we were enabled by the English Electric Co. to make a further and more detailed inspection of that section adapted to deal with high power problems. The description below will serve to stress the complexity and scale of the apparatus needed for testing present-day circuit-breakers, transformers and fuse gear under the most severe conditions likely to be encountered on existing supply networks. More than 2 000 detailed performance reports on switchgear have already been compiled.

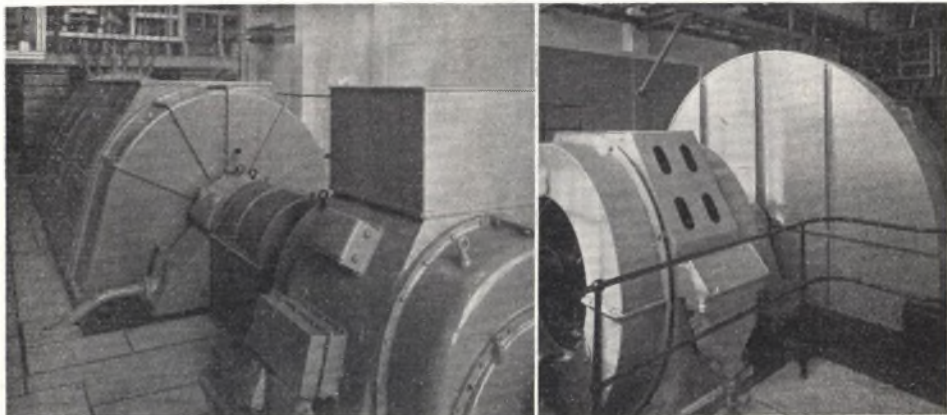
Comprising two complete installations which may be operated simultaneously, either independently or in parallel, to produce instantaneous short-circuits of up to $2\frac{1}{2}$ million kVA at voltages between 11 kV and 264 kV, the high power laboratory centres around two specially constructed standard frequency alternators, one of which was commissioned in 1938 and the other a few weeks ago. Except in minor details, the alternators are identical as, fundamentally, are their associated control rooms and auxiliary plant.

To enable them to withstand the abnormally heavy strains placed on conduc-

tors and windings by short-circuit currents, the main factor governing the design of the two alternators is a high degree of mechanical and electrical strength. Circuit reactance is kept to a minimum to permit the greatest possible currents to flow and, in order that the oscillatory recovery voltage after a short-circuit occurs at the highest possible frequency—this representing the most severe test conditions—it is also necessary to reduce the capacity of the windings to the lowest value. Both latter requirements can be met in the alternators by reducing size, and the physical dimensions have, therefore, been kept small by designing the sets for 3 000 r.p.m. The frame size, in fact, corresponds to that of a standard two-pole 70 000 kVA alternator. Voltages of 11 kV in star and 6.6 kV in delta are obtainable, and the initial short-circuit reactance at 11 kV is 0.057 ohms in star, or 3.3 per cent. of 70 000 kVA.

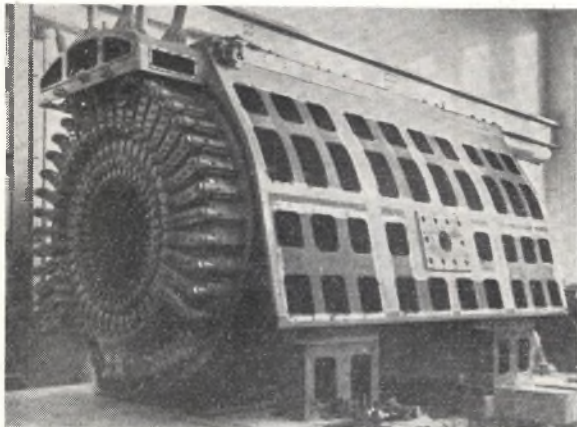
Of the stator windings, the part most vulnerable to damage by electrical forces is where the conductors emerge from the stator slots. To provide adequate support at this point, the non-magnetic core end-plates are machined to the same shape as the slots, and Bakelite wedges are inserted to form complete rings around the face of the stator. The end windings themselves are clamped to the stator face by phosphor-bronze bolts screwed into the core end-plate between each of the coils.

During a symmetrical single-phase short-circuit, the oscillatory torques set up in the windings may result in a shock load



Inside one of the high power rooms. Left, the alternator and its driving motor; right, the exciter and flywheel

as heavy as 300-400 tons being applied to the foundation. The stator is, therefore, secured to reinforcing girders at the bottom of the foundation by 24 bolts each 9 ft. long and $3\frac{1}{2}$ in. in diameter. The founda-



The stator of the first short-circuit alternator before lowering on its foundations

tion itself weighs approximately 350 tons and is supported by 42 reinforced concrete cast-in-situ piles driven to a depth of 35 ft.

At the moment of test, it is the kinetic energy of the rotor, not the driving motor, which drives the machine. Weighing 30.5 tons and with an outside diameter of 36 in., the rotor is a solid forging of high-grade carbon steel, and the resulting kinetic energy at full speed is 110×10^6 ft. lb. Even with this amount of stored energy available, however, the rotor speed may drop by as much as 20 per cent. during a very severe test. Driving the rotor is a three-phase two-pole 3 000 r.p.m. 6.6 kV slip-ring induction motor continuously rated at 1 500 H.P., and interposed between the two is a Ferodo-type slip coupling set to slip when the load exceeds 2 500 kW; this prevents the torsional oscillations of the rotor being transmitted to the driving motor shaft. Controlled by a liquid resistance in the rotor circuit, the driving motor runs the set up to speed and at the moment when a test takes place a resistance is connected in series with its rotor to minimise disturbance to the supply network. Dynamic braking equipment brings the motor and alternator to rest in about 3 mins.—a process which would otherwise occupy $\frac{3}{4}$ hr.

It is in the system of excitation that the special requirements of short-circuit testing are clearly seen, the method used being chosen to give a rapid rate of rise of current to a high value. The excitation current required to produce the normal

open-circuit voltage of the alternator is little more than would be needed for a standard machine of the same frame size. During a test, however, the short-circuit currents in the stator exert a strong demagnetising effect, and to keep the output current constant the initial exciting current has to be increased very considerably. The additional energy required for this is derived from the stored kinetic energy of the exciter set, augmented by that of a 12 ton flywheel. The d.c. machine has a continuous rating of 1 800 kW at 1 000 V and is capable of short-period outputs of 6 000 kW. Driving it and the flywheel is a 750 H.P. three-phase induction motor, in the rotor of which a liquid resistance is connected during starting and immediately before a test, to reduce, as in the case of the motor driving the alternator, load changes on the supply system.

Three different techniques are available to ensure the maximum rate of rise of excitation current. In the first, the alternator is initially excited to that value of open-circuit voltage which gives the correct initial short-circuit current, but with a resistance in series with the exciter and the alternator rotor. At some predetermined instant before the test, this resistance is then short-circuited. In the second method, the d.c. generator is excited to a value higher than that required to produce the necessary alternator open-circuit voltage, but is not connected to the alternator until the commencement of the test. As the alternator open-circuit voltage rises to the correct value, the short-circuit is then applied. In this case, the demagnetising effect of the stator current is counteracted by the increase in rotor current above its normal value. A combination of these two expedients is often used to provide the third method of excitation.

A most important part of the equipment of each of the high power installations is a "back up" circuit-breaker which is used to disconnect the alternator from the test breaker and, if necessary, to clear a fault in the event of failure of the apparatus under test. Like the other equipment in the laboratory, the circuit-breaker is constructed for heavy duty and is rated at 15 kV, 3 000 A. Its symmetrical breaking capacity is 1 500 MVA.

Since the ohmic resistance of the circuits and the apparatus under test is necessarily small, the magnitude of the

short-circuit current at a given voltage is mainly determined by the circuit reactance, and to give the required range of values reactors are used which allow wide variations between maximum and minimum currents. On each alternator there is one reactor per phase, air-cored to reduce capacity effects and divided into tapped sections—eight on the original installation and ten sections on each reactor working with the second alternator. The reactances obtainable range between 0.02-1.1 ohms on the older units and 0.012-1.5 ohms on the remainder, the required values being obtained by series, parallel, or series-parallel arrangements of the windings. Banks of tapped resistors allow adjustment of the circuit power factor.

The majority of tests carried out on the high power apparatus are "break" tests where the breaker under examination is originally closed and the short-circuit applied by means of a separate breaker. Each pole of this breaker can be operated separately or the three can be closed together. This independent closing permits the short-circuit to be synchronised at a pre-determined point on the voltage wave, so that it is possible to make the tests either symmetrical or asymmetrical.

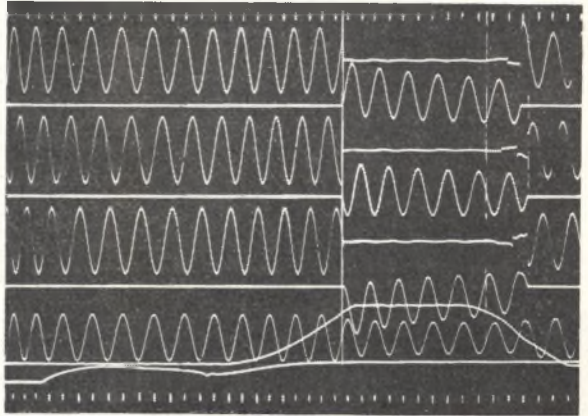
Where, as is customary, voltages higher than the 11 kV available at the alternator terminals are required, it is necessary to resort to the use of high-voltage transformers. There are to each alternator three 23 300 kVA single-phase transformers giving a combined three-phase rating of 70 000 kVA, each having two 11 kV l.t. windings and four 19 kV h.t. windings. The three transformers can be connected in delta or star for three-phase tests or in parallel or series for single-phase working, the series arrangement permitting a maximum voltage of 228 kV to be obtained. Altogether there are 24 standard three-phase connections and 42 single-phase connections available. The transformers are also used as reactors on certain tests. A special low voltage transformer, providing a range of test voltages between 254 V and 1 760 V, is used for l.t. heavy current switchgear tests.

Throughout the high power laboratories, great care has been taken both to reduce the fire hazard and to minimise the risk of injuries to personnel arising from the explosion of the apparatus under test. Oil storage tanks, pumps and filters, the low voltage transformers, "back-up"

breaker and the main h.t. transformers are situated outside the buildings, and all high power tests are carried out in reinforced cells.

In each of the two control rooms, which are interconnected to permit either separate or parallel operation of the short-circuit alternators, an interesting feature is a timing cam for operating in sequence up to 20 separate control circuits for the various motors, circuit-breakers and recording oscillographs used in a test. Where greater accuracy is required than could be obtained from the mechanical timer, electronic timers permit various operations to be performed to an accuracy of milliseconds. For recording low frequency phenomena associated with each test, a 12-element magnetic type oscillograph is provided: more rapid transients are recorded on a three-phase cathode-ray oscillograph, this instrument consisting of three tubes focussed on to a common screen to permit photography of the traces by an automatic recording camera.

Among outstanding contracts seen in progress during our visit were a 60 000 kW, 3 000 r.p.m. hydrogen-cooled alternator for Stourport power station (the corre-



Record produced by the 2-element magnetic oscillograph of a three-phase make-break test

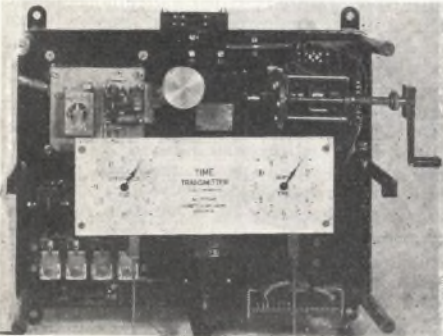
sponding steam turbine is under construction at the Rugby works); a 15 000 kW, 125 r.p.m. vertical shaft alternator for Waitaki power station, New Zealand; a 57 000 kVA 70/220/10 500 V three-phase generator transformer for the Yorkshire E.P. Co.; a 1½-million kVA 33 000 V metal-clad, air-blast switchgear for Leicester Corporation, and 12 000/15 000 V d.c. metal buoy type mercury-arc rectifiers for broadcasting.

Recently, the company has made a number of transformers to operate on the new Australian 230 kV system.

Instrumentation Developments

New Time-Keeping and Measuring Devices

ELECTRICAL recorders, a new type of clock control apparatus and a wide variety of multi-range and specialised meters were among the instruments seen in production and under test during a visit to the Colindale factory of Everett, Edgumbe and Co., Ltd., last week. Almost completely self-contained, in that apart



The time transmitting apparatus as installed on board ship. The two clock dials show G.M.T. and ship's time respectively

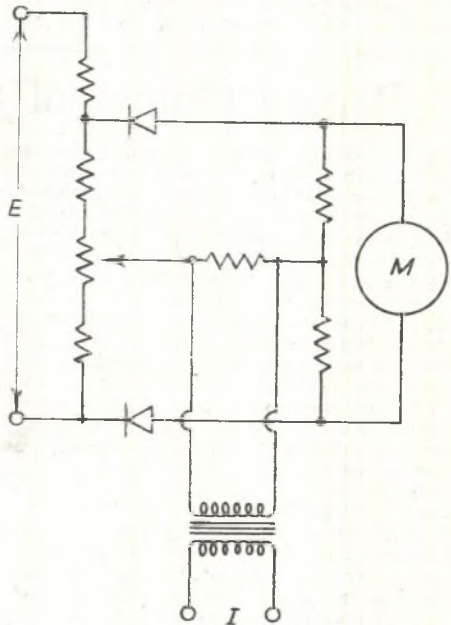
from a few items like jewelled bearings and escapements all other components are made in the works, the company manufactures measuring apparatus of types ranging from load indicators for large power station installations to sensitive miniature meters, as well as a number of products to special order, such as an optical test bench for a foreign technical college, which was seen in the course of construction, and large electrostatic voltmeters for extra-high-voltage research.

Particularly interesting aspects of the work carried out, noted in the machine shop, were the radio-frequency pre-heating of plastics before moulding, the machining of very small gears for incorporation in the company's familiar "Synclock" frequency-controlled motors—a device which is embodied in many of the recording instruments—and an automatic machine, built and designed in the works for burnishing the ends of small instrument spindles. An infra-red oven for stoving is now in the course of erection. To comply with load staggering requirements, the company has this year installed a 55 kW Brush Diesel-alternator set, which provides a considerable proportion of the factory load.

One of the newest developments is a system for controlling a number of electric clocks from a central source in locations,

such as ships, where frequency-controlled mains are not available. The apparatus, which has already been installed in the liner s.s. "Warwick Castle," comprises essentially a d.c. positioning transmitter, the receivers being embodied in the driven clocks, a variable-speed driving motor and a mechanically-operated chronometer-type master clock. The electrical transmitter consists of a ring of resistors, tapped at three points 120° apart, into which d.c. energy is fed by a slip-ring and commutator arrangement. The three tappings, in turn, are star-connected to three coils on each clock, and a permanently magnetised rotor, to which is connected the clock gear-train driving the hands, is free to rotate in the resultant field.

The rotating part of the transmitter is driven at about $2\frac{1}{2}$ -3 r.p.m. by an orthodox d.c. motor arranged to run at three speeds, normal and normal ± 25 per cent. As the



The basic circuit of the "Vampire" test set, transmitter rotates, the current in each coil of the receiver varies proportionately, with the result that the receiver rotor and consequently the clock hands move in synchronism.

Up to this point, the rotation of the clock hands is controlled by the driving motor alone. The motor drive, however,

is compared by means of a differential gear system with the clockwork-driven shaft of the chronometer. The displacement occurring in the event of the two shafts revolving at different speeds has the effect, through relays, of either raising or lowering momentarily the speed of the driving motor until the shafts, and thus the slave clocks, are brought back into alignment.

The new system is capable of controlling, to within a high degree of accuracy, up to 100 slave clocks, while remaining wholly independent of fluctuations in the supply voltage. An added feature, valuable in marine work, is a device for advancing or retarding the clocks by a fixed amount each day, this alteration being spread evenly over the whole 24 hour period. The clocks may also be adjusted simultaneously by means of a handle.

Another recent development to be examined was a maximum demand indicator for factory use, responsive to the kVA, as opposed to the kW, of demand. This device, which is arranged to give an audible warning when the m.d. is exceeded, embodies an electronic timing and measuring circuit and will, the designers believe, do much to dispel the

existing prejudice against "electronics" in heavy industry.

Of the smaller instruments, one of the most interesting was the "Vampire" test set, recently introduced at Radiolympia. This is a portable a.c. meter by means of which a.c. volts (0-250) current (0-20 A in four ranges) and watts (0-5 000, single-phase, in four ranges) may be directly measured on a single instrument without changing any external connections. The determination of power in the circuit is by means of a metal rectifier bridge network in which voltage applied across a resistive arm is compared with current injected through a transformer, unity power factor producing the maximum out-of-balance condition at a given power and a 90° lead or lag causing no deflection of the meter. An added feature of the instrument, arising from the lightness of the moving coil movement and critical magnetic damping and consequent high-speed response, is its ability to give an accurate reading of motor starting currents. It is capable of power measurement at low power factor and, in view of the lowest range of 50 W, can be used for measurements on small motors and transformers.

Record Output of Sydney Undertaking

ALTHOUGH shortage of coal during the winter months made it necessary to shed load on several occasions, sales of electricity by the Sydney (N.S.W.) undertaking for the year 1946 were the highest on record, amounting to 959 143 000 kWh, compared with 901 978 000 kWh, an increase of 6.34 per cent. Income from this source increased from £4 125 000 to £4 391 000, turning a deficit of £12 837 in the previous year into a surplus for the year 1946 of £1 775.

An analysis of sales in the annual report of the undertaking shows that the largest proportion of units sold, 32.3 per cent., was for industrial low voltage supplies, with domestic supplies accounting for 31.1 per cent. of the total.

Total units generated during the year amounted to 1 139 416 000 kWh, an increase of 122 504 500 from the previous year. Of this figure the Pymont station generated 28 592 400 kWh, Bunnerong "A" 559 069 500 kWh, and Bunnerong "B" 551 754 000 kWh. The average price received per unit sold was 1.099d., compared with 1.098d. in 1945.

Coal consumption rose during the year to 748 574 tons, representing a cost of 0.187d. per kWh sold, compared with 620 515 tons in 1945, giving 0.221d. per kWh sold. The maximum demand on the system during the year was 272 800 kW,

compared with 256 200 kW, and the system load factor showed a rise of 2.5 per cent. to 48.2 per cent.

The generating capacity of the whole undertaking at the end of 1946 was 324 500 kW, made up of seven 25 000 kW sets at Bunnerong "A," two 50 000 kW sets at Bunnerong "B," and a total of 49 500 kW in four smaller sets at Pymont. The latter station was used only for peak load operating during the year.

Thermal efficiencies of 23.29 per cent. and 16.93 per cent. were recorded at the Bunnerong "B" and "A" stations, respectively, this representing a slight deterioration on the previous year's figures.

The main constructional activities of the undertaking were at Pymont, where a "B" station, designed for an ultimate capacity of 200 000 kW, is being built. Two 50 000 kW, 33 kV, turbo-alternators for the first stage are currently being manufactured in England by the Metropolitan-Vickers Electrical Co., Ltd., and two 430 000 lbs. per hr., 1 250 lbs. per sq. in. boilers are under construction at the works of International Combustion (Australasia) Pty., Ltd. The whole station is scheduled for completion in the winter of 1951. It has been decided, the report states, that a further generating station will be needed to meet the demand of 1953, and potential sites are now being inspected.

Results of Load Spreading

Some Observations on the National Effects

WHEN the arrangements for spreading the industrial load were introduced throughout the country on October 6, the interest in their possible effects was, quite naturally, considerable. As will have been gathered from the national load curves reproduced in *THE ELECTRICIAN* of October 17 and 24, the early results were not very strongly marked, but the most recent evidence shows that there are now appreciable increases in the night and late evening loads, with corresponding reductions in the morning loads. There is a reduction in the early afternoon loads but a pronounced peak still exists and in some areas has been accentuated between 4.30 and 5.30 p.m.

It was, during October, difficult to obtain a comparison between current conditions and those existing a year ago, as Summer Time^s was in force from October 6 until November 3 this year, and G.M.T. during the comparable period of 1946. Since November 3 this year, however, when Greenwich Mean Time was adopted, it has been possible to compare daily load curves with those set up one year previously, and to obtain some indication of the effects on load spreading.

The national daily load curves for November 4, 1947, and November 5, 1946, are, by courtesy of the Central Electricity Board, reproduced herewith, together with those obtaining at a later date. It will be seen that with load spreading in force, there is a lift compared with 1946 of some 300 to 400 MW in the night and late evening loads; with a smaller lift in the early afternoon and a slight reduction in the morning peak loads. There is also evidence that morning loads develop a little earlier.

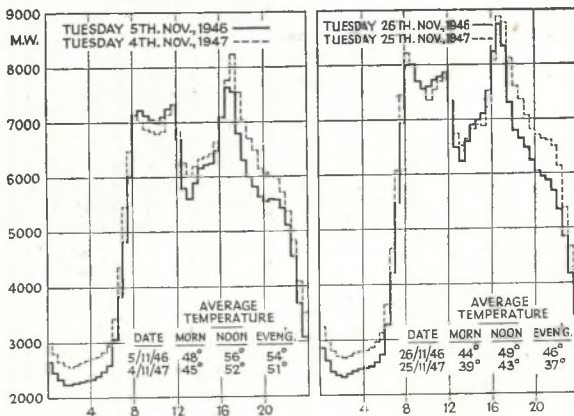
This is helping to avoid load shedding by reducing the rate of increase of the morning load, which previously tended to exceed the rate of response of the generating plant and to cause load shedding, even at times when there was sufficient generating plant to meet the total load.

The present situation is that the only load shedding likely to be necessary in any but the severest weather is between the hours of 4.30 and 5.30 p.m., when the lighting load overlaps the afternoon industrial load. Everything possible should therefore be done to transfer load from this period.

It is interesting to compare the loads for Wednesday, November 5, 1947, and Wednesday, November 6, 1946, as the number of units consumed was practically the same on both days. For the same consumption, existing conditions gave a higher night load, an earlier morning rise of load and an increased load in the late evening. The morning maximum demand was reduced by some 500 to 750 MW, and the early afternoon demand was reduced by about the same amount. The afternoon peak demand, however, which was also the peak demand for the day, was almost as high as that set up last year, and was higher than the present morning peak by some 750 to 1 000 MW. It is probable that in extremely cold weather this difference will be reduced, as lower temperatures will have a greater effect on the morning than on the afternoon loads, but there seems to be a case for making special efforts to reduce the loads between, say, 4 p.m. and 6 p.m.

Summarising the daily load curves for each area for Wednesday, November 5, 1947, and Wednesday, November 6, 1946, shows that in the case of Scotland, unit consumption increased by 11.5 per cent., which discounted the slight increase in morning and evening peaks. In N.W.

England there was a marked increase in the night and late evening loads, and an earlier morning rise of load. There was, however, no substantial change in the morning and afternoon peaks. In the case of Mid-East and N.E. England, there was a very heavy increase in the night and late evening loads, with an earlier



morning rise of load. No substantial change in morning and afternoon peaks was recorded.

A marked increase in the night and late evening loads, with an earlier morning rise of load, was also recorded in Central England. There was, however, some reduction in the morning and early afternoon demand. South-East England experienced an increase in night load, with an earlier morning rise in demand. The morning peak was, however, reduced, though a peak developed during the half-hour 8 a.m. to 8.30 a.m.

There were considerably higher temperatures in the S.W. England area on

November 5, 1947, than on November 6, 1946, and the number of units used was 10.4 per cent. less; this accounted for a general reduction in the day load. The lack of any substantial change in load demand was probably due to the high proportion of continuous process load in the area.

It may be said in conclusion that apart from the peak period between 4.30 to 5.30 p.m., which may tend to become less significant as temperatures become lower and darkness arrives earlier, the reduction in the day-time peak demand due to load spreading appears to be of the order of 500/600 MW, which is about 10 to 12 per cent. of the current industrial demand.

Electricity Statistics

THE latest return of the Electricity Commissioners of engineering and financial statistics relating to electricity supply in Great Britain for the year 1943-44, was published this week (H.M.S.O., 41 ls.).

In the course of the year there was a net increase of 99 000, or 0.9 per cent., in the number of consumers of electricity connected to the public supply systems throughout the country, the total number being over 10 786 000. The total sales of electricity to consumers of all classes amounted to 31 904 million units as compared with 30 049 million units in 1942-43, an increase of 1 855 million units, or 6.2 per cent. Sales for lighting, heating and cooking rose from 9 447 to 9 805 million units, an increase of 3.8 per cent.; while power sales rose from 19 434 to 20 941 million units, an increase of 7.8 per cent.

At the end of 1943-44, authorised undertakers, including the C.E.B., owned or leased 364 generating stations containing in aggregate 11 972 000 kW of generating plant. The 114 largest stations (31.3 per cent. of the total), each having an installed capacity of 25 000 kW or over, contained 10 755 000 kW of generating plant, or 89.8 per cent. of the total plant installed. The total amount of electricity generated amounted to 37 790 million units, as compared with 35 290 million units in 1942-43, an increase of 7.1 per cent. Of the total output, 95.4 per cent. was generated under the direction of the C.E.B. as compared with 96 per cent. in 1942-43. The gross public supply, generated by authorised undertakers and the C.E.B., together with supplies purchased from outside sources, amounted to 37 971 million units, compared with 35 437 million units in 1942-43, an increase of 7.2 per cent. The Earley generating station came into effective use during the period covered.

The sales to consumers (31 904 million units) accounted for 84 per cent. of the gross public supply, the remaining 16 per cent. being accounted for by the works requirements of the undertakers, and by losses in transmission and distribution, etc. Of the total sales, power supplies accounted for 66 per cent. and lighting, heating and cooking supplies 31 per cent. The corresponding percentages for 1942-43 were 65 and 31.

The aggregate of the individual maximum loads on the undertakings (based on units generated and/or purchased) was of the order of 10 813 000 kW, and on the generating stations of authorised undertakers, including the C.E.B., of the order of 9 968 000 kW. The corresponding figures for 1942-43 were 10 081 000 kW and 9 544 000 kW respectively. At the end of 1943-44 the capacity of the generating plant installed was 20 per cent. in excess of the combined maximum demand upon it. The load factor of the generating stations of authorised undertakers taken collectively, was of the order of 43.3 per cent., as compared with 42.2 per cent. in 1942-43.

Authorised undertakings consumed 22 696 000 tons of coal and coke (inclusive of 3 854 000 tons of pulverised fuel).

The net total revenue of all authorised undertakers (exclusive of all sales of electricity in bulk) was £142 182 000, compared with £134 551 000 in 1942-43. The total revenue from working represented an average of 1.069d. per unit sold, the corresponding figure for 1942-43 being 1.075d. For lighting, heating and cooking supplies, the average revenue per unit was 1.627d., compared with 1.640d. in 1942-43. For power supplies the average revenue per unit was 0.737d., compared with 0.718d. in 1942-43.

• Electrical Personalities •

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

MR. E. HAMER, deputy borough electrical engineer of Darlington, who is due to retire after 42 years with the Corporation, is to be retained for another six months.

MR. C. R. HEATHCOCK, managing director and general manager of the Midland Electric Corporation for Power Distribution, Ltd., Birmingham, has been nominated as senior vice-president of the Chartered Institute of Secretaries.

MR. J. M. GRAHAM, secretary of the County of London Electric Supply Co., Ltd., and of its twenty-one associated companies is, with the consent of the County Company board, resigning his post with effect from December 31 to join, in an executive capacity, the board of Almin, Ltd.

MR. G. E. W. HIRD, the recently-appointed engineer and manager of Brierfield electricity department, and Mrs. Hird, on November 25, were the recipients of a presentation by Mr. J. S. Lattin, the president, from the Bingley branch of N.A.L.G.O. Mr. Hird was formerly mains superintendent at Bingley, and Mrs. Hird, until their marriage about two months ago, was also on the staff of the Bingley electricity department.

The Radio Industries' Ball, organised by the Radio Industries Club of the Midlands, and held at Birmingham, on November 24, brought together a gathering of approximately 400, including leading

man of the club, Mr. F. B. Jackman, introduced the president, Dr. W. Wilson, of the



At the Radio Industries' Ball, Birmingham, left to right: MR. G. H. WELLS, MR. F. A. CROFT, MR. F. B. JACKMAN (chairman), MR. J. A. LLOYD, MRS. F. B. JACKMAN, MR. F. WESTERMAN (hon-treasurer), MR. A. V. WOOD and MR. C. C. SHIPWAY, (hon. secretary)

G.E.C. research department, and the vice-president, Mr. Percy Edgar, Midland Regional Director of the B.B.C. The club presented bouquets to Mrs. Jackman, Mrs. Wilson and Mrs. Edgar. Also present were Mr. H. Bishop, chief engineer of the B.B.C.; Mr. O. Pawsey, representing the

Radio Industries Club, London; Mr. C. F. Partridge, head of the Birmingham Technical College; and Mr. W. S. Burge, of the C.E.B.

The Lancashire Electric Power Co. invited all contractors in its area of supply to a conference at its Chorley offices recently. Mr. O. Howarth, sales manager and chief technical engineer, presided and outlined the company's load spreading arrangements. He stressed the need for economy by domestic users, and directed attention to a letter which was being distributed to the company's domestic consumers.

The contractor, he said, could help by persuading consumers to lag hot water cylinders. The company's policy



Some of the electrical contractors who attended the L.E.P. conference at Chorley on Thursday, November 20. In the centre is MR. O. HOWARTH, sales manager and chief technical engineer of the company; on his left is MR. STEWART PORTER, chairman of the Preston branch of the E.C.A.

personalities of the radio industry. During the course of the proceedings the chair-

was to reserve electric fires for new dwellings and cases of need on health grounds, etc. An exchange of views on the shortage of installation materials and the need for improvisation took place. The testing of installations was also discussed.

The Metropolitan-Vickers Dramatic and Operatic Society staged an admirable presentation of Roland Pertwee's "Pink String and Sealing Wax," at the M-V. Club Theatre, Trafford Park, Manchester, from November 24 to 29. Jean Macpherson.



A scene from the play "Pink String and Sealing Wax" produced by the M-V. Dramatic and Operatic Society

Len Tredgett, Tom Davies and 14-year-old Sheila Hay were conspicuous among a well-balanced cast. The producer was Mr. Harold Carter.

On Thursday, November 27, Vactric, Ltd., gave a dinner and cabaret for 50 executives, superintendents and foremen, at Hamilton, a few miles from the four Vactric factories at Chapelhall, Lanarkshire.

SIR NOEL ASHBRIDGE, who has been deputy Director-General of the B.B.C. since 1943, is to be director of technical services on the new board of management. Sir Noel Ashbridge is an engineer and was formerly the corporation's controller of engineering. The new post is designed to concentrate work on research and development problems.

MR. J. E. LOTT, at present employed in the mains department of the Reading electricity undertaking, has been appointed to the position of radio engineer in connection with the Council's decision to supply radio receiving sets under its hire-purchase scheme and set up a servicing department.

MR. TOM RILEY, deputy borough electrical engineer at Burnley, has been recommended for appointment as acting borough electrical engineer as from August last, when Mr. T. B. Nutter, the borough electrical engineer, retired on superannuation. Mr. Riley was educated

at Burnley Grammar School, and in 1906 became an articled pupil to Mr. J. E. Starkie, who was then borough electrical engineer at Burnley. Since then he has occupied, successively, the positions of switchboard attendant and shift engineer, assistant mains engineer, and mains engineer, being appointed deputy borough electrical engineer in 1942. From 1917 to 1942, Mr. Riley was part-time lecturer in mathematics in the engineering department at the Municipal College, Burnley. He was admitted an associate member of the I.E.E. in 1917, and transferred to full membership in 1943.

MR. R. T. MORRELL has joined the staff of F. Westerman (Wholesale), Ltd., as sales manager and buyer for their industrial electrical department. He was, for many years, with the Sun Electrical Co., Ltd., and latterly general manager with Fred Reynolds, Ltd.

MR. H. A. DELL, employed by the Mullard Radio Valve Co., Ltd., on research and development work in connection with electronic instruments, has been awarded the degree of Doctor of Philosophy of the University of London for his thesis entitled "A Physical Investigation of the Properties of Thin Films used in the reduction of Surface Reflections from Lenses."

MR. G. A. TAYLOR, of Leonard Heys, Ltd., is to go to New Zealand early next year to open a branch depôt for the company in Auckland, and take up permanent residence there. The New Zealand branch, which will buy through its Blackpool head office, will be concerned with the distribution of radio and electrical merchandise.

MR. E. A. LANGHAM has relinquished his appointment as sales manager, in the sales division of the British Aluminium Co., Ltd., to take up a new appointment as general manager for the company in India. Mr. Langham left for India last week. Mr. A. W. Langham, who has been manager of the sales planning department, will, for the present, also undertake responsibility for sales with the title of sales manager.

Obituary

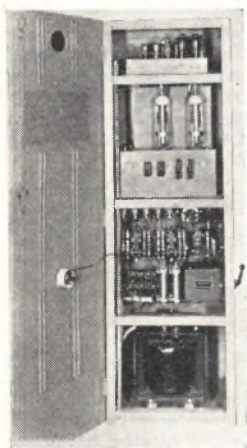
MR. ROBERT McCULLOCH, late of the Clyde Navigation Trust, Glasgow, on November 22. He was an associate member of the I.E.E.

MR. EDWARD TODD, district manager to the Cornwall Electric Power Co., at Carn Brea, until his retirement in July this year, aged 62 years. He joined Edmundsons Electricity Corporation in 1905 and went to Carn Brea as district representative. He became district manager at Truro and later returned to Carn Brea in a similar capacity.

Equipment and Appliances

Electronic Motor Controller

An electronic motor control unit with a variety of possible industrial applications



Back view of the Philips electronic motor control unit

is a recent introduction of Philips Electrical, Ltd. Working on the principle of grid control of the d.c. output of hot-cathode mercury vapour rectifiers fed from an a.c. supply, the apparatus will provide an infinitely variable range of speeds in a standard d.c. shunt excited motor. The required control voltage is applied to the rectifier grids automatically by means of an electronic control unit, the operator having only to adjust a small knob. The control unit brings the motor quickly up to any speed, subsequently holding the speed constant irrespective of load. During the period of acceleration, the current is held to a pre-determined maximum value by means of the control unit and the acceleration is therefore constant so long as the load torque is unchanged. A dynamic braking resistor in conjunction with full field excitation provides quick stopping. Rapid reversal of the motor is possible, and during the period of deceleration before reversal energy is returned to the a.c. mains through the rectifier, which in these circumstances acts as an inverter. Inching facilities can also be provided when required, this feature being particularly applicable for setting up printing machinery or machine tools. Consisting of a transformer, switchgear panel, rectifiers and control unit—all of which are enclosed in a single cabinet—and the push-button station and speed control knobs, which are connected to the cabinet by means of a multi-core cable, the control unit can also be used in conjunction with limit switches, etc., for special applications.

Electric Furnaces

The "hairpin" type heating elements introduced some years ago by Wild Barfield Electric Furnaces, Ltd., of Elecfurn

Works, Watford By-Pass, Watford, were later developed for use in a smaller type of production furnace of moderate output about midway between muffle furnaces and the larger production equipment. This type, known as the "Hairpin Minor," operates at a temperature of about 1 050° C. and has recently been improved in design. The heating chamber is backed with graded insulating bricks and lined with moulded refractory plates, a restricted vestibule minimising heat losses at the door. A flue with damper is provided. Grooves in the refractory carry nickel-chromium heating elements with thickened low-resistance ends where they pass through the insulation to prevent overheating. These thickened ends are threaded and plated. Switchgear and transformer are mounted beneath the chamber, access to the wiring being afforded by removable panels in the stand casing. According to type, either direct deflection or potentiometric pattern automatic temperature correction may be employed, and a thermo-couple with protected head and 20 ft. of compensating leads is provided. Model HM2 is rated at 12 kW and model HM3 at 20 kW.

Window Extraction Fan

The General Electric Co., Ltd., have introduced an improved version of their plastic "Xpelair" window fan. The complete unit, which is fixed in the window glass by means of a rubber cushioned clamping ring, consists of an extraction fan of 7½ in. diameter housed in a circular casing with an external weather-proofing cowl. The provision in the casing of four rubber cushions to receive the fan arms reduces noise and vibration. Stale air is extracted at the rate of 230 cu. ft. min. One of the problems with fans of this type has been to turn the air through 90° at the cowl



The G.E.C. "Xpelair" window fan

without serious loss of volume. In the present fan, the air is conducted smoothly by a combination of an impeller giving partly axial and partly centrifugal discharge and a cowl with a mid-vane. The resulting loss of air is said to be only 6½ per cent.

Correspondence

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

B.E.A. and Company Staff

[TO THE EDITOR]

Sir,—With reference to the paragraph under the above heading in last week's issue of *THE ELECTRICIAN*, I would like to correct a wrong impression which may possibly be given by the statement that the E.S.S.A.S.A. "has been formed from within the industry by officials in receipt of a salary of £700 per annum or more who have in the past considered it unnecessary to protect their interests by joining a trade union." It might be inferred from this that all such officials in the industry were previously outside the trade union movement, whereas I submit that the great majority of them were already members either of the E.P.E.A. or the National Association of Local Government Officers. Among the Northmet Company's staff, for instance, all but three of the members of the clerical and administrative staff with salaries in excess of £700 per annum are members of the N.A.L.G.O., and the majority of the technical staff in the same category are members of the E.P.E.A.

Moreover, all these members of the staff have been approached, though with little success, to join the new association which is therefore guilty of "poaching."

The ranks of N.A.L.G.O. are open to all clerical and administrative officers of the industry, and the association is competent to look after their interests whatever their salaries.

Whilst under the Electricity Act, 1947, the B.E.A. are obliged to investigate the claim of any organised body purporting to represent employees, it is questionable whether they will recognise this new body which is attempting to recruit members from unions already recognised by the B.E.A.—Yours faithfully,

C. H. HARDIE,

Northmet Branch Chairman.

National Association of Local Government Officers.

Purchase Tax on Projector Lamps

[TO THE EDITOR]

Sir,—My director wishes me to draw your attention to the decision of H.M. Customs and Excise that Purchase Tax on projector lamps shall now be the same as for other lamps with tungsten filaments, i.e., taxable up to and including 250 W. instead of up to and including 750 W.

The rate of Purchase Tax on tungsten filament lamps was increased under the recent special Budget from 33½ to 50 per cent. of the wholesale value. The current rate of Purchase Tax, where applicable, on projector lamps is, therefore, chargeable to the trade at 39 per cent. of the list price.

Yours faithfully,

T. O. FREETH,

Publicity Manager,

Electric Lamp Manufacturers' Association.

New E.D.A. Cooker Specification

A NEW edition of the pre-war purchasing specification for domestic electric cookers, containing fresh recommendations in regard to earthing and the calibration of oven thermostats, has been prepared by the E.D.A. for the guidance of supply authorities.

The new specification requires that all metal parts be vitreous enamelled or processed against corrosion, hobs made of iron or steel other than stainless steel being finished with an acid-resisting vitreous enamel. Grills and/or grill boilers are to be rectangular with an effective grilling area of not less than 9½ in. x 7½ in., and the boiling plate and grill-boiler elements must be of the plug-in type with separate earthing terminal.

In calibrating the scales of oven thermostats, it is necessary for the scales

to be marked in 25 degree divisions and numbered only in hundreds of degrees F. the figures to consist of one large numeral followed by two small noughts. All thermostats are to operate in a clockwise direction to raise heat. Pilot lights, where fitted, shall light up only when the oven circuit is energised to full load.

The section of the specification dealing with earthing requires that connections to the castings of solid (cast) boiling plates be made so as to ensure a permanently low resistance, preferably by welding or brazing a non-corrodible earth strip or wire to the plate at one end, the other end being taken to the earth pin.

Copies (E.D.A. 1273/2) are available free of charge for issue to prospective tenderers from the E.D.A., 2, Savoy Hill, London, W.C.2.

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

In the two-reaction theory for synchronous machines described in "The Electrician" of February 7, 1947, the direct and quadrature synchronous reactances were not mentioned; how are these included in the theory?

The diagram of Fig. 1, reproduced from the previous answer referred to, shows the

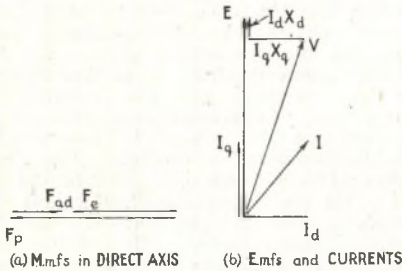


Fig. 1. — Vector diagram for salient pole synchronous machine

vector diagram for a salient pole machine in which E is the e.m.f. generated by the main direct flux, $I_d X_d$ is the leakage reactance drop due to the direct axis component of current and the direct-axis leakage reactance and $I_q X_q$ is the voltage drop due to the quadrature-axis component of current in association with the whole of the quadrature-axis flux. The direct-axis armature m.m.f. F_{ad} , if the power factor is lagging as shown, is directly in opposition to the pole m.m.f. F_p so that the actual flux produced in the direct axis is set up by the resultant m.m.f. $F_e = F_p - F_{ad}$. This is the flux which generates E .

Suppose now that the fluxes set up by F_p and F_{ad} have separate existences and produce separate e.m.fs. The flux produced by the pole m.m.f. would set up E_0 as found from the air line of the open-circuit characteristic (saturation being neglected). The flux produced by F_{ad} would be linked with the armature winding and, since it would be proportional to current, could be treated like the leakage flux and assumed to produce a leakage reactance drop $I_d X_{sd}$ —this hypothetical value of leakage reactance X_{sd} which would be produced by the direct axis flux due to armature m.m.f. is called the *direct-axis synchronous reactance* and, since this flux includes the true leakage flux, it includes the direct-axis leakage reactance. The re-

actance X_{sq} , due to the quadrature-axis flux produced by the armature m.m.f. is called the *quadrature-axis synchronous reactance* and is the same as the X_q used in Fig. 1.

The vector diagram of the e.m.fs. can now be drawn as in Fig. 2. E_0 is the hypothetical e.m.f. corresponding to the field m.m.f. F_p on the poles and from this is subtracted the direct-axis synchronous reactance drop due to I_d and the quadrature-axis synchronous reactance drop due to I_q giving the terminal voltage V as shown, resistance being neglected.

In practice it is generally necessary to draw the above vector diagram in the reverse way since V , I and $\cos \phi$ are generally known and it is desired to find E_0 and hence the field current needed for this particular load. X_{sd} and X_{sq} will normally be known but since E_0 is not known it is not possible to resolve I into its components I_d and I_q . The following procedure can, however, be adopted—draw V and I as shown in Fig. 3 at the known phase angle and draw VA 90° ahead of I —this line is also shown

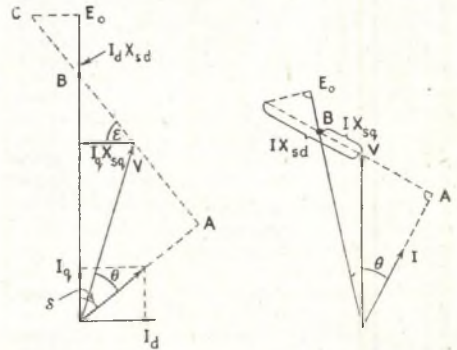


Fig. 2 (left).—Vector diagram with synchronous reactances. Fig. 3 (right).—Construction to find E_0 from V , I , $\cos \phi$, X_{sd} and X_{sq}

dotted on Fig. 2. If VA cuts the E_0 vector at B , then it can be seen from the geometry of Fig. 2 that

$$VB = I_q X_{sq} / \cos \delta = I X_{sq}$$

Setting $I X_{sq}$ along VA in Fig. 3 therefore gives the point B and fixes the position of the E_0 vector.

Referring again to Fig. 2 if E_0C is drawn

at 90° to cut VB at C it can be seen that

$$\begin{aligned} VC &= I_d X_{sd} / \sin \delta \\ &= I X_{sd} \end{aligned}$$

If, therefore, on Fig. 3 $I X_{sd}$ is set off along VA and a perpendicular dropped on to the E_o vector, the length of E_o is fixed. The field current corresponding to this can then be found from the air line of the o.c.c. in the usual way with allowance for saturation if necessary.—E.O.T.

How can corona loss be avoided on very high voltage transmission lines which are now being proposed ?

Lines under consideration employ voltages up to 400 and 500 kV and experiment shows that conductor diameters of 2 to 2½ in. will be necessary if excessive loss is to be avoided. Such a conductor, if made of stranded copper would have a cross-sectional area of about 3 to 3½ sq. in. which would be unnecessarily large and therefore too expensive; even a steel-cored aluminium conductor of these diameters would have an equivalent copper section of about 1½ in. To obtain a large diameter without an excessive amount of conductor material, hollow conductors have been used on many existing high-voltage lines, typical examples being shown in Fig. 1. Hollow conductors similar to these could be built with diameters of 2 or 2½ in. and experimental lengths have in fact been constructed and tested.

Such large conductors are, however, difficult to handle and only a relatively

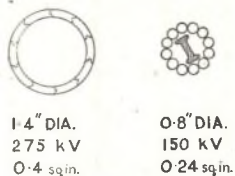
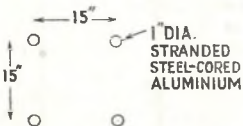


Fig. 1.—Typical hollow copper conductors

Fig. 2.—Grouped conductor, 400 kV, 0.8 sq. in. equivalent copper section



short length could be wound on a drum; an alternative method of construction was suggested in Germany before the war and has since been investigated there and in other countries—this proposes the use of a group of 2, 3 or 4 conductors in parallel to form one main conductor, a typical arrangement for a group of 4 being shown in Fig. 2. Experiment shows a much lower corona loss for such a conductor than for a hollow conductor of the same

equivalent copper section and it seems likely that this form of conductor will, therefore, be of considerable value for the extra high voltage lines now being envisaged.—E. O. T.

Batti-Wallahs' Society

A TALK on "The Dangers of Nationalisation to Production" was given by Sir Arnold B. Gridley, M.P., at a luncheon of the Batti-Wallahs' Society, in London, on Thursday, November 27. Col. H. J. Wellingham, the president, was in the chair.

In the course of his address, Sir Arnold Gridley said that the first of the dangers of nationalisation to our capacity to produce the exports needed not merely for national recovery, but, as he saw it, for our very survival, was the creation of monopolies. There were two outstanding monopolies which it was the intention of this Government to create. The first embraced coal, coke, oil, gas and electricity; and the second, road, rail and air transport. Already we had seen as the result of Government control of the coal industry, a tremendous increase in the cost of fuel. For half a century there had been not unfriendly competition between the gas and electricity supply industries, which had led to the high efficiency of both, and under the monopoly that was being created that competition would cease. He thought that monopolies created by a Government had far greater potential dangers than those created by finance and cartels. The next danger was the practical certainty that costs would rise, or heavy State trading losses would be incurred. A third danger was that the heavy costs which hampered production for export would have to be countered by subsidies, and those would have to be found by the taxpayer, whereas under private enterprise, those who found the money took the risks and if there were losses they came out of the profits of those who had been enterprising enough to find the capital.

There were also dangers facing the employees in those State enterprises, which, he was convinced, the workers did not at present realise. Every additional enterprise secured by the State was bound to diminish the opportunities of the worker to choose the form of industry which he would like to embark upon, or the master under whom he would desire to serve. Under our industrial machinery, if there was a trades dispute between employers and employees, there had been a higher authority—the Government—to whom reference could be made. Where would the appeal lie when the State was the employer?

Electricity Supply

Darlington.—It is planned to begin work on the raising of No. 1 cooling tower at the power station, in order to reduce excessive precipitation, next April, subject to satisfactory conditions prevailing at the time.

St. Helens.—The question of promoting a Bill in Parliament for powers to erect the town's new generating station close to Bold Colliery, where large-scale mining developments are in progress, is being considered by the Town Council.

Darwen.—The Town Council has decided to promote a Parliamentary Bill shortly, to obtain power to carry out the proposed £500 000 district heating scheme. The scheme will involve the diversion of part of the river.

Blackburn.—Authorisation has been issued for the fourth extension to the generating station, at an estimated cost of £1 500 000, to be ready by July, 1951. The third extension, costing a similar amount and to be ready in 1950, is already in progress. The second extension was inaugurated by Mr. George Tomlinson, M.P., earlier in the year.

Middlesex.—Consent to the installation of a cable and switchgear, costing £148 310, is being sought by the Metropolitan E.S. Co., Ltd. Required to augment the bulk supply given to the Egham and Staines Electricity Co., Ltd., the new cable, which will be rated at 25 kV, will run from the company's new 66/22 kV intake point at Hayes to a sub-station at East Bedfont and thence to the Ashford Common sub-station at Sunbury Cross.

Rye House.—Under the direction of the C.E.B., the North Metropolitan Power Station Co., Ltd., has applied to the Electricity Commissioners for consent to extensions at Rye House, Hoddesdon, which will, it is estimated, cost £2 404 700. The extensions will include two 30 000 kW turbo-alternators, a 2 000 kW auxiliary alternator, two 350 000 lbs. per hr. boilers, two 1.9 million gallons per hr. cooling towers and the necessary ancillary plant, buildings and civil engineering work.

Leeds.—High-pressure mercury-vapour fluorescent lamps are used in the new street lighting installation in New York Road, one of the city's main traffic outlets, illustrated on this page. Switched on by the Lord Mayor and the Chairman of the recently-formed Street Lighting Committee, the installation comprises 35 G.E.C. Difractor lanterns housing Osram 400 W h.p.m.v. fluorescent lamps. The lanterns are mounted on concrete columns in a stag-

gered layout, with post-top Difractor units located on centre islands every third span. Spacing is 120 ft. The installation con-



New York Road, Leeds, where 35 G.E.C. h.p.m.v. fluorescent lamps have been installed

forms to the recommendations of the Final Report of the Ministry of Transport, and was completed under the supervision of Mr. L. A. Doxey, the street lighting engineer.

Oxford.—On the grounds that the increase of 6s. 6d. per ton in the price of coal will throw an additional burden estimated at £13 000 per annum on the undertaking, the Electricity Committee have recommended that application be made to the Commissioners for permission to make a uniform increase of 10 per cent. on all accounts, other than those already containing coal clauses.

Manchester.—The construction of a conveyor system between Bradford colliery and the Stuart Street power station is being considered, to enable supplies of fuel to be transferred. The cost of the scheme would be shared between the National Coal Board and the Corporation, and it is estimated that the Electricity Committee's portion of the expenditure would be £52 700.

Otley.—A proposal of Electrical Distribution of Yorkshire, Ltd., to instal an experimental length of fluorescent street lighting in Kirkgate has been refused by the Ministry of Transport. The Ministry has stated that while in normal circumstances the experiment would provide interesting information, the application had to be considered in view of the present restrictions on street lighting. It was,

however, prepared to give further consideration to an amended proposal.

Skipton.—It has been decided that the present 10 per cent. increase on the accounts of ordinary consumers shall be suspended for the December quarter. On the basis of the determination recently made by the Electricity Commissioners on the Ilkley Council's claim, Skipton expects a substantial return from the bulk suppliers in respect of accounts dating back to 1939.

Bristol.—About 200 firms will benefit from a 13 per cent. reduction in charges decided on by the Electricity Committee in view of the need to keep down the prices of goods. The total cost of the concession will be not less than £75 000 a year. There is no prospect of a similar reduction in the cost of domestic electricity, the present

move having been decided upon to level up what has been felt to be an anomaly benefiting the domestic user.

Yorkshire.—The earlier decision of the Ministry of Fuel and Power not to confirm the Cracoe, Hebden and District Special Order authorising Electrical Distribution of Yorkshire, Ltd., to proceed with a distribution scheme in the Craven Dales (*THE ELECTRICIAN*, November 7, 1947) has now been reversed. A spokesman of the prospective suppliers has stated that the preliminary proposals are ready, but the availability of essential materials for carrying out the work is likely to be the limiting factor. Cracoe will be among the first villages to be supplied, but no likely date can be indicated. It is hoped that the Order will be finally approved by Parliament by the beginning of 1948.

In Parliament

Coal Target.—It is expected that for the 52 weeks ending December 27, national coal output will be 196 million tons, and for the 53 weeks ending January 3, 199 million tons. (MR. H. GAITSKELL, Minister of Fuel and Power.)

Supply to Farms.—Premises where a supply of electricity would be of direct assistance to food production are accorded priority and progress in connecting them is limited only by the amount of materials available, which, unfortunately, remains insufficient to meet all priority needs. Some 3 000 farms were connected to the public supply in the year ending September 30, last. (MR. H. GAITSKELL, Minister of Fuel and Power.)

Copper Purchases.—The quantity of copper purchased by the Ministry of Supply in the first ten months of 1947 was about 230 000 tons. Owing to the differences in quality and specification, an average price would not have any significance, but in general, prices were closely related to the New York export price of electrolytic copper, which varied during that period between £109 7s. and £132 per ton f.a.s. (MR. J. FREEMAN, Ministry of Supply.)

State-Owned Patents.—The Board of Trade has considered the recommendation of the Committee on the Patents and Designs Acts that all patents in respect of State-owned or State-subsidised inventions should be treated as a public asset and be vested in a central body, capable of taking the steps necessary for the development and use of the inventions in industry. If time permits, it is hoped to introduce a Bill this session to set up a National Research and Development Corporation which will have essentially the

functions recommended by the Patents Committee. (MR. H. WILSON, President of the Board of Trade.)

Hydro-Electric Projects.—The generating capacity now in course of development from water power is 400 000 kW. The estimated cost of construction is £19 million and the estimated average annual output is 802 million units. Additional capacity estimated at 400 000 kW has been surveyed but is not yet being developed. Estimates in respect of 308 000 kW of this show a construction cost of £15.5 million (at 1944 prices) and an average annual output of 520 million units. It is estimated that the Severn Barrage scheme would cost £47 million (at 1944 prices) and would provide an average annual output of over 2 000 million units. (MR. H. GAITSKELL, Minister of Fuel and Power.)

Domestic Services.—The Secretary of State for Scotland (MR. A. WOODBURN) was asked by Mr. McKinlay if he was aware of the action of the Clyde Valley E.P. Co. in refusing to instal electricity in new houses in Dumbartonshire unless gas was excluded from the services laid on; and that the company had offered to run service cables free of charge and arrange to supply electric cookers and immersion heaters on hire purchase terms on condition that gas be excluded; and what steps he would take to ensure that no such monopoly was permitted. In reply, MR. WOODBURN said that, in general, it was not desirable that tenants should be compelled to depend entirely on one type of fuel to the complete exclusion of another. After a further question, MR. MCKINLAY said he would raise the matter on another occasion.

Contracts Open

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

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

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

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

tricity Supply Department, Upper Bridge Street, Walsall.

Epsom and Ewell, January 19.—Supply, delivery and erection of h.t. switchgear and transformers; supply and delivery of h.t. and l.t. p.i. lead covered armoured and served cable. Specifications from Borough Electrical Engineer, Electricity Showrooms, High Street, Epsom.

Electricity Area Maps

THE Electricity (Areas of Area Boards) Order, 1947, which came into force on December 1, defines the area for which each Area Board is established under the Electricity Act, 1947, as the area lying within the boundaries shown on a map prepared on the authority of the Minister of Fuel and Power. Fourteen large scale maps have been prepared and these may be inspected at the Ministry of Fuel and Power, 7, Millbank, London, S.W.1 (Room 162, first floor) between the hours of 10 a.m. to 12 noon from Monday to Saturday, and 2 to 4 p.m. from Monday to Friday. Copies of the maps may be seen during the same hours at the following addresses in the fourteen areas: *South Eastern*: Regional Office, Ministry of Fuel and Power, Oakfield Court, Grovehill Road, Tunbridge Wells. *Southern*: Regional Office, Ministry of Fuel and Power, Whiteknights, Earley, Reading. *South Western*: Regional Office, Ministry of Fuel and Power, 12-14, Apsley Road, Clifton, Bristol, 8. *Eastern*: Regional Office, Ministry of Fuel and Power, Shaftesbury Road, Brooklands Avenue, Cambridge. *East Midlands*: Regional Office, Ministry of Fuel and Power, Castle Gate House, Castle Gate, Nottingham. *Midlands*: Regional Office, Ministry of Fuel and Power, 63, Hagley Road West, Birmingham, 17. *South Wales*: Regional Office, Ministry of Fuel and Power, 27, Newport Road, Cardiff. *Merseyside and North Wales*: Town Clerk's Office, Municipal Buildings, Liverpool, 2. *Yorkshire*: Regional Office, Ministry of Fuel and Power, Century House, South Parade, Leeds, 1. *North Eastern*: Regional Office, Ministry of Fuel and Power, Government Buildings, Pentelands Road, Newcastle-on-Tyne, 5. *North Western*: Regional Office, Ministry of Fuel and Power, Burton Road, West Didsbury, Manchester, 20. *South East Scotland*: Regional Office, Ministry of Fuel and Power, 51, Cockburn Street, Edinburgh, 1. *South West Scotland*: Sub-Regional Office, Ministry of Fuel and Power, 145, St. Vincent Street, Glasgow.

Monthly Digest of Statistics

THE current issue of the Monthly Digest of Statistics issued by the Central Statistical Office shows that in October the weekly average consumption of coal by authorised electricity undertakings was 538 000 tons, compared with 474 000 tons in September and 513 000 in October last year, while distributed stocks amounted to 4 197 000 tons, as against 4 106 000 tons in September and 2 280 000 tons in October, 1946. The amount of electricity generated rose from 3 150 million kW in September to 3 725 million kW in October. In October last year the figure was 3 733 million kW. Exports of electrical machinery amounted to 5.9 thousand tons in October, contrasted with 5.0 thousand tons in October, 1946, and the monthly average of 3.7 thousand tons in 1938; wireless sets shipped numbered 29.5 thousands as against 54.5 thousands in October, 1946, and the monthly average of 7.1 thousands in 1938; and wireless valves numbered 428 000 compared with 400 000 in October last year and a monthly average of 184 000 in 1938.

Industrial Information

Radio Industries' Ball

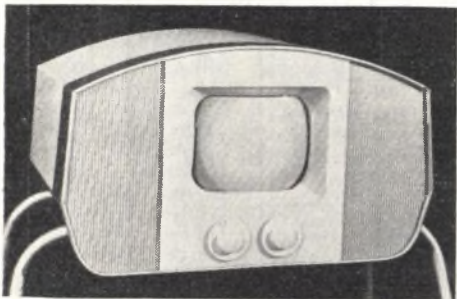
Following the success of the recent Radio Industries' Ball at the Royal Albert Hall, the Committee of the Radio Industries' Club, at their last meeting decided that a Radio Industries' Ball should be made an annual event to be held under the auspices of the club, the date and place to be varied according to circumstances.

E.A.W. Thames Valley Branch

The tenth birthday celebrations of the Thames Valley branch of the E.A.W. on November 26 took the form of a visit to the new headquarters, 35, Grosvenor Place, London, where a talk on the "Development of the E.A.W." was given by Miss Vera Norvick, assistant secretary. A birthday cake was made from ingredients provided by members, and decorated with the E.A.W. monogram in blue and white icing.

E.D.A. Wedding Gift

The television receiver illustrated on this page was produced by Ferranti, Ltd., and was the wedding gift of the British Electrical Development Association to



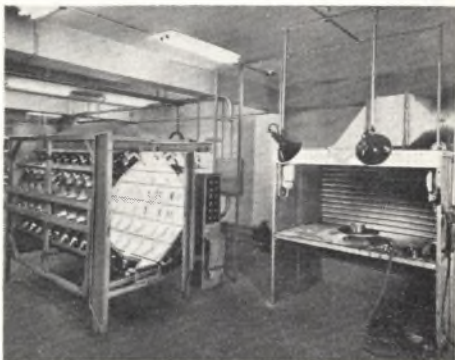
This television receiver was the wedding gift of the B.E.D.A. to Princess Elizabeth

Princess Elizabeth. The set is housed in a cabinet with a copper lacquer and cream finish, supported by a tubular metal stand. It has a 10 in. by 8 in. viewing screen and two speakers. Other wedding gifts were mentioned in our last issue.

Infra-Red Lamp Heating

The Metropolitan-Vickers Electrical Co., Ltd., have established a special infra-red electric lamp demonstration department at 132-135, Long Acre, London, W.C.2. Four different types of production plant,

with a total load of 75 kW, are at present installed and tests can, therefore, be carried out on a wide range of articles. The installation includes a 6 ft. spray



Infra-red electric lamp demonstration department established by the Metropolitan-Vickers Electrical Co., Ltd., at Long Acre, London

booth and compressor unit. This department deals with many varied industrial requirements including paint stoving, moisture extraction and preheating, and interested executives are invited to take samples of their products for test.

Directorate of Mica

The Board of Trade announce that the address of the Directorate of Mica is now 23, Buckingham Gate, Westminster, London, S.W.1. (Telephone: Victoria 7503.)

Export Orders

In a statement outlining the work of the Tyneside area for the export trade, Mr. John Rhodes, the Northern Regional Controller for the Board of Trade, stated that C. A. Parsons and Co., Ltd., had orders for turbo-alternators worth £10 000 000 for almost every quarter of the globe, and A. Reyrolle and Co., Ltd., had orders for switchgear valued at more than £2 000 000.

Third Congress on Large Dams

The Third Congress on Large Dams will open in Stockholm on June 10 next year. The meetings on June 11 and 12, in the Concert Hall, will be followed by a five days' study tour to a number of dams and hydro-electric power plants, and to one of Sweden's large industries. The tour includes a visit to the waterfall at Harspranget, which is in process of development. The capacity of the power

station is to be 260 000 kW. Applications should be made to the Secretary, British National Committee of the World Power Conference, 201-2, Grand Buildings, Trafalgar Square, London, W.C.2, not later than December 31.

Charter for Technical Staff

A charter for technical staff in the engineering and metallurgical industries has been prepared by the Association of Scientific Workers. It introduces a method of grading professional workers in this field with the object of establishing equitable salary levels.

Electronics Exhibition

New electronic instruments for industrial and scientific use will be shown for the first time at a trade exhibition to be held by Cinema-Television, Ltd., at Brettenham House, Lancaster Place, W.C.2, from January 20 to 31, 1948. Among the items on view will be, it is announced, a device for detecting metal objects in food, etc., a high-speed electronic counter and several cathode-ray oscilloscopes, including a model with a 15 in. screen that may be viewed from front and rear.

Research Survey

The statistical survey carried out by the F.B.I. industrial research secretariat to assess the scientific and technical research effort in British industry's laboratories and works, has now been published. The survey is based on returns from 420 firms

scientific research, carried out by a staff of some 45 000, of whom about 10 000 are qualified scientists and engineers. More than half the 420 firms are in direct contact with universities and technical colleges and 60 have endowed research scholarships or fellowships. The importance of each firm of any size possessing a scientific staff commensurate with its technical needs is stressed.

Five-Day Week Adopted

E. K. Cole, Ltd., announce that as from Monday, November 24, their Scottish service depôt, adjacent to the Ekco works at Rutherglen, Lanarkshire, will work a five-day week. The entire Rutherglen organisation of the company will normally be closed on Saturdays.

Industry in Sussex

With the object of attracting to the county its share of the export trade, the Sussex Engineers' and Manufacturers' Association, Ltd., 3, Marlborough Place, Brighton, 1, has published a brochure giving, in addition to information relating to the history and places of interest of the county, particulars of Sussex industries, old and new. The book is being circulated to H.M. Consuls, trade correspondents, chambers of commerce and buyers throughout the Empire and world.

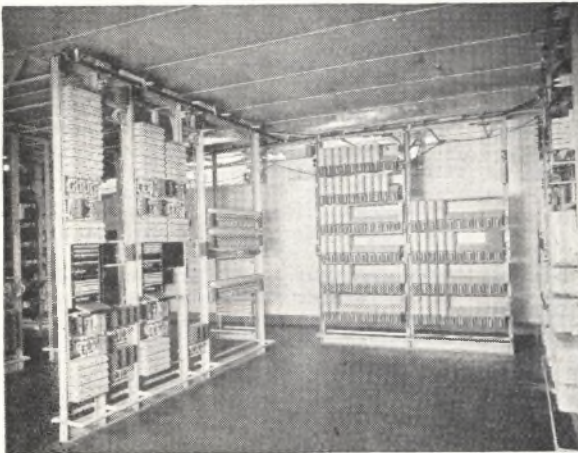
Post Office Training School

The Post Office engineering department, in order to solve the problem of the efficient training of their maintenance personnel, have provided a central training school at Stone, Stafford. The Automatic School has representative examples of telephone exchange equipment employed by the G.P.O., and most of these have been installed by the General Electric Co., Ltd. Seven separate automatic exchanges are housed in various buildings within the school. The G.E.C. has also supplied some equipment for the Transmission School, which provides training on carrier equipment and the like.

B.S. for Book Sizes

It has long been felt desirable that there should be greater uniformity in the sizes of books, and as a step in this direction the B.S.I. has issued in B.S. 1413/1947,

some recommendations on the subject. These included a series of eight sizes representing those commonly used in Great Britain which, if universally



The exchange "Herald" at the Stone, Staffordshire, Post Office training school. The G.E.C. equipment shown here is of the pre-2 000 type

covering, it is estimated, some 75 per cent. of industry's total research effort. It shows that British industry is now spending about £30 000 000 a year on industrial

adopted, would conduce to economy in library shelving and to general convenience. The second part of the booklet establishes a system for the inclusion of the dates of publication of books. Copies, price 1s. post free, may be obtained from 24, Victoria Street, London, S.W.1.

Birmingham Handbook

The varied municipal activities which provide Birmingham with its homes, educational and health services, with water, gas and electricity, with transport services, municipal meals, banking, and other services are fully described in the City of Birmingham Handbook, price 2s. 6d., or 3s. post free. The handbook is compiled and edited by the City Public Relations Officer.

Agents Appointed

The Arora Co., Loughborough, announce that they have completed arrangements for J. J. Clune and Co., 27, East Essex Street, Dublin, to act as their agents and distributors in Eire, and A. Oswald and Co., of 192, St. Vincent Street, Glasgow, C.2, to act as their agents in Scotland.

Lamp Sales Aids

In addition to the cut-out display piece illustrated in our issue of October 24. Cryselco, Ltd., Kempston Works, Bedford, have now available to the retail trade two attractively designed showcards printed in colours—one effectively directing attention to general service lamps and the other to motor car lamps.

Emergency Lighting Equipment

"Keopalite" automatic emergency lighting equipment, manufactured by the Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester, has been ordered for the Military Hospital, Hounslow; Crumpsall Hospital, Manchester; Withington Hospital, Manchester; and St. Cross Hospital, Rugby.

Conduits and Fittings

The 21st edition of "G.E.C. Conduit, Conduit Fittings and Accessories," is now available from the General Electric Co., Ltd., Magnet House, Kingsway, London. This 200-page catalogue contains much useful information and will be an invaluable guide for all who use conduit. It has a comprehensive alphabetical index.

F.D.A. Area Conference

A conference of architects and electrical engineers arranged by the B.E.D.A. (Northern Counties Area) was held at Newcastle-on-Tyne on November 27. Mr. H. H. Mullins (area chairman of the B.E.D.A.) presided and a paper on "Lighting and its Application to Architecture" was given by Mr. E. B. Sawyer,

of the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London. This was followed by a general discussion on the subject.

Publications Received

A revised edition of the booklet "Standard Specifications and Typical Analyses—Metals, Metallic Alloys and Carbides," published by Murex, Ltd., Rainham, Essex.

An illustrated booklet, issued by Metway Electrical Industries, Ltd., King Street, Brighton, giving details and prices of their moulded terminal blocks, strips and accessories.

A catalogue—the fifth abridged list—issued by John Dugill and Co., Ltd., Hazel Grove, near Stockport, giving particulars and prices of their movable, focussing and self-sustaining lighting fittings.

A leaflet illustrating in colours nine different types of fluorescent lighting fittings for 40 W lamps, published by the Queensbury Engineering Co., Ltd. (fluorescent lighting division), Cumberland Road, Stanmore, Middlesex.

Two new catalogues, issued by the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.2, dealing, respectively, with propeller ventilating fans, and electric pumps and pumping plant, details and prices of which are given.

The newly-published wholesale and export price list of electrical appliances supplied by Brooks and Bohm, Ltd., 90, Victoria Street, Westminster, London, S.W. These are available to their usual customers and home trade and overseas buyers.

Philips' Lighting Publication A.161, issued by the lighting department of Philips Electrical, Ltd., Century House, Shaftesbury Avenue, London, W.C.2. It describes the company's sodium industrial lighting fittings and gives technical data of the fittings, lamps and apparatus.

Leaflet C. 471, "Arora Electrical Heating Appliances: Catering and Industrial Equipment," issued by the Arora Co., Rosebery Street, Loughborough, giving details of their electric hot cupboards and toasters for canteens, hotels and restaurants, and also drying ovens for industrial purposes.

Southwark Cathedral Calendar for 1948. Twelve attractive views of the cathedral and some of its treasures. Published by, and in aid of, The Friends of Southwark Cathedral (Patron, Queen Mary). During 1947 the Friends, now more than one thousand strong, defrayed the cost of restoring and rehanging the famous cathedral bells. Calendars are obtainable from Mrs. E. G. Benn, M.B.E., 16, Duke Street Hill, London, S.E.1, price 3s. 6d. each, post free.

Company News

HANKOW LIGHT AND POWER CO., LTD.—Loss for yr. £2 663; this added to debit £535 brot. in leaves debit blee. £3 198 go fwd.

HOOVER, LTD.—Resolutions to subdivide and convert 40 000 unissued 5½ per cent. cumulative preference £1 shares into 800 000 "A" ls. ordinary shares were approved at a meeting of shareholders on Monday. The purpose of the proposals, explained Mr. C. B. Colston, chairman, at the meeting, was to provide a form of incentive to employees and even executives.

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—At an extraordinary meeting of stockholders, presided over by Sir Robert Renwick (chairman), Sir Allen Rae Smith was appointed Stockholders' Representative under the Electricity Act for the company and its associated electricity supply companies.

JERUSALEM ELECTRIC AND PUBLIC SERVICE CORPORATION, LTD.—Opertg. surplus and sundry receipts. for yr. to Mar. 31 £P.125 577 (£P.108 966), deduct admin. exes. £P.6 953 (£P.6 447), dirs.' fees £P.2 800 (same), lvg. £P.115 824 (£P.99 719). To tax provn. £P.30 000 (£P.36 000), cap. amort. fund £P.5 477 (same), renewal and deprecn. acct. £P.45 000 (£P.30 000), contng. £P.10 000 (£P.5 000), staff provident fund £P.8 500 (nil), pref. div. £P.8 662 (£P.7 875), ord. div. 6% (same). fwd. £P.20 343 (£P.20 408).

CRABTREE ELECTRICAL INDUSTRIES, LTD.—A proposal to set up a manufacturing organisation in South Africa was announced by the chairman (Mr. H. Schofield) at the annual meeting. The decision was taken following a visit by a representative of the company to South Africa earlier in the year, and the necessary senior personnel would shortly be leaving to initiate the project. During the next few years they anticipated big dividends from this new venture. The company had been steadily increasing its overseas representation, the chairman added, and now had agents in most parts of the world.

ELECTRICAL AND MUSICAL INDUSTRIES, LTD.—The company's large contribution to the export drive was emphasised by Sir Ernest Fisk (vice-chairman and managing director) at the annual meeting. The group's exports, visible and invisible, accounted for more than 20 per cent. in value of the total United Kingdom exports of consumer goods in those particular fields of activity. Their total production in the United Kingdom during the year was valued at approximately £5 million,

and their contribution to the national economy in both hard and soft currencies was approximately £2 million. The last figure was made up of £1 600 000 in manufactured goods and nearly £400 000 earned abroad by way of profits, royalties, pressing fees and reserves. In the course of a technical survey, Sir Ernest said that the only market for their television transmitting equipment at present was in the United Kingdom, but they hoped in future years to supply a number of overseas countries. At present, their only competitors in the field were in the U.S.A. That competition would be keen, but the British system was technically as good as any other, and overseas competition would therefore resolve itself largely into a matter of price. They were not confining themselves to the present television standard of 405 lines and 25 frames and were already in a position to quote anyone interested for a television system with higher definition than anything at present in use. The company had also produced a new television camera which permitted a greater depth of focus than heretofore and which could produce good results for television transmission from light of 1 c.p. per sq. ft. or less.

Metal Prices

	Monday, Price	December 1 Inc. 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. 6¾d.	— —
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	per ton £91 10 0	— —
Foreign or Colonial	" £90 0 0	— —
Tin—		
Ingot (minimum of 99.9% purity)	per lb. £442 10 0	— —
Wire, basis	per lb. 5s. 6¾d.	— —
Aluminium Ingots	per ton £80 0 0	— —
Spelter	" £70 0 0	— —
Mercury (spot)	per bott. £16 0 0	— —
(ex. warehouse)		

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

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.

RUSSELL, Harris (trading as Russell Electrical Co.), High Street, Merthyr Tydfil, Glam., electrical engineer. £39 6s. 9d. October 1.

BAUMBER (male), Saxilby, Lincs., electrical dealer. £25 9s. 10d. September 16.

BIGNELL, A. (male), and CATLEY, T. (male), 350, Yeading Lane, Hayes, Middx., building and electrical contractors. £14 4s. 4d. September 30.

MURFIT, J. C. M. (male), Main Road, Fishpool, Mansfield, electrical dealer. £11 4s. 9d. September 9.

Receiving Order

LUTON RADIO AND ELECTRICAL SERVICES (a firm), lately carrying on business at 13, The Arcade, Leagrave Road, Luton, Beds., radio and electrical engineers. Receiving order dated November 14, 1947.

Dividend

BRIMFIELD, Robert Thomas Henry, lately of Wellington Cottage, Wellington Square, S.W.1, and lately carrying on business as Richfield Electrical Components (a firm), at 73-78, High Holborn, London, W.C.1. (electrical contractor). Amount per £. 10d., third. Payable December 9, 1947, at Bankruptcy Buildings, Carey Street, W.C.2.

Winding-Up Order

BOWMAC ELECTRIC, LTD. — Kingston-on-Thames. November 10.

Coming Events

Friday, December 5 (To-day)

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

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

Saturday, December 6

JUNIOR INSTITUTION OF ENGINEERS, N. WESTERN SECTION.—Manchester. 16, St. Mary's Parsonage. "Sub-Station Equipment and Operation," by J. L. Breedon. 2.30 p.m.

I.E.E., SOUTHERN CENTRE.—Bournemouth. The Pavilion. "The Application of Electrical Technique to the Service of Some Other Industries," by H. Cobden Turner and G. M. Tomlin. 2.30 p.m.

Monday, December 8

I.E.E., S. MIDLAND CENTRE. Transmission Group.—Birmingham. Imperial Hotel. Chairman's Inaugural Address, by Prof. W. J. John. "Operational Characteristics of Modern H.V. Wood Pole Lines," by G. T. Garwood. 6 p.m.

I.E.E., RUGBY SUB-CENTRE.—"New Possibilities in Speech Transmission," by Dr. D. Gabor.

I.E.E., WESTERN CENTRE.—Cardiff. "Comparisons Between Gas and Electricity on the Basis of Coal Economy," by P. Schiller. 5 p.m.

I.E.E., N. EASTERN CENTRE.—Newcastle-on-Tyne. "Some Observations on Oil Deterioration in Transformers and Switchgear," by H. Hurworth. 6.15 p.m.

Tuesday, December 9

I.E.E., RADIO SECTION.—London. "Commercial Disc Recording and Processing," by B. E. G. Mittell. 5.30 p.m.

I.E.E., MERSEY AND N. WALES CENTRE.—Wigan. Mining and Technical College. "Recent American Hydro-Electric Schemes, With Special Reference to Boulder Dam," by W. A. Hatch. 7 p.m.

THE ELECTRICIAN

Wednesday, December 10

I.E.E., SCOTTISH CENTRE.—Edinburgh. "The High-Pressure Mercury-Vapour Discharge and Its Applications," by V. J. Francis and W. R. Stevens. 6 p.m.

BELFAST ASSOCIATION OF ENGINEERS.—"Some Aspects of Modern Welding. With Special Reference to the Applications of X-Rays," by A. Marshall.

I.E.E., N. EAST SCOTLAND SUB-CENTRE.—Aberdeen. "The Klydonograph and Lightning Measurements," by E. Wilkinson. 7.30 p.m.

I.E.E., TRANSMISSION SECTION.—London. "Some Observations on Oil Deterioration in Transformers and Switchgear," by H. Hurworth. "An Electrical Resistance Test for Insulating Oils," by J. S. Forrest. 5.30 p.m.

I.E.E., SHEFFIELD SUB-CENTRE.—Report on "The Practical Training of Professional Electrical Engineers," by a member of the Joint Committee on Practical Training in the Electrical Industry. 6.15 p.m.

INSTITUTION OF MECHANICAL ENGINEERS. Automobile Division.—London. "Operation of the British Public Service Vehicle Industry," by J. C. Gillham. 6.30 p.m.

Thursday, December 11

WOMEN'S ENGINEERING SOCIETY.—London. "Ultrasonics," by C. Cropper and G. M. Wells. 7 p.m.

I.E.E., INSTALLATIONS SECTION.—London. "Electrical Engineering Problems in the Tronics," by R. Allan. 5.30 p.m.

I.E.E., N. EAST SCOTLAND SUB-CENTRE.—Dundee. "The Klydonograph and Lightning Measurements," by E. Wilkinson. 7 p.m.


SCOTTISH ENGINEERING STUDENTS' ASSOCIATION.—Glasgow. Institution of Engineers and Shipbuilders. "Water Tube Boilers," by E. G. Yarrow. 7.30 p.m.

I.E.E., N. WESTERN STUDENTS' SECTION.—Manchester. "Hydrogen Cooling for Rotating Machines," by D. F. Davidson. 6.15 p.m.

Friday, December 12

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. "Air-Blast Circuit Breakers," by G. K. Simpson. 6.30 p.m.

I.E.E., MEASUREMENTS SECTION.—London. "The Design, Testing and Calibration of a Combustible-Gas Detector," by R. Poole. 5.30 p.m.



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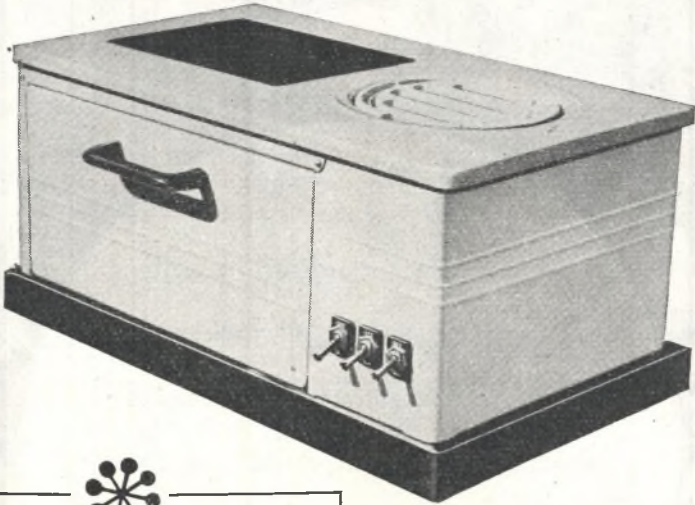
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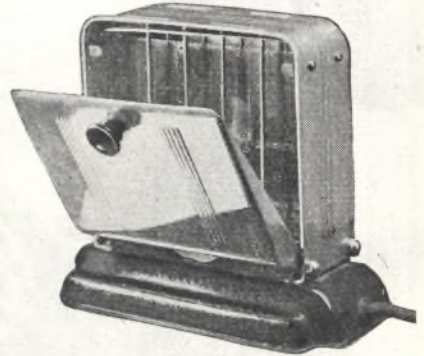


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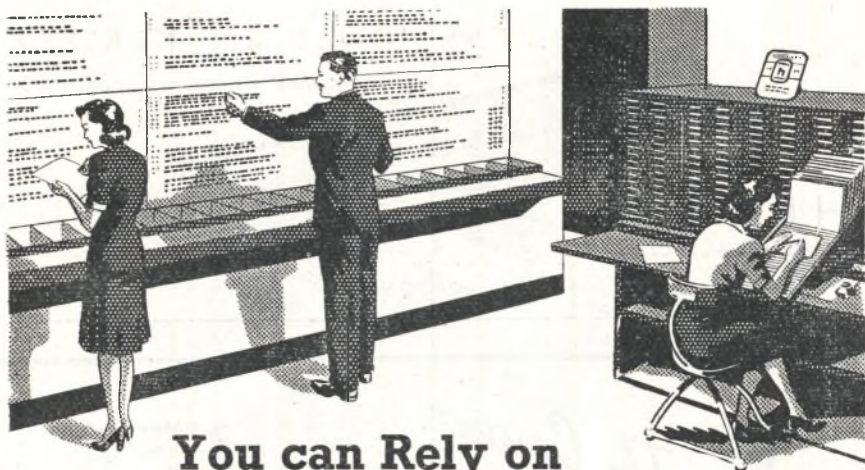


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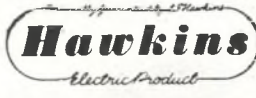
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Yours faithfully,
(Sgd.) C. C. Crispin



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Many people are still not convinced that a Radio owes much of its performance to the Transformer inside it. Slowly we are proving to our friends, the Radio Manufacturers, that a Parmeko Transformer makes a very real and lasting contribution and like most people - who rely on our extensive Research and Design Departments - they are wisely beginning to forget that silly old word 'Transformer' and think 'Parmeko' instead and to use properly the many services it is our specialist job to give.

Do think over the fact that we make only Transformers - not Radios, Refrigerators, etc., plus Transformers. Surely it follows that with specialization we produce a better Transformer cheaper.

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December

December is balance month. The last few days of the year make heavy demands upon the staff of the bank, for every account is "balanced" and checked. Modern office methods, involving the use of mechanised book-keeping systems and of photographic records in accountancy, have reduced the time spent in searching for the proverbially elusive penny, but even so, hard work by every officer is required at "balance time". You will soon have an opportunity of studying the balance sheet of the Midland Bank; it is clothed in conventional form, but behind its figures lies the story of great achievements for customers large and small.

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Modern streamlined design; the absence of dirt traps outside or of grease-collecting corners inside; smooth enamel finish; drop-down type oven door—these factors combine to make the Falco Cooker a genuine labour-saving unit in the kitchen. It has the staunch excellence of Falco engineering throughout.

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- Thermostatic oven control.
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The Everett Edgcombe Live Conductor Tester embodies a Series Resistor with a Rectifier Moving-Coil Indicator of high sensitiveness, reading direct in Kilovolts to "Earth." The scale is open at the lower end, enabling it to be checked on a medium voltage circuit before use. A flexible lead terminating in a bulldog clip forms an efficient earthing connection.

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SANTON heaters are manufactured in many different types and sizes to meet every water heating requirement. The new SANTON Data Book gives the specification, size and loading capacity of every SANTON Model. Write for your copy to-day to Santon Ltd., Newport, 15, Mon.

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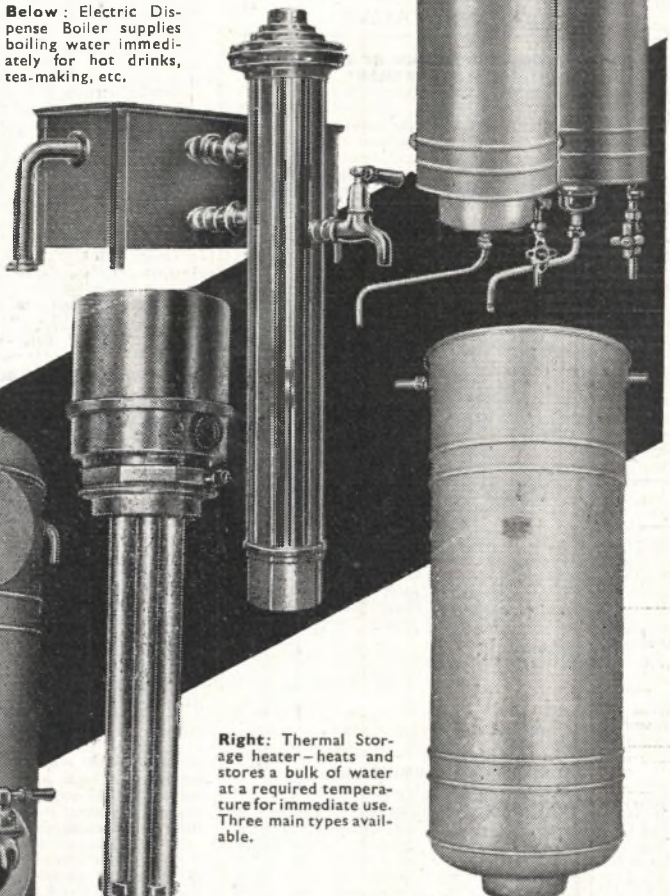
Below Right: Typical immersion heater. SANTON Circulators and immersion heaters, with or without thermostat, meet all domestic and industrial requirements.

Below: Automatic Boiler - provides a constant and immediate bulk supply of boiling water for tea making, etc.

Below: Electric Dispense Boiler supplies boiling water immediately for hot drinks, tea-making, etc.



9934 E



Right: Thermal Storage heater - heats and stores a bulk of water at a required temperature for immediate use. Three main types available.



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CLASSIFIED ADVERTISEMENTS

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

CITY AND COUNTY BOROUGH OF BELFAST ELECTRICITY DEPARTMENT.

APPOINTMENT OF JUNIOR ASSISTANT (SHIFT) ENGINEER.

APPLICATIONS are invited for the position of Junior Assistant (Shift) Engineer for the Harbour Power Station.

It is desirable that applicants have a University Engineering Degree or a Higher National Certificate in Electrical or Mechanical Engineering and/or be Corporate Members of the Institution of Electrical or Mechanical Engineers. They must have a sound engineering training.

The commencing weekly wages are equivalent to Grade 9a, Class J, of the National Joint Board Schedule of Salaries for Technical Engineers on the staff of Authorised Undertakers. The scale is £389 per annum for the first two years, £398 for the third and fourth years, and £408 after the fourth year. Upon the completion of twelve months' satisfactory service the position will be established on the Salary List, and shall be terminable during the first twelve months by one week's notice and thereafter by one calendar month's notice on either side.

Preference will be given to ex-Service candidates possessing the required qualifications.

Applicants must not be more than 40 years of age on January 1st, 1948. In computing applicants' ages for the purpose of the age qualification clause, any periods of war service in H.M. Forces will be deducted from applicants' actual ages, provided that this will not apply to applicants whose actual ages would be over 45 years on the date of taking up duty.

Applications must be made on official forms, which can be obtained from the City Electrical Engineer and General Manager, Electricity Department, East Bridge Street, Belfast, and, with copies of not more than three recent testimonials, should reach the Town Clerk, City Hall, Belfast, not later than 4 p.m. on Friday, December 19th, 1947.

Canvassing, oral or written, if proved to the satisfaction of the appointing authority, will disqualify.

JOHN DUNLOP,
Town Clerk.

City Hall,
BELFAST.
November 27th, 1947.

(412)

UNIVERSITY OF BIRMINGHAM.

FACULTY OF SCIENCE.

APPLICATIONS are invited for the post of Lecturer in Electrical Engineering (Grade IIc) at a salary of £550-£600 per annum, preferably with such experience as will enable him to teach subjects in heavy current engineering.

Three copies of applications, with the names of three referees, should be sent to the undersigned (from whom further particulars may be obtained) not later than January 10th, 1948.

C. G. BURTON,
Secretary.

The University,
Edmund Street,
BIRMINGHAM, 3.
November, 1947.

(411)

DESIGNER-DRAUGHTSMAN to be engaged upon oil insulated H.T. transformers up to 10 kVA capacity, also associated control equipment. Excellent prospects for suitable applicant. Salary according to qualifications. —Apply, giving age and details of qualifications and experience to: Personnel Department, General Electric Co., Ltd., Union Works, East Lane, Wembley. (399)

SITUATIONS VACANT

CORPORATION OF LONDON.

APPOINTMENT OF ENGINEERING ASSISTANT.

APPLICATIONS are invited for the above appointment in the City Surveyor's Department at a salary according to qualification and experience up to a consolidated amount of £600 per annum. Candidates for the appointment must be members of the Institution of Electrical Engineers, with good experience in design and supervision of electrical, heating and hot water supply installations, with ability to direct a maintenance staff and to control contracts in connection with such works.

The appointment is for the present on a temporary basis and in the event of establishment to the permanent staff, temporary service will count for the purposes of superannuation.

The appointment will be subject to the provisions of the Corporation's superannuation scheme and candidates will be required to pass a medical examination. The appointment is subject to one month's notice on either side.

Applications, endorsed "Technical Staff," to be made to George Holliday, F.R.I.C.S., City Surveyor, 55-61, Moorgate, E.C.2, giving the following particulars: Age, training and experience, past and present appointments, service with Armed Forces, and date when available to commence duties if selected, together with a copy of a recent testimonial. (TC121)

METROPOLITAN BOROUGH OF ISLINGTON ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the following permanent appointments—by permission of the Ministry of Labour and National Service, under the Control of Engagement Order, 1947—from persons who are not at present or normally employed in agriculture or coalmining.

JUNIOR SHIFT CHARGE ENGINEER (two vacancies).

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class G, Grade 9, at present £399, rising to £414 15s. per annum inclusive.

Applicants should have had a sound technical training in mechanical and electrical engineering, preferably with some experience of the maintenance and operation of steam raising plant and turbo generators. Consideration will, however, be given to those who have been unable to obtain practical experience but who have the necessary technical qualifications.

ASSISTANT TESTING ENGINEER.

Salary and conditions of service will be in accordance with the National Joint Board Agreement, Class II, Grade 9a, at present £383 5s., rising to £400 1s. per annum inclusive.

Applicants should have had a sound technical training preferably with some experience in a meter and testing section of a large supply undertaking. The person appointed will be required to assist with testing and maintenance of protective gear, and testing of new equipment prior to commissioning.

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

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 two recent testimonials, in an appropriately endorsed envelope, not later than December 15th, 1947.

H. DIXON CLARK,
Acting Town Clerk.

Town Hall,
Upper Street,
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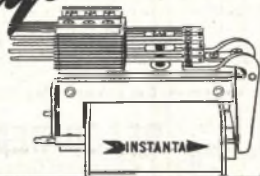
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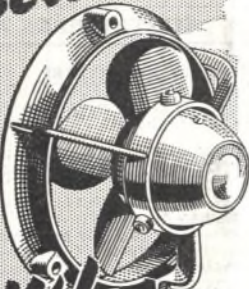
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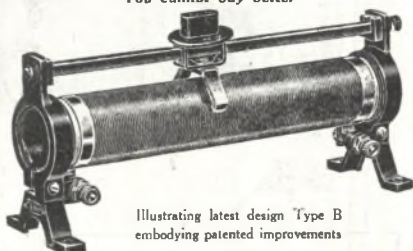
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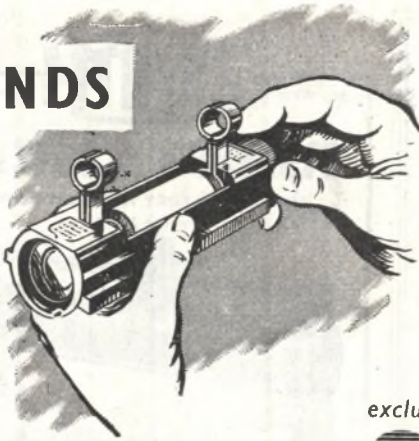
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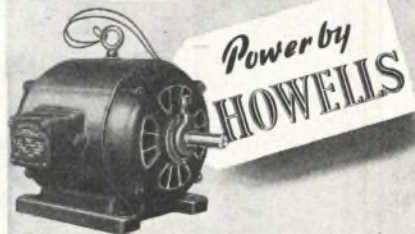
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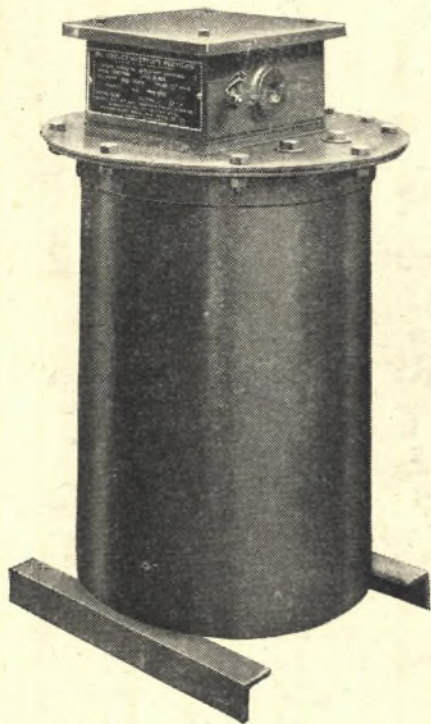
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This range of rectifiers has been designed to provide a reliable DC power supply under extreme conditions of a dirty, highly-contaminated atmosphere. Typical applications are vibrating screens used for sieving materials ranging from ore, quarry rock and coal to face powder; magnetic chucks in machine shops; lifting magnets used in the open; and magnetic separators in foundries.



TANK. Small equipments have circular tanks as illustrated. Larger tanks are rectangular and, where greater dissipation is required, as when dealing with large power outputs, cooling tubes are provided. All tanks are provided with oil-filler plug, dip stick and oil breather, and drain plug.

TERMINAL CHAMBER. Detachable cover giving access to terminals. Weather-proof and tapped to take armoured cable or conduit.

RECTIFIER. Double-voltage Westalite

TRANSFORMER. Double-wound with vacuum impregnated windings.

FINISH. Interior finished in chrome yellow oil-resisting paint. Exterior grey synthetic resin paint.

DC OUTPUT. These equipments may be employed for a variety of DC power outputs.

These sets may be supplied as a single-phase half-wave rectifier without transformer, a single-phase bridge-connected rectifier with transformer, or a three-phase bridge-connected rectifier with transformer.

WESTINGHOUSE
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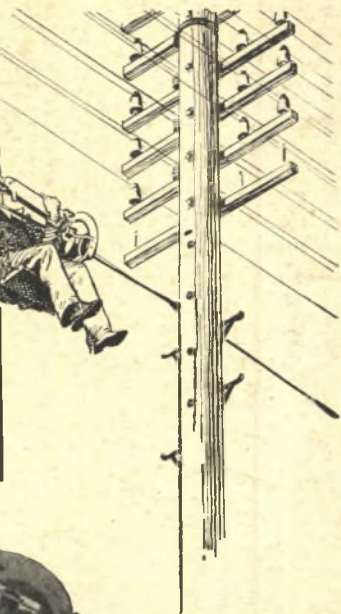
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THE PG METHOD FOR THE

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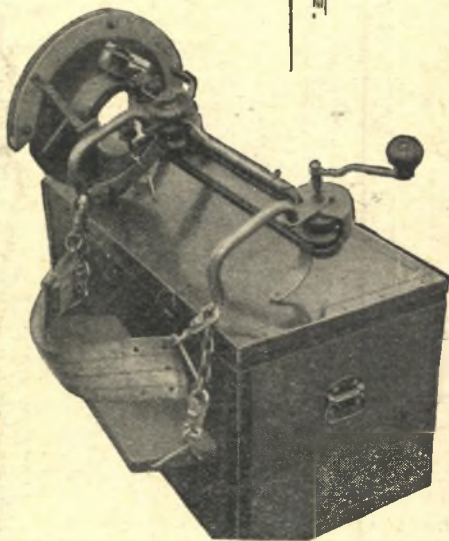
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This machine is suitable for binding cable to new or existing Catenary wire. Its application eliminates the use of cable suspenders or rings.

Further details are given in our Technical Instruction Sheet 19f which will be sent on request.

We shall be pleased to quote for these Aerial Cable Spinning Machines for which delivery can be made from STOCK.



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