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THE

P.60/46/II

ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

R.137/1946/1123

DECCA NAVIGATOR TOWERS



Built by

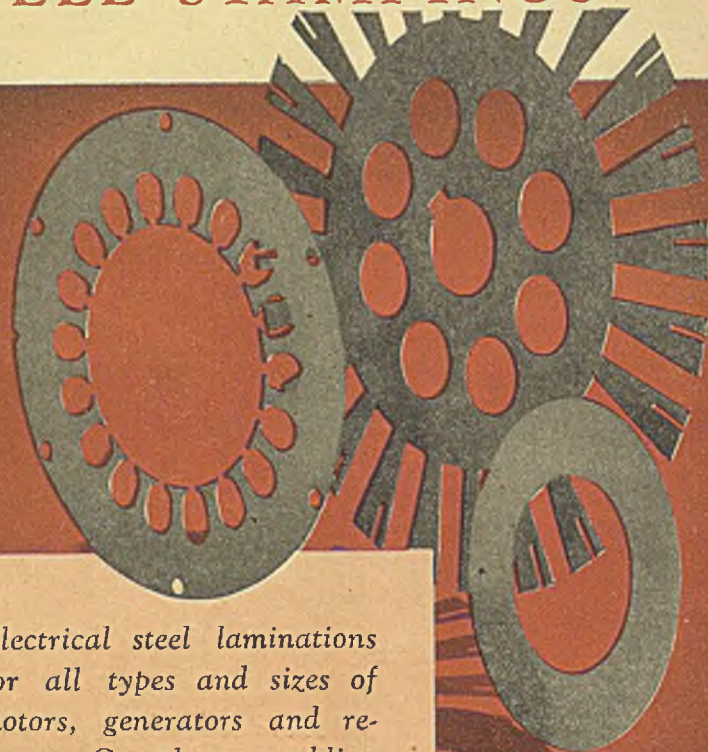


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And even if the hole's too small?

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And one of the two takes any screw?

That's right.

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marvellous plugs, mate!*

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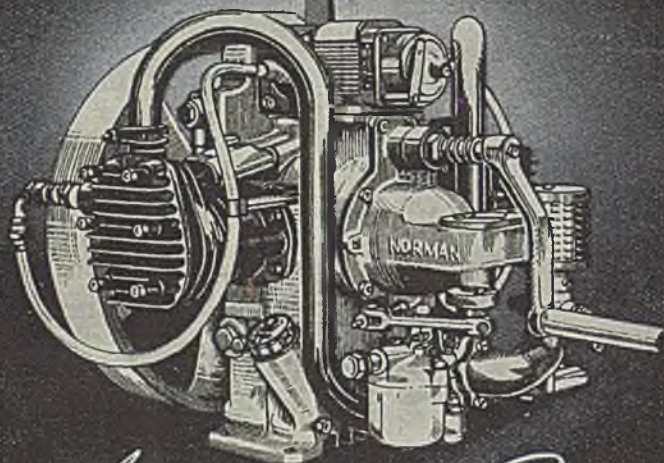
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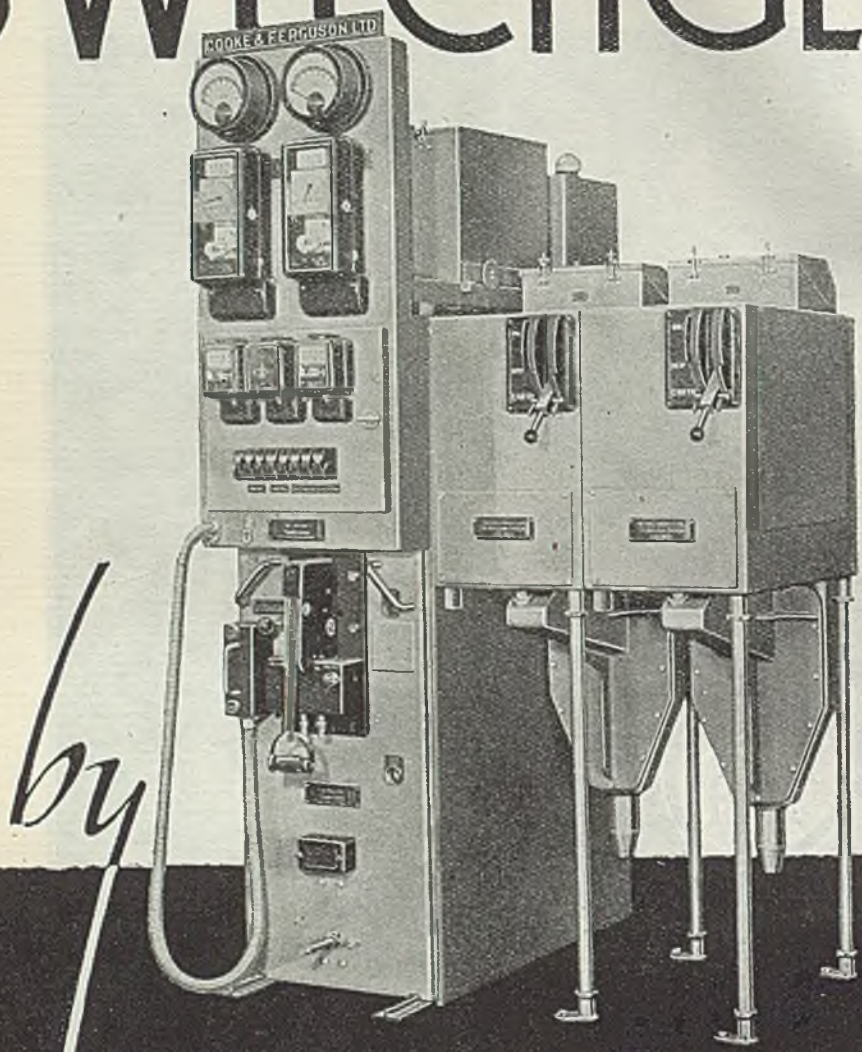
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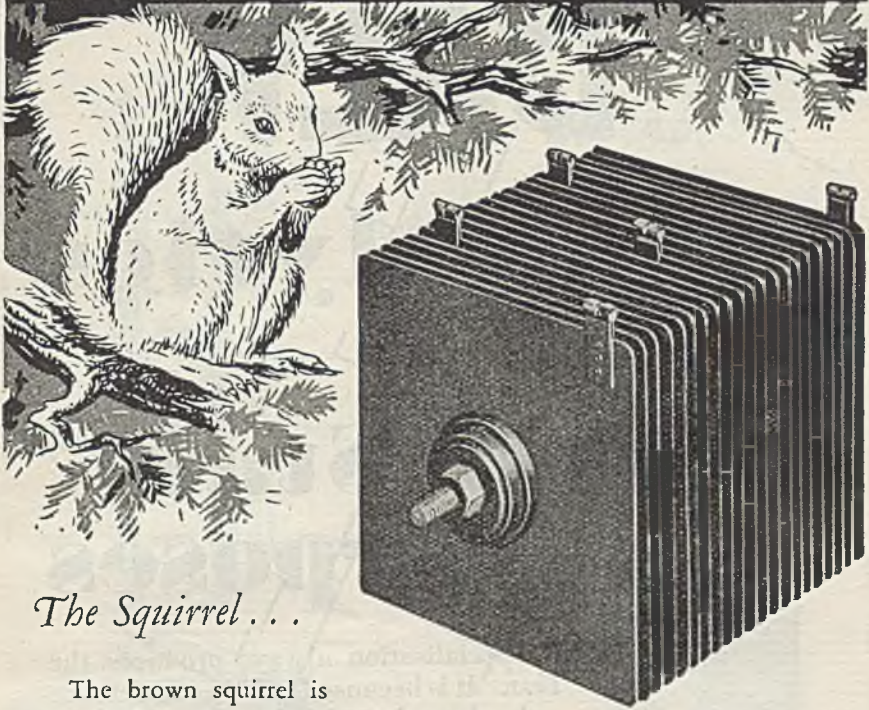


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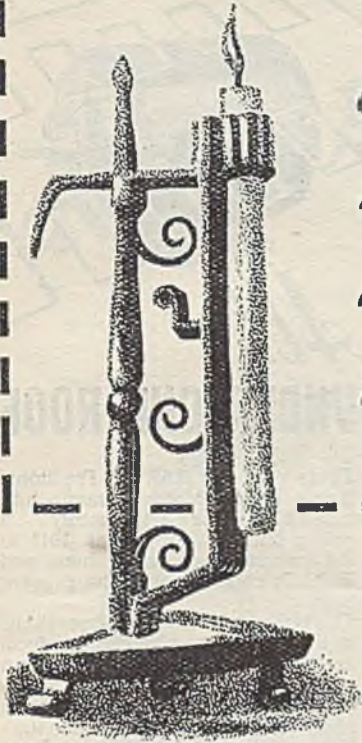
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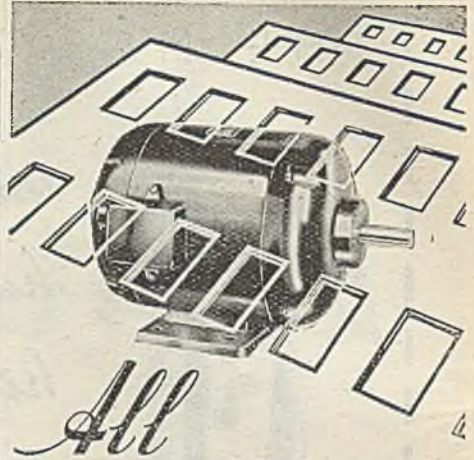
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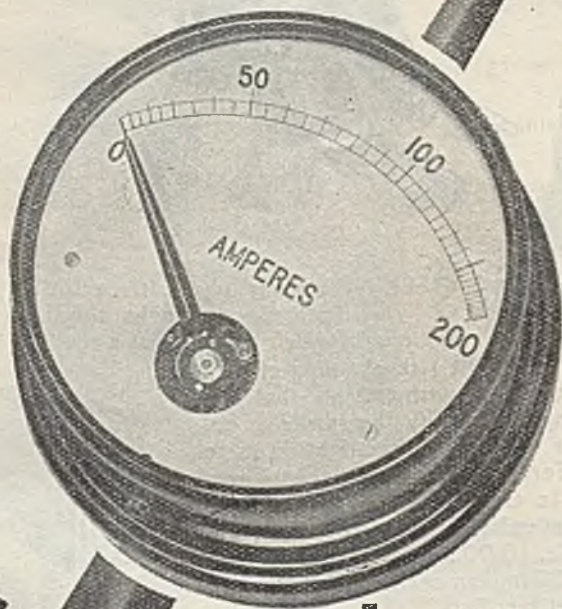
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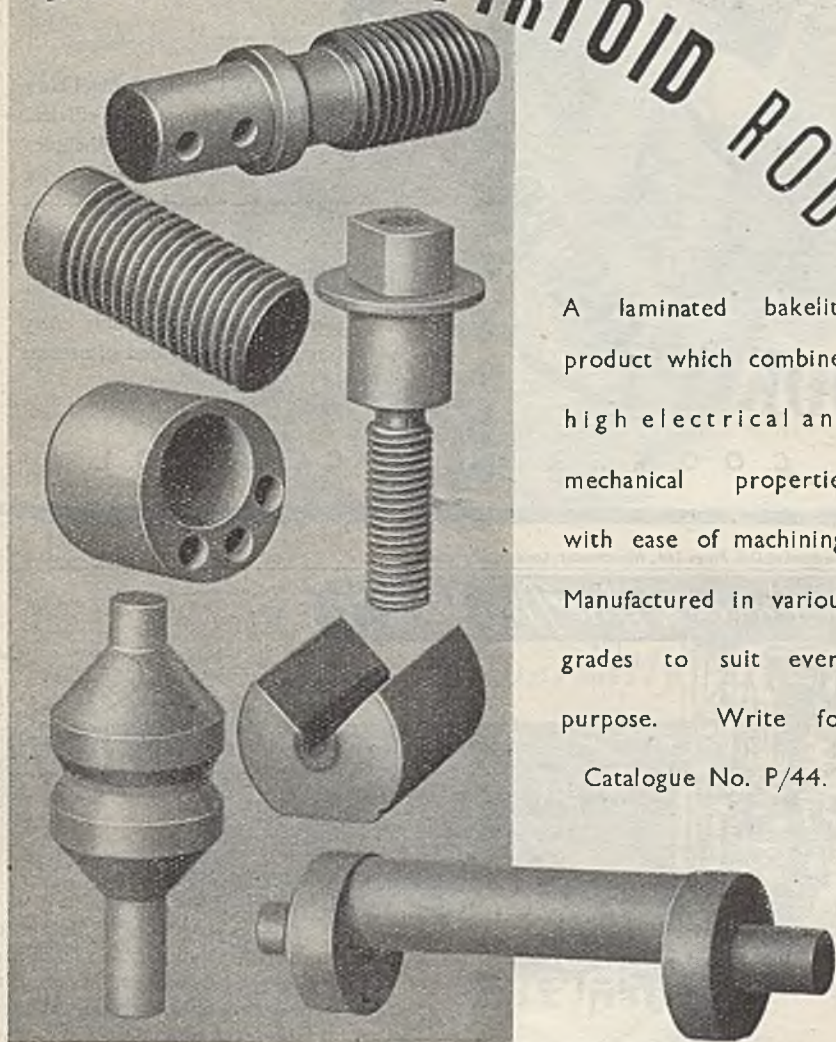
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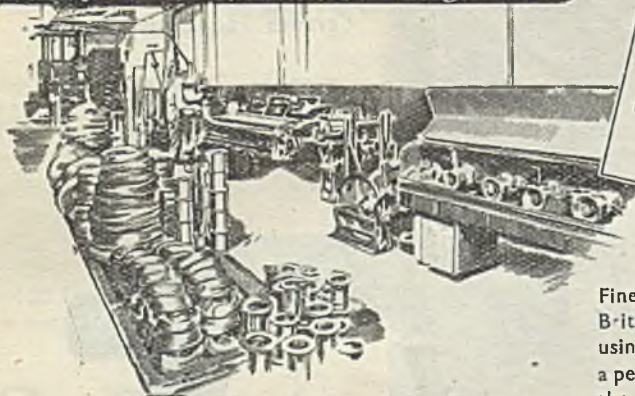


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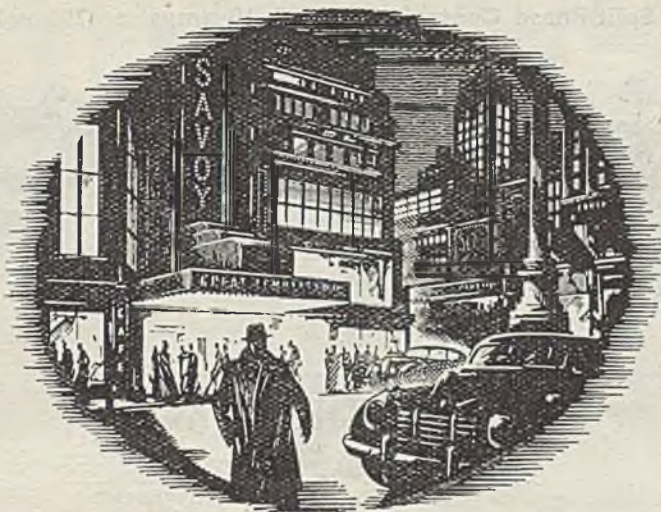


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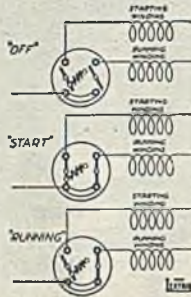
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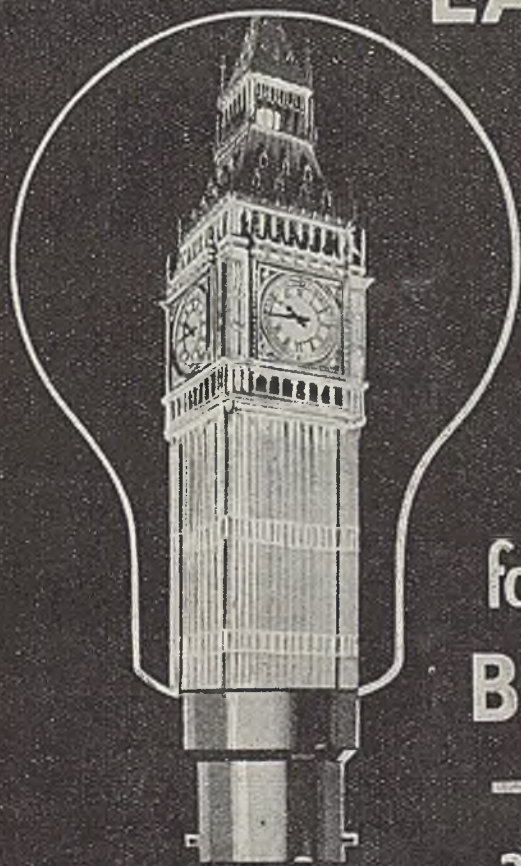
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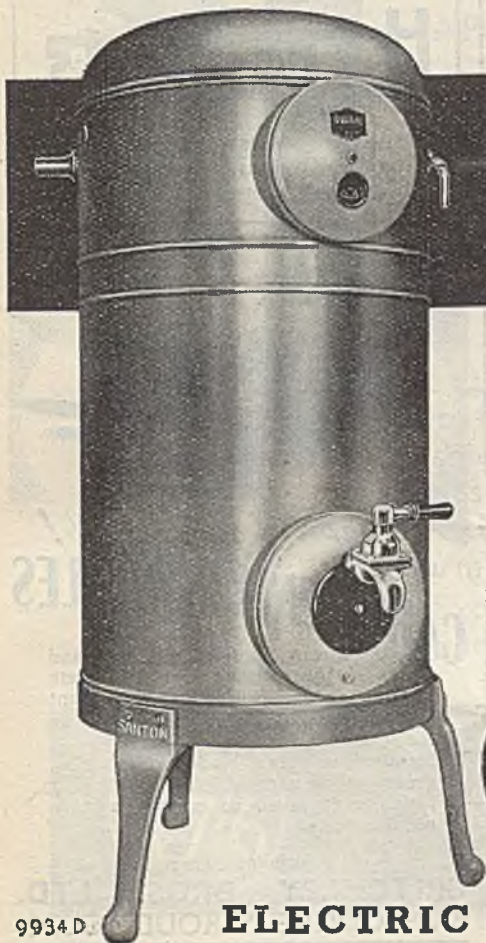
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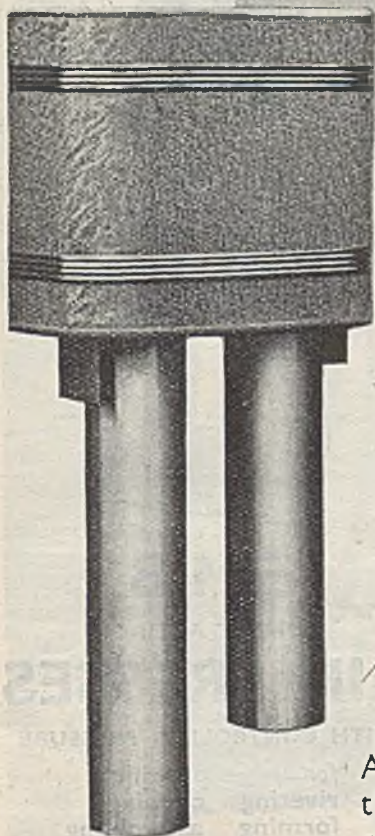
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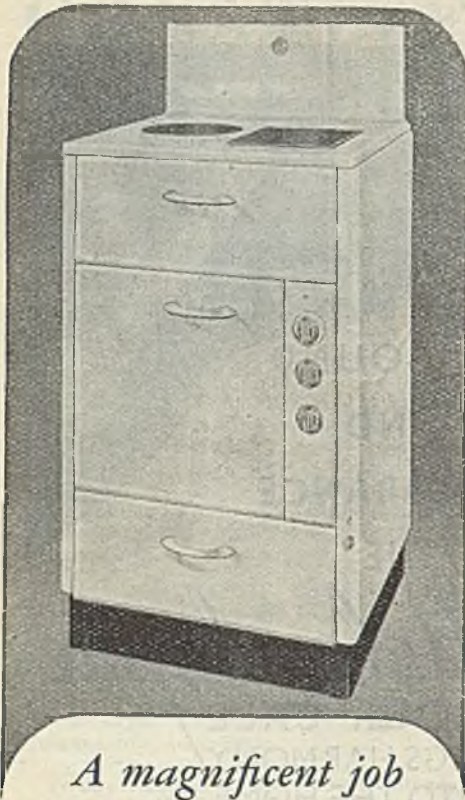
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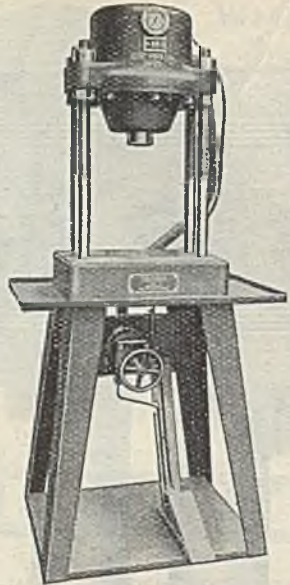
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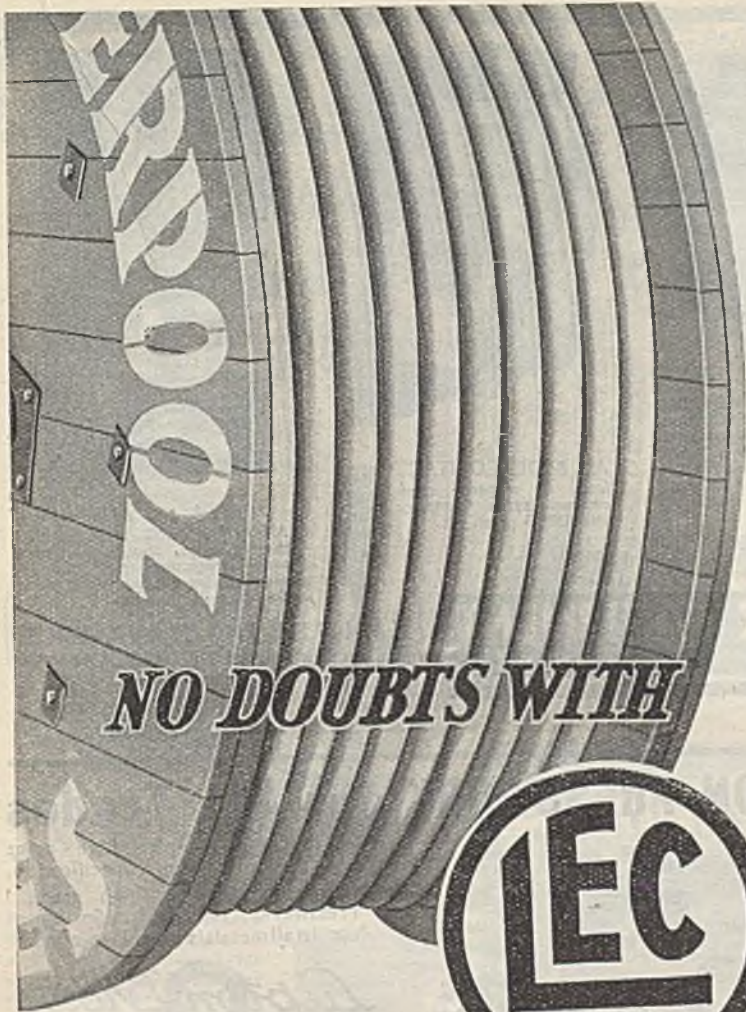
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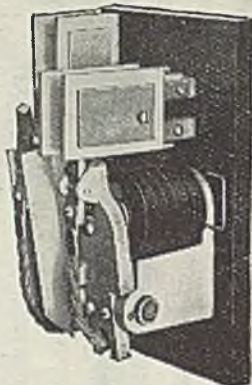
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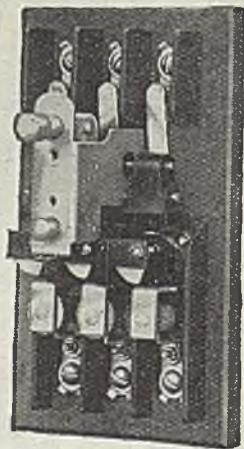


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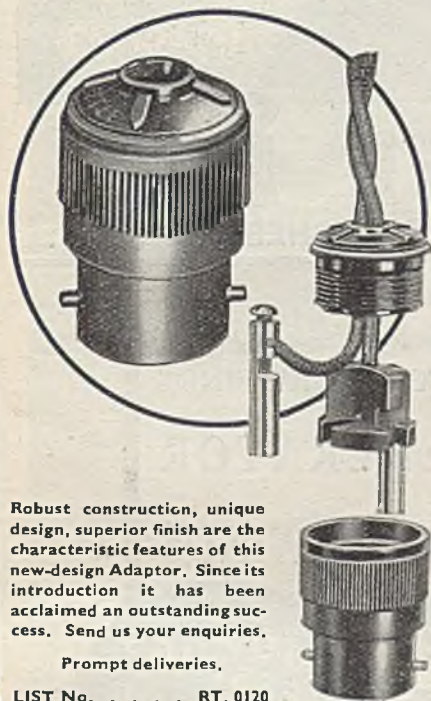


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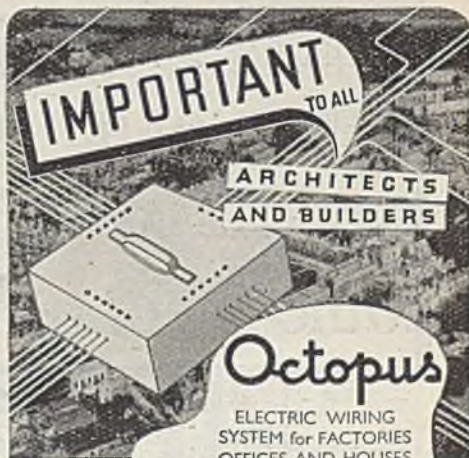
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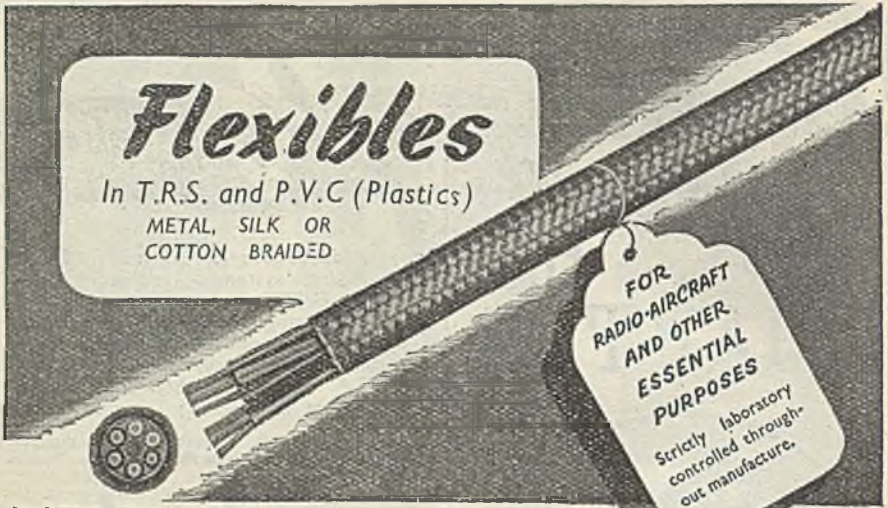


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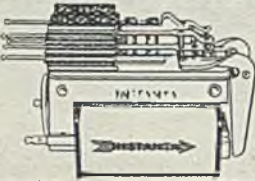
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ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply and delivery of

STREET LIGHTING POSTS AND FITTINGS for housing schemes at Bracken Bank and Woodhouse, which are being developed by the Keighley Corporation.

Particulars and Form of Tender may be obtained from the undersigned.

Completed tenders should be sent to S. Walker, Esq., Town Clerk, Town Hall, Keighley, by Saturday, 11th January, 1947, in sealed envelopes devoid of any indication as to sender and endorsed "Tender for Street Lighting Equipment."

The Corporation does not bind itself to accept the lowest or any tender.

G. F. MOORE,
Engineer and Manager.

Electricity Offices,

Coney Lane,

KEIGHLEY.

30th November, 1946.

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.

CONTRACT NO. 726.

NEEPSSEND POWER STATION.

Sale of Redundant Plant as Scrap.

THE Electricity Committee invite Tenders for the purchase and removal of:—

- 2 Turbo Alternators and Ancillary Plant, 12 500 kW.
- 5 Boilers and Ancillary Plant, 40 000 lbs./hr. 200 p.s.i.
- 3 Electric Feed Pumps.
- 1 Steam Feed Pump.
- 1 Feed Tank.
- 2 Ash Suction Plants.
- 3 Ash Hoists.
- 2 Ash Ropeways.
- 1 Passenger Lift.
- 2 Steam Cranes and Grabs.
- 1 20-ton Crane.
- 1 Pressure Reducing and Desuperheating Plant.
- Circulating Water Screens and Pumps.
- Piping.
- Spare Motors, Valves and Parts.

A Schedule and Specification of the Plant for disposal is available on application to the undersigned, and the Plant may be inspected by appointment.

In the execution of the work of removal, the successful Tenderer will be required to comply with the Standing Orders of the City Council relating to standard rates of wages and conditions of labour.

The Corporation reserves the right to accept Tenders for the whole or part of the Plant referred to.

Tenders to be forwarded to the Town Clerk, Town Hall, Sheffield, 1, enclosed in the official envelope provided, which must be sealed and bear no name or mark indicating the sender, and received by him not later than first post on Wednesday, 15th January, 1947.

Tenders received after the time stipulated herein will not be considered.

Sgd. JOHN R. STRUTHERS,
General Manager.

Commercial Street,
SHEFFIELD, 1.
November, 1946.

**TENDERS
CITY OF MANCHESTER.**

THE Electricity Committee invites tenders for the supply, delivery and erection, over a period of two years (with the option to terminate at end of first year) of 6.6 kV SUB-STATION SWITCHGEAR (Specification No. 883).

Specification, etc., may be obtained from Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of £1 is., which amount will be refunded on receipt of a *bona fide* tender.

Tenders, addressed to the Chairman of the Electricity Committee, to be delivered not later than 10.0 o'clock a.m. on Monday, 13th January, 1947.

The Committee does not bind itself to accept the lowest or any tender.

PHILIP B. DINGLE,

Town Hall, Town Clerk,
MANCHESTER, 2.
28th November, 1946.

**SITUATIONS VACANT
COUNTY BOROUGH OF SOUTHEND-ON-SEA.
ELECTRICITY DEPARTMENT.**

APPPLICATIONS are invited for an Electrical Fitter for construction and maintenance work on various types of electrical plant of electricity distributing sub-stations. Wages in accordance with No. 9 Area District Joint Council plus 8d. per hour, making the present rate of pay £5 12s. 13d. per week of 47 hours.

The appointment is subject to the provisions of the Local Government Superannuation Act 1937 if the applicant is under 35 years of age or is already a contributor under the above Act. A successful applicant who does not comply with these conditions can make application to become a contributor, which will remain at the discretion of the Council.

Applications in writing, giving details of training and experience, enclosing copies of two recent testimonials, and endorsed "Electrical Fitter," must be addressed to the Borough Electrical Engineer and Manager, Electric House, London Road, Southend-on-Sea, and must be received not later than 16th December, 1946.

Canvassing directly or indirectly will be a disqualification.

ARCHIBALD GLEN,

Municipal Buildings, Town Clerk,
SOUTHEND-ON-SEA.
November, 1946.

**METROPOLITAN BOROUGH OF POPLAR.
APPOINTMENT OF SENIOR DRAUGHTSMAN,
ELECTRICITY DEPARTMENT.**

APPPLICATIONS are invited for the position of Senior Draughtsman, in the Electricity Department of the Council, at a salary in accordance with Class G, Grade 8, of the scales of salaries of the National Joint Board for the Electricity Supply Industry (at present £490 per annum inclusive).

Applicants must be fully qualified draughtsmen, familiar with building and structural engineering, and a knowledge of general Power Station and Sub-station work is essential.

The successful applicant will be required to pass a medical examination, and the appointment is subject to the provisions of the Poplar Borough Council (Superannuation) Acts, 1911-1937.

Applications stating age, particulars of qualifications and experience, accompanied by copies of three recent testimonials, should be addressed to the undersigned, endorsed "Senior Draughtsman—Electricity Department," and should be received not later than 9 a.m., Tuesday, 24th December, 1946.

Canvassing members or officers of the Council in any form will disqualify.

S. A. HAMILTON,

Poplar Town Hall, Town Clerk,
BOW ROAD, E.3.
27th November, 1946.



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BOROUGH OF LUTON ELECTRICITY UNDERTAKING.

APPLICATIONS are invited for the following appointments:

1. Shift Charge Engineer.

Candidates must have had experience with the efficient running of a selected Generating Station operating in parallel with the C.E.B. Grid. The existing Station comprises 24.5 M.W. of generating plant.

Salary in accordance with the N.J.B. Schedule, Class G, Grade 8, at present £467 rising to £476 per annum.

2. Sub-Station Charge Engineer.

Candidates must have had experience in operating C.E.B. supervisory control equipment, H.T. and L.T. Switchboards, and the operation and maintenance of rotary converting plant.

Salary in accordance with the N.J.B. Schedule, Class F, Grade 8b, at present £386 rising to £401 per annum.

3. Switchboard Attendant.

Candidates must have had experience in the control of H.T. and L.T. switchboards, and the operation and maintenance of rotary converting plant.

Salary in accordance with the N.J.B. Schedule, Class G, Grade 9a, at present £343 rising to £358 per annum.

The successful candidates will be required to pass a medical examination and to contribute to the Corporation's Superannuation Scheme.

Applications giving age, details of training and experience, and accompanied by copies of three recent testimonials, should be delivered not later than Friday, 20th December, 1946, to C. T. Melling, M.Sc., Tech., M.I.E.E., M.I.Mech.E., Borough Electrical Engineer, Electricity Offices, St. Mary's Road, Luton.

Canvassing directly or indirectly will be a disqualification.

W. H. ROBINSON,

Town Hall,
LUTON,
29th November, 1946.

CITY OF LEEDS ELECTRICITY DEPARTMENT. DEMONSTRATORS.

APPLICATIONS are invited for the following positions:

Senior Demonstrator.

Candidates should preferably possess a recognised Diploma in Domestic Science and the E.A.W. Certificate in Electrical Housecraft, be competent to organise and conduct lecture demonstrations, and to advise on the selection and use of all domestic apparatus.

Salary in accordance with the Clerical Division of the National Scales for Local Authorities' Administrative, Professional, Technical and Clerical Services £252 to £288 per annum plus war bonus at present £48 2s. per annum.

Junior Demonstrator.

Salary in accordance with the General Division of the above grading scheme.

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

Applications giving full particulars of training and experience to be received by 14th December, 1946.

F. NICHOLLS,

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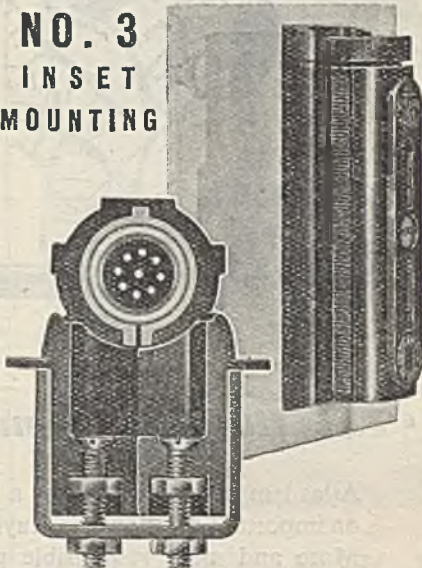
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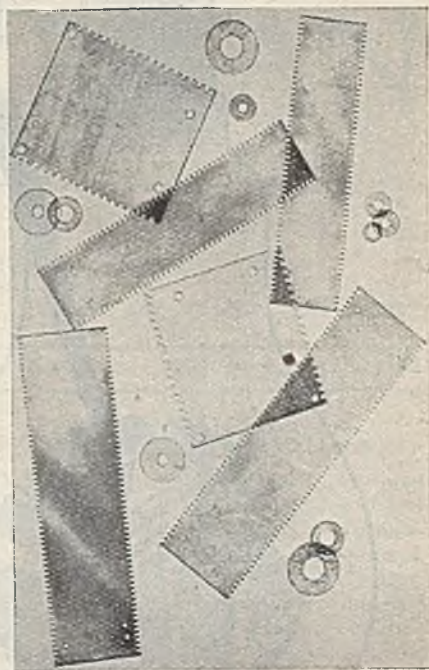
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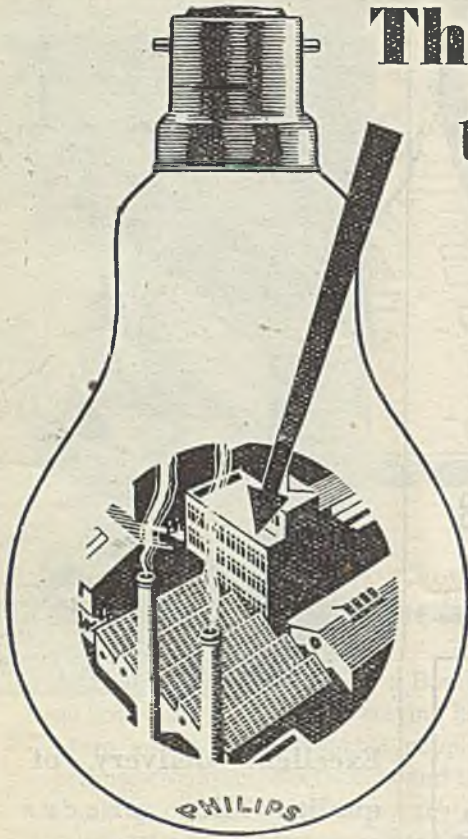
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Supply Statistics

THE resumption by the Electricity Commission of the publication of the annual returns of engineering and financial statistics relating to authorised undertakings in Great Britain, is a sign that conditions in the supply industry are slowly returning to normal, and has been made possible by the willing co-operation of all concerned.

It will be remembered that when the statistics became subject to censorship control in 1939, undertakings were requested to maintain their records, so that when the time came for their publication the continuity of the returns might not be broken. So well was this done that the Commissioners were able yesterday, Thursday, to publish a volume covering a period of five years, from the last return up to 1942/43.

Developments in the years covered by the statistics were encouraged on the one hand by war-time production of all forms of equipment and armaments, while on the other the extension of generating capacity to meet the increased demand for power was to all intents and purposes prohibited. Read in conjunction with the annual reports of the Central Electricity Board for the same period, the returns give therefore, some indication of the enormous contribution which the supply industry of this country made to the war effort, despite the fact that circumstances denied it the opportunity of increasing its plant capacity to that figure which

good engineering judgment warranted. Growth in the number of consumers was checked during the period under review by war-time restrictions applied to the domestic load, and the increase in unit sales as recorded elsewhere in this issue, was due therefore mainly to the demand for power which, when compared with 1938/39 increased by 81 per cent. Analysing the figures further shows that in 1942/43, power unit sales compared with 1941/42 increased by 2 633 million, while sales to domestic consumers decreased by 530 million—thus reflecting the effect of the fuel economy campaign at that time.

A War-Time Hang-over

THE aggregate generating plant available to the industry at the end of 1942/43 was 11 679 000 kW and the maximum load 10 081 000 kW, compared with 9 302 000 kW in 1938/39, indicating thereby how cramping upon the industry was the war-time policy of the Government and how justified was the Central Board in emphasising in the annual reports at the time, the probable results of such policy upon future electricity supplies. As enlightening as the statistics now published by the Commissioners may prove after careful study to be, their details concern the industry only up to the time when the all-out effort leading up to D-day was made, and the next volume, covering 1943 onwards, should therefore, be an even more valuable indication of what the future may hold, both with respect to growth in number of consumers and potential demand.

I.M.E.A. Convention, 1947

THE I.M.E.A. is not apparently allowing the nationalisation atmosphere to depress it, for we learn that consideration is being given to the venue for the convention next year, and that already, papers are being prepared by Mr. R. BIRT of Ealing, and Mr. F. W. LAWTON of Birmingham, covering respectively, the law relating to electricity supply, and recent developments in power station practice. A third paper, on the development and application of super-imposed current systems of controls, has also been suggested, though its author is not yet decided upon. It was the considered opinion of many at the convention at Blackpool last June, that, despite

the views expressed by Mr. E. SHINWELL at the Jubilee Dinner, the I.M.E.A. would, even in a nationalised industry, still be an active body in the promotion of the welfare of supply interests, and one gathers from the preparations being made for the next convention that the opinion has spread. This is all to the good for the association is rich in experience, and if the energy of its membership is to be coupled to the efforts of the Ministry of Fuel in exercising control over the industry, many of the pitfalls present in the Government policy may be shorn of some of their dangers, if they cannot be avoided altogether.

Future Copper Supplies

IN view of the industry's interest in the copper position, the comment last week by Lt.-Col. R. M. PRESTON, chairman of the Copper Development Association, on probable future supplies, warrants attention. Electrical developments are almost certain to require large and increasing tonnages, the provision of which will be aggravated by the fact that copper has now been accepted as a standard building material and is expected to remain so. Shipbuilding and the motor trade are other industries which make claims upon copper stocks when they exist, but since every ton of copper that is being produced in the world is going straight into production, they, like the electrical industry, face a future which for some years at least, must be expected to produce problems in copper supplies as embarrassing as those associated with lead. Development in Northern Rhodesia may in two or so years ease the position, but the desire of the production engineer, like that of the hungry man for bread to-day, must be satisfied now—and there's the rub.

Increasing Consumption of Copper

POINT to the remarks expressed above is given by the fact that copper consumption in this country rose in October to the highest level since the end of the war. With an increase of 2 700 tons to 31 976 tons, it reached nearly one and a half times the average monthly home consumption in 1935-38. Scrap consumption rose 4 660 tons to 17 916 tons. Month to month fluctuations must be expected, but if the overall trend follows the forecast that consumption will continue to increase steadily and remain

high for about two years, the Ministry of Supply will have difficulty in maintaining stocks. Net imports of unwrought copper in October amounted to 23 000 tons, which means that supplies, having risen from 73 100 tons in May to 94 700 tons in September, must now be on their way back to the neighbourhood of 85 000 tons.

New Street Lighting

IT will be remembered that an experimental street lighting installation using fluorescent tubes was described at the conference of the A.P.L.E. in September, and on Tuesday two practical examples of street lighting by this means were inspected, one in Old Bond Street and the other in Brompton Road, London. Installations of this type have been experimented with for some time but material shortages and the austerity conditions which prevail have made it difficult hitherto, to give practical application to the conclusions reached. The installations put into service on Tuesday, are perhaps the first large-scale street lighting developments the London public has seen since the days of war-time black-out and are, we hope, the first of many others which will take the place of bomb-damaged gas installations which have outlived their efficiency.

Nationalisation Proposals

THE power companies' expression of alarm at the proposal that the general and main transmission should be separated from the distribution side of the industry, should not go unnoticed, for what may be a main transmission line-to-day may at any time be utilised for distribution. If all main transmission lines were to be owned by a separate generating authority, then the distribution side of the industry would no longer be able to use a line in this way and would have to provide additional lines in consequence. In day-to-day working, co-operation between generating and distribution interests would become more difficult than at present and for reasons of security of supplies and safety of staff, an intricate procedure of safety precautions would be essential. It is reported that the Minister of Fuel will, early this month, meet all sections of the supply industry, when possibly the points raised above may be

discussed. Though they have been put forward by the companies as distinct from municipalities, the issues are the concern of both and should be so dealt with. It is not clear whether the meeting this month will result in the industry being presented with any details based on the proposed nationalisation Bill, or whether the purpose is to seek assistance in framing the Bill itself; either way, an opportunity should be sought for discussing the points which prompt this note, for no matter what form the industry may assume in the future the criticisms outlined will still need to be answered.

Production of Ceramics

AN announcement by Mr. J. WILMOT which may have caused some dismay in the ceramics industry, is that four Royal Ordnance factories are to make ceramics. One at Swynnerton has already started production, that at Poole is on the verge of starting and two others—at Glasgow and Cardiff—will be joining them shortly. Some months ago, when it was alleged that a bottleneck in ceramics was holding up the output of electrical appliances, leading manufacturers of ceramics, interviewed by a representative of *THE ELECTRICIAN*, were confident that they could keep pace with the housing programme if given the necessary labour, and were emphatic in their opinion that there was no real justification for the threatened entry of the Ministry of Supply into the production field.

Competition by the State

THE Minister has not yet suggested that the turning-over of Royal Ordnance factories to the manufacture of ceramics is a temporary expedient, and the prospect of State competition on such an extensive scale must, therefore, be disconcerting, if not alarming, to those manufacturers, who before the war, sent their products all over the world. If an increased output in ceramics be really necessary, surely, a better economy would be to make more labour and factory space available to those who have the advantage of technical knowledge and experience, than for the Ministry to start from scratch? As it is, the Ministry borrowed a trained nucleus from the industry, which may in the future have to struggle for survival against State-subsidised competition.

D.C. ARMATURE REACTION CHART

by O. H. HAHN, PH.D., M.SC.(ENG.)

IN d.c. generators possessing a drooping external characteristic, a knowledge of the demagnetising effect by armature reaction is of great importance since the latter assists in reducing the voltage as the load current rises. Such a case occurs, for instance, in regeneration in d.c. traction where an inherent drooping characteristic is required. In such machines with interpoles, only the cross-magnetising component of armature reaction need be considered. It can be determined by actual test or computed from the no-load saturation curve of the air-gap. For the latter, textbooks describe a graphical method and show how the armature-reaction must be compensated by increasing the excitation. This entails the measurement of areas and where a whole range of values is required involves a large amount of tedious work.

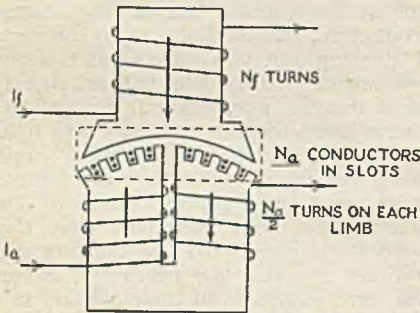


Fig. 1.—Armature conductors replaced by equivalent winding

The following method simplifies the process and is readily understood from Fig. 1.

That portion of the armature winding lying under a field pole shoe may be replaced by windings carried on two limbs each carrying the same current in opposite directions yielding the well known field distortion. It follows from the fundamental line integral of flux that each conductor in a slot is equivalent to one turn on one of the limbs.

In Fig. 2 the magnetisation curve of the gap is shown.

Let P_0 be the working point with no armature current passing. Inserting the additive and subtractive ampere-turns of the armature, points P_1 and P_2 are obtained. The de-magnetising effect of the armature is then represented by the difference in the areas $P_1 L_1 P_0$ and $P_0 L_2 P_2$. To simplify matters consider these areas as triangles and producing $P_1 P_0$ to L_3 , it follows that the shaded area $P_0 L_3 P_2$ represents the reduction by armature reaction. The equivalent

rectangular area is found by drawing $M_1 M_2$ such that $L_1 M_1 = \frac{P_2 L_3}{4}$. The horizontal distance between P_0 and P_m then gives

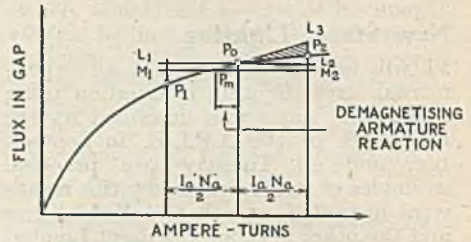


Fig. 2.—Simplified construction for determining de-magnetising effect of armature reaction

the armature reaction in field-weakening ampere-turns.

This method possesses the advantage of dispensing with the measurement of areas, it being merely necessary to measure a length while the accuracy is reasonable for practical purposes.

The armature current thus reacts on the field by establishing a flux which appears to have been caused by a lower field current.

By converting the armature reaction in the turns ratio it may be expressed as an equivalent de-magnetising field current. Repeating the above process for a number of values, a chart as in Fig. 3 can be constructed showing the effective field current in terms of the percentage rated currents for both armature

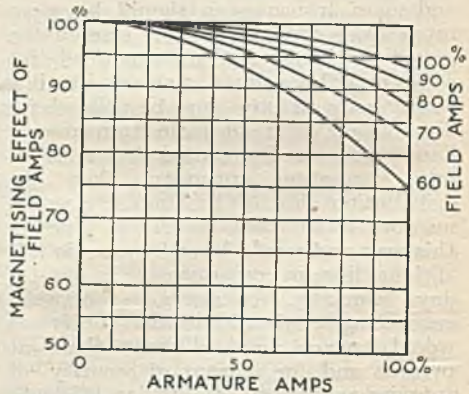


Fig. 3.—Magnetising effect of field current for various armature currents

and field, the figure actually referring to a typical traction motor for use in regenerative braking.

Electricity Supply Statistics

Commissioners' Report Covering Five Years' Working

WHEN the publication of the Electricity Commissioners' Annual Returns was suspended, on the outbreak of war, undertakers were requested, in order to maintain continuity in the main statistics relating to the electricity supply industry, to compile statistical records as fully as circumstances permitted.

As a first step towards publishing the information collected, the Commissioners have concentrated on the compilation of a statistical volume covering a period of five years from the last public return. The volume just issued deals with the activities of all authorised undertakers holding statutory powers of supply at the termination of each of the five years 1938-39 to 1942-43. The particulars relating to the operations of individual undertakers cover the year ending December 31, in the case of companies, joint electricity authorities and the Central Electricity Board; and the year ending March 31, in the case of local authorities and joint boards in England and Wales. The annual statements for most of the Scottish local authorities are compiled up to May 15.

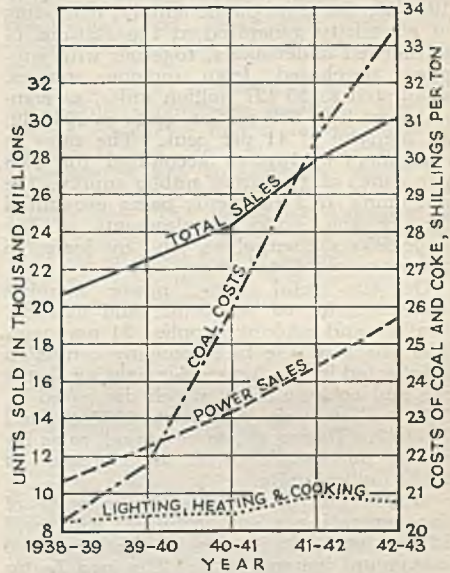
During the year 1938-39, there was a net increase of 755 000 (8 per cent.) in the number of consumers connected to public supply systems, and the total number of consumers by the end of that year was 10 113 000. At the end of 1942-43, there were 10 688 000 consumers, representing an average annual increase of 144 000 during the ensuing four years.

The growth of war industry during the first years of the war is shown by the figures for power sales, which rose 81 per cent. in the five years period, from 10 757 million units to 19 434 million units. During the same period, domestic sales, for cooking, heating and lighting, rose only 12 per cent., from 8 438 million to 9 447 units. Total sales to consumers of all classes were 20 827 964 million units in 1938-39, and by 1940-41 had risen to 24 312 015 million units. The sales during 1942-43 were 30 049 194 million units. This is equivalent to a percentage increase of 44 per cent. over the whole period of five years.

At the end of 1942-43, there were 575 authorised undertakers holding supply powers, inclusive of the C.E.B., of whom 571 were affording supplies. Of the total supply of electricity by authorised undertakers, about 60 per cent. was provided by public authorities and about 40 per cent. by companies.

Authorised undertakers owned, or leased,

at the end of 1942-43, 365 generating stations, containing in aggregate 11 679 000 kW of generating plant, of which 11 457 000 kW presented a.c. plant. These stations ranged from a minimum of 20 kW installed to a maximum of 541 500 kW. There were 16 stations of over 150 000 kW



The curves above show the rise in power sales brought about by the expansion of war industry. The effect of fuel economy campaigns is reflected in the very slight increase in domestic sales.

capacity, of which nine were operated by public authorities, and 110 stations (30.1 per cent. of the total) with an installed capacity greater than 25 000 kW. These contained 10 432 000 kW of generating plant, or 89.3 per cent. of the total plant installed. Public authorities operated 205 of the total of 365 generating stations.

The rated evaporative capacity of boiler plant at the end of 1942-43 was 129 817 805 lbs. per hour, against 99 528 345 lbs. per hour in 1937-38. Of these totals, about 65 per cent. was in stations operated by public supply authorities.

The report shows that, in 1942-43, a.c. supplies were being given by 552 undertakers, while 241 were giving both a.c. and

d.c. and 17 d.c. only. Of a total of 552 undertakers considered, 550 were giving a.c. supplies at standard frequency.

Supply voltages showed a majority at 230 V, from 454 undertakers, and 400 V, from 453. On the new standard voltage of 240 V, only 52 undertakers, consisting of 32 public authorities and 20 companies, were giving supplies in 1942-43, while there remained 16 undertakers working at 100 V and 92 at between 200 V and 220 V.

INCREASED SALES

Turning to the consumption of electricity, the report states that in the year 1942-43, the gross public supply, consisting of electricity generated at the stations of authorised undertakers, together with supplies purchased from outside sources, amounted to 35 437 million units, as compared with 25 059 million units in 1938-39, an increase of 41 per cent. The sales to consumers in 1942-43 accounted for 84.8 per cent. of the gross public supply, the remaining 15.2 per cent. being accounted for by the works requirements of the undertakers themselves, and by losses in transmission, distribution, etc.

Of the total sales, power supplies accounted for 65 per cent., and lighting, heating and cooking supplies 31 per cent. The effect of the fuel economy campaign is reflected in the figures for lighting, heating and cooking sales, which decreased by 530 million units between 1941-42 and 1942-43. During the same period, sales for power purposes showed an increase of 2 633 million units.

At the end of 1942-43, the capacity of the generating plant installed was still 22 per cent. in excess of the combined maximum demand on it. The load factor of the generating stations of public authorities and companies taken collectively was of the order of 42.2 per cent., as compared with 35.4 per cent. in 1938-39.

RISING FUEL COSTS

During the five years from 1938-39 to 1942-43, the average costs of coal and coke (including costs of handling, preparation and ash disposal) were 20s. 4d., 21s. 9d., 25s. 11d., 30s. 5d., and 33s. 6d. per ton, while over the same period the cost of oil fuel rose from 105s. 1d. to 199s. 2d. per ton. In the same years, the average revenues per unit sold were: 1.040d., 1.009d., 1.033d., 1.034d. and 1.010d. In 1942-43, the average revenue per unit for different classes of supply was: 1.640d., for lighting, heating and cooking, 0.718d., for power, 4.109d., for public lighting, and 0.728d. for traction sales. At the same time, the average cost per unit generated rose from 0.189d., in 1938-39, to 0.291d., in 1942-43.

The net total revenue of authorised

undertakers from the working of their undertakings (exclusive of all sales of electricity in bulk) rose from £98 626 000 to £134 551 000, while in the same period working expenses rose from £54 110 000 to £82 191 000. The working expenses in 1942-43 absorbed 61.1 per cent. of the revenue from working, against 54.9 per cent. in 1938-39. The works cost of generation accounted for 52 per cent. of the total working expenses in 1942-43, compared with 36 per cent. in 1938-39, and the average working expenses per £100 of total capital expenditure by the supply industry grew from £8.3 to £11.0.

Of a total of 115 undertakers who obtained an average revenue per unit sold, for lighting, heating and cooking supplies, of under 1.5d., 108 were public authorities, while of 173 who obtained more than 1.5d. and less than 2d., 136 were public authorities. In power supply sales, 64 local authorities were among the 82 undertakers who obtained less than 0.75d., and 101 were among the 119 undertakers who received more than 0.75d. and less than 1d. Lighting, heating and cooking supplies, for which the average revenue was over 2d. per unit, were given by 119 public authorities and 152 companies. Power supplies at over 1½d. per unit came from 60 public authorities and 68 companies.

LESS FOR RATE RELIEF

The excess of revenue from working over working expenses, together with revenue from other sources, provided a gross surplus in 1942-43 of £55 440 000, representing about 7.4 per cent. of the total capital expenditure at the end of the year, as compared with 7.3 per cent. for 1938-39. In the case of public authorities, the gross surplus in 1942-43 was appropriated to the extent of 28.6 per cent. for interest charges on loans and deposits, 55.7 per cent. for loan repayments, etc., 10.2 per cent. for income, 5 per cent. for special expenditure and 0.3 per cent. for relief in local rates, the latter item representing a net contribution of about £79 000, as compared with £644 000 in 1938-39. The gross surplus of the company undertakers was appropriated to the extent of 42.5 per cent. for interest charges and dividends, 41.9 per cent. for transfers to depreciation and reserve funds, and 12.6 per cent. for income tax. The average rates of preference and ordinary dividends at the end of 1942 were 5.48 per cent. and 6.95 per cent. respectively.

The number of staff in regular employment fell from 109 000 at the end of 1938-39 to about 90 000 at the end of 1942-43. In the same period, total salaries and wages charged to revenue account rose from £17 958 000 to £23 456 000.

MODERN SWITCHGEAR

by R. N. BUTTREY, M.Sc.TECH., A.M.I.E.E.

IN this Part V of the series,* consideration is given to high-power current carrying contacts, as distinct from relay, auxiliary contacts, etc.

The types of contacts employed in switchgear construction may be classified according to the following functions:—
1. Permanent; 2. Off-load isolating; and
3. On-load isolating, including circuit-breaker arcing contacts, etc.

Permanent Contacts.—The achievement of satisfactory permanent electrical contact, involving the application of considerable pressure between the contact parts or faces, by means of direct bolting or by special clamps, is dependent upon the effective number of contact points, mechanical pressure per point, disposition of contact points (effecting distribution of current entering and leaving the contact) and preparation of contact surfaces. In explaining the above reference to "contact points" it must be realised that contact between two faces (unless metallically fused together by brazing or sweating) consists, effectively of a number of points; the number of points depends upon the method of application of the pressure, i.e., magnitude and distribution of pressure.

The electrical resistance of a contact includes the resistance across the contact proper plus resistance in the region of the contact due to "streamline effect," i.e., the streamline of the current paths towards the individual contact points. Hence whilst the resistance of the contact at the points of making is approximately independent of the number of points, and dependent only upon the total mechanical pressure, the overall effective current resistance takes into account the current distribution in the region of the contact, so that the total resistance is a function of the disposition and number of contact points made. This fact has been investigated¹ with reference to overlapping joints to determine the effect of the amount of overlap on current distribution.

Current distribution at the contact is also of great importance in the operation of heavy short-circuit current arcing contacts where, in order to prevent welding during current making, there is a limitation on the value of current per point, irrespective of contact pressure. Empirical data and theoretical considerations of con-

tact resistance as a function of pressure, effective resistance of streamline, etc., are published elsewhere^{1, 2, 3} and are, therefore, not reproduced here.

It is often of advantage to design contact clamping arrangements which provide for a specified number of points or lines (a contact line consisting essentially of a number of points) so that the current distribution at the contact may be predetermined and consistently maintained independently of the total mechanical pressure.

Fig. 1 shows a clamping arrangement for making connections between a circular section conductor and a busbar, also of circular section. In this arrangement, two independent line contacts are made between the conductor and each side of the busbar run. The diametrical thickness of the conductor also serves as a connection between adjacent busbar sections. In this type of connection, it will be seen that there are no intermediate connections such

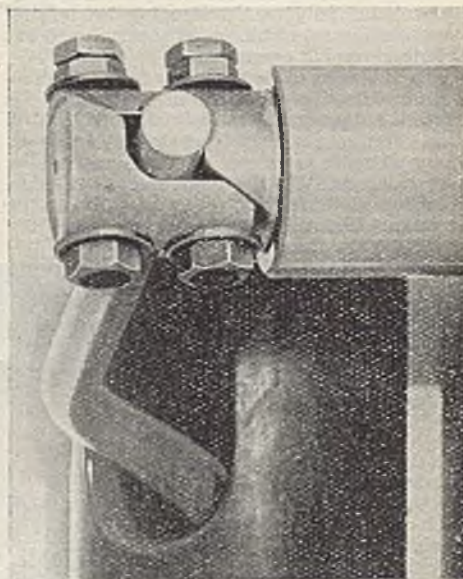


Fig. 1.—Clamping of circular section connection to tubular busbar

as screwed or sweated clamps which, in themselves, tend to produce additional losses. For great lengths of switchboard, and particularly with compound filled busbars, special flexible connections between busbar sections are necessary to allow for

* Parts I, II, III and IV of this series appeared in THE ELECTRICIAN of July 25, August 16, September 27 and October 25, respectively.

expansion. In the design of such connections, the current distribution in the busbar is maintained as far as possible through the connections, usually by means of a number of flexible elements. The same principle of pre-determining the cur-



Fig. 2.—Typical isolating sockets; (a) 400 A; (b) 800 A

rent distribution at a joint is followed in the well-known silver wire line contact in hinged isolator blade assemblies.

Preparation of Contact Surfaces.—The treatment of surfaces against oxidation,² formation of sulphides or other surface contaminations consists normally of tin plating, although for heavy current work silver plating, by reason of its high conductivity, is employed. Contact between untreated copper surfaces is made by previously cleaning the surfaces, coating with petroleum jelly, and clamping or bolting together, the petroleum jelly serving to exclude corrosive agents.

In the case of connections to aluminium conductors, special precautions must be taken to prevent electrolytic corrosion if the contact surfaces are liable to be in contact with moisture. Aluminium is also more effected by the development of high resistance oxide films than in the case of copper. In the case of connections for outdoor application bi-metal contact faces are usually fitted to overcome electrolytic troubles.

Off-load Isolating Contacts.

—The operation of a non-permanent contact requires a design to obtain the maximum current carrying capacity per unit mechanical loading in order to avoid the need for excessive operating forces. As in the case of the permanent contact, there is a definite limitation on the current which can be passed per point contact, each point in this case being considered as a mechanically independent member of the contact. For example, in the plug and tulip type of contact, a single point contact per segment would normally be obtained, since, for reasons of operation, only a moderate

pressure per segment would be permissible. Repeated operations, producing "bedding-in," will tend to improve the current distribution in such a contact. Allowing for a maximum current per point of 300-400 A, a typical value of current which can be carried per lb. mechanical loading is about 10 A. Hence, a four-segment tulip with a mechanical loadings of 40 lbs. per segment would be expected to carry a maximum current of 1 600 A in air, assuming the sections of the current carrying parts to be adequate

for this current. Specific current loadings in excess of this will tend to produce oxidation at the point of contact, resulting in cumulative deterioration of the contact. An additional hazard, in the case of isolating contacts, is that the operation of withdrawal and re-making contact may be comparatively infrequent so that the cleaning action which would be associated with switch or circuit-breaker contacts is absent. For this reason, it is becoming customary to silver plate the surfaces of all such contacts.

It is not considered that there is any appreciable difference in the current carrying capacity of contacts in air or under oil since, whilst in the latter case additional cooling is obtained, there is, however, introduced the factor of tarnishing and scale-forming due to possible acidity and moisture content of the oil.

The problem of short-circuit current

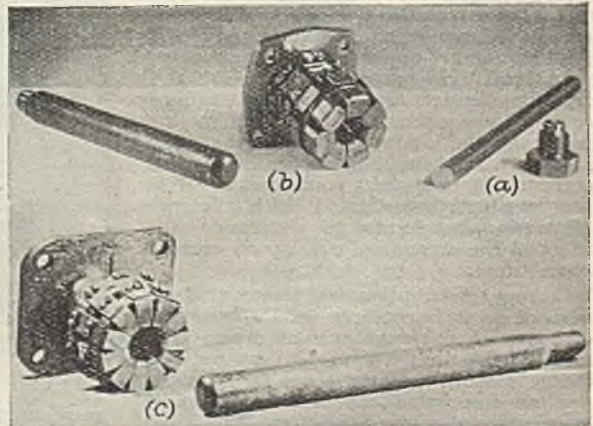


Fig. 3.—Typical circuit-breaker contacts; (a) 150 MVA, 11 kV; (b) 250 MVA, 11 kV; (c) 1 000 MVA, 11 kV. Type (a) is a full contact, while (b) and (c) are classed as high initial pressure segmental tulip contacts

carrying for isolating contacts is a factor which must be taken into consideration. For such contacts it is generally desirable that short-circuit forces shall tend to increase the contact pressure and in no case must the effect of short-circuit currents be to distort the contact in any way detrimental to its current carrying capacity.

Fig. 2 shows two types of isolating contacts employed with a withdrawable circuit-breaker, one consisting of a split tubular socket, contact pressure being applied by means of garter springs, and the other of a multi-segmental socket, each segment being fitted with its individual compression spring. Both these contacts undergo a considerable increase in mechanical pressure under the influence of heavy short-circuit currents.

On-load Isolating Contacts.—For contacts under this category, the additional duty of making and breaking heavy short-circuit currents is introduced. The functions of these contacts may be classified separately as follows:

1. The contact may carry normal current without deterioration.
2. The contact must be capable of making the maximum short-circuit current without welding or undue burning.
3. The contact must be capable of breaking the maximum short-circuit current without welding or undue burning.
4. The contact must be capable of carrying the maximum r.m.s. short-circuit current for the rated time durations of 1 sec., 2 secs., or 5 secs.
5. After short-circuit operations in accordance with B.S. 116/1937, Clause 98, the contact must still be in a condition to carry normal full load current.

Requirements to satisfy the above individual conditions are mostly related with the exception that control of the deterioration of the contact during breaking operations is generally a function of the amount of metal (arcing tips) provided at the points of arcing of the contacts.

The making capacity of a contact is a function of contact pressure, number of points of contact, and the particular design of the contact assembly to permit release of products of initial arcing, i.e., "ventilation." It has been found that a single point of contact will make on initial peak currents up to about 25 kA, requiring mechanical pressures of between 1 and 2 lb. per kA. For currents greater than this, additional points of contact would be required, effectively obtained by increasing the number of "segments" of the contact, the specific current loading per unit mechanical pressure being maintained

constant. Since these requirements are in existence on making contact, then the contact pressure must attain immediately contact is made, which introduces the well known "initial pressure" contact in which the segments are retained against their maximum spring loading until the opposite member engages. High speed of contact make, in order to reduce pre-arcing energy to a minimum, requires that the contact entry shall be "sharp," i.e., not tapered or streamlined. Wedge and finger type contacts in which the fingers are at an angle and considerable engagement of the contact takes place before the arc is struck results in excessive burning of the contact faces.

The requirements of satisfactory opening of a contact under short-circuit conditions necessitates a "balanced" electro-magnetic design in the case of tulip contacts, whilst the butt type contact may be permitted to increase the contact pressure under the action of electro-magnetic forces. The chief disadvantage of the butt type contact is that, for a small compression of, say, $\frac{1}{2}$ in., accurate setting and maintenance of the total contact movement is necessary.

For on-load isolating and circuit-breaker contacts, materials usually employed are copper, brass, bronze, etc. Special conditions involving frequent operation under heavy overload introduces the use of arcing tips of a high melting point material such as tungsten, copper tungsten alloys, etc. These are fitted to the main contact members by bolting, silver soldering, etc. Contacts which are not intended to interrupt current such as auxiliary main contacts on circuit-breakers may be classified as off-load isolating contacts, although they must be of a balanced electro-magnetic design to permit opening and closing under the conditions of maximum short-circuit current. Fig. 3 illustrates some typical circuit-breaker contacts for short-circuit currents ranging from 10 kA r.m.s. to 66 kA r.m.s.

Manufacturers who will have stands at the Welsh Industries Fair, to be held at the Royal Horticultural Hall, Westminster, from January 1 to 7, will include the following: South Wales Switchgear, Ltd. Treforest Trading Estate, Pontypridd, Glam., and Blackwood, Mon. (h.t. switchgear, transformers, electric washboilers, cookers, immersion heaters and house service panels); Santon, Ltd., Somerton Works, Newport, Mon. (electric water heaters and rotary switches); Thorn Electrical Industries, Ltd., 105/109, Judd Street, London, W.C.2 (electric lamps, irons and vacuum cleaners).

1. Melson, S.W., and H. C. Booth—"The Efficiency of Overlapping Joints." *J.I.E.E.* Vol. 60, 1922, p. 889.
 2. G. E. Luke—*Elec. Journal*, Vol. 21, 1924, p. 66.
 3. C.D.A. Publication, No. 22, 1937.

OVERHEAD LINES

by THEODORE RICH, O.B.E., A.M.I.E.E.



Dead-end tower at River Po crossing of 230 kV power line in Italy. The overall height of the tower is 30 m., and at the conductors 22 m. The weight of the tower is 8 400 kg.

THE papers in the section dealing with overhead line construction at the recent International High Tension Conference in Paris, tended to show that in general, certain principles had been accepted, and below is given a resumé of the various conclusions reached or discussed, together with details of some of the equipment used. As illustrations to the article are reproduced a number of examples of Italian technique, and these show in some cases interesting originality.

F. Bianchi di Castelbianco, of Milan, gave some details of steel tower constructions developed in Italy since 1937. At that time it was decided to make drastic reductions in the weight of the steelwork. This movement was accentuated by wartime supply restrictions, but the results have been so satisfactory that the new types will continue to be used even when supply facilities return to normal. In the face of Allied raids, damage by Germans and sundry sabotage incidents, the new system of towers has come out very favourably.

The main factors in the construction lies in the use of structural steel with a higher tensile strength and yield point. With appropriate design the higher stresses can be adopted for compression members as well as those under tension. To get the greatest benefit out of high yield point steel it is necessary to give special attention to the compression members and reduce the "slenderness ratio."

Tubular sections are very useful in compression and to balance the usual extra costs of such sections, cheap welded tubes are used; by limiting their use to the more slender members, the weight gain

becomes the greater, and the cost objection is overcome.

By the use of a special technique of arc-welding, weight reduction, etc., lowering of the fabrication costs has been attained, the use of joint plates and bolts has been reduced to a minimum, and the special points of stress have been simplified.

It has been possible to keep down the sections of members by adhering closely to the factors of design; all the newer types of towers have been tested, some to destruction, with satisfactory results. Towers of the mast design are lighter and more slender than formerly. The towers for horizontally arranged conductors, known in Italy as Delta towers, have similarity to some of American type. The use of redundant members has been avoided.

As a result of the application of the foregoing principles, the weight reductions have been in the neighbourhood of 50 per cent. The monetary gain regarding the towers themselves amounts to about 20 per cent., but when haulage, erection, and painting are allowed for, the benefit is about 30 per cent. Suitable stress values have been adopted for high yield-point steel, and for the tubular members, thicknesses of half the normal minima have been allowed for the tubular sections, as compared with the use of normal steel sections.

The towers of different types have narrow bases, which enables economic foundations to be adopted. The foundation designs were framed to make the maximum use of the earth weight and earth thrust; the foundations themselves are reduced to mere skeletons to carry the tower stresses to the earth.

It can be said that the primary object of a transmission tower structure, is to keep the conductors off the ground with a certain minimum clearance, to keep them a certain minimum distance apart consistent with the voltage of the system, and to stand up against the stresses due to storms, sleet and snow, which in mountainous Italy can be expected to affect the structure or the line that it supports.

One would judge that the new Italian system of construction will fulfil its objects very well. Owing to the much more difficult climatic conditions in the U.K., as affecting corrosion, it is doubtful whether such light dispersed bracing members would be economical with us. In the discussion on the various papers relating to line construction, it was said that with wood poles which had been used successfully for lines of 60, 110 and 220 kV lines, very rapid construction was possible. With the aid of a metallic platform connected to the conductor, repairs could be carried out while the line was under tension.

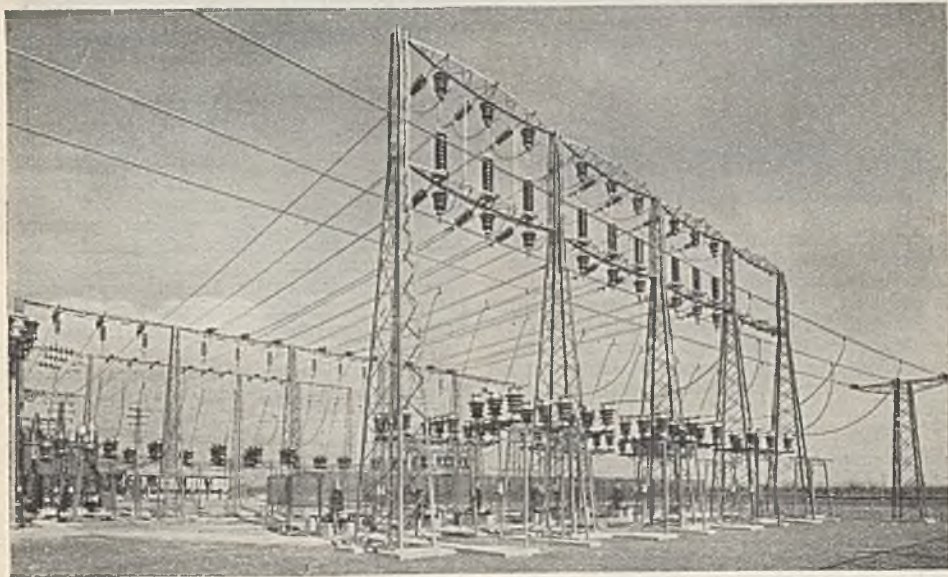
Before the war, the question of wind pressures was the subject of study in Belgium, as was also that of pole stability. During the war, despite the difficulties and troubles of the time, a special committee was formed by the Société Intercommunale Belge d'Electricité with the support of the Fonds National de la Recherche Scientifique de Belgique, to study the question of pole foundations, M. Ramelot being the President. Prof. Vandepenn of the Brussels University was

appointed the director of research, with the assistance of four other engineers.

It is not always realised that the cost of foundations is about 20 per cent. of that of completed lines, so the question is one of material importance, and although the studies are still in progress some interesting conclusions have been arrived at. While numerous efforts have been made to solve the problem of the stability of pole foundations, yet the methods of calculation have remained conventional and if tower foundations have been stable it is because the effective stability factor has been over-rated.

There are two uncertain factors, one being the distribution of horizontal pressure exerted by the ground on a prismatic foundation embedded vertically and subject to an overturning movement. Some assume a triangle distribution of pressure, others one which is parabolic, and formulae have been used covering these contradictory hypotheses. As the result of tests in Belgium, it is considered that neither of these corresponds to practice, the values assumed for the overturning moment being six times too small on an average.

To account for this state of affairs, about the time of the birth and development of electric power networks, the theory of the resistance of retaining walls had been formulated and this theory was relied upon by those who were newcomers to civil engineering. The retaining wall theory assumes resistance to the



Arrangement of a 75 kV sub-station frame at Parabiago, near Milan

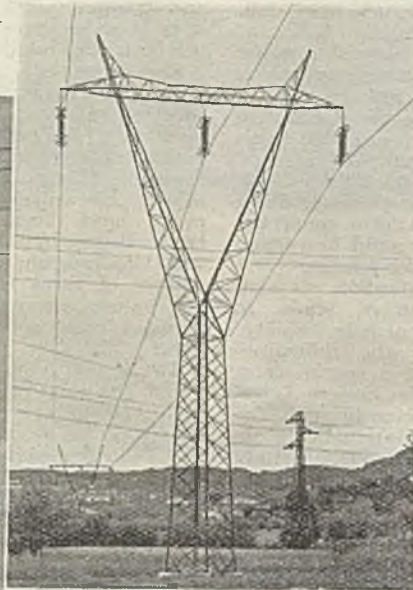
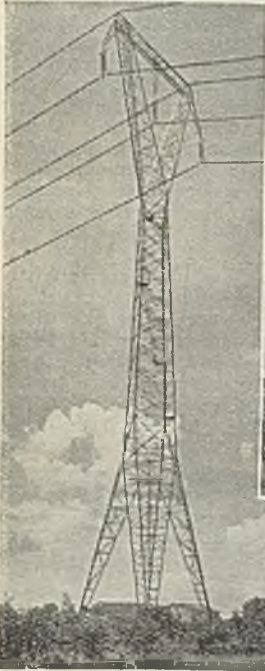
pressure of a granular mass devoid of cohesion, while in actual fact the mass is almost invariably formed of cohesive earth carefully rammed in the filling; this current theory is valid and corresponds to practical conditions if the earth is strictly granular; this is not even approximately the case in principles relating to pole foundations.

The other uncertain factor relates to foundations of the buried platform type;

tion to the former. In view of the number who have made investigations in the past, and the paucity of results noted we must conclude that there is not enough fundamental knowledge regarding the phenomena involved.

In view of the numerous tests required it was decided to undertake tests on models, and to that end a bench was constructed in the laboratory of the society at Malines.

Special suspension tower at River Po crossing of 230 kV power line in Italy. The span is 980 m.



Suspension tower for 130 kV power line in the Italian System. The ruling span is 250 m, the weight of the normal tower 1 250 kg.

it is the question as to the volume of earth which by bearing down on the platform contributes to the stability of the foundation. Some, by taking into account the angle of slope, over estimate the volume of earth on the platform; others do not allow for this favourable factor, and nobody seems to know the precise state of affairs.

No real progress can be made regarding foundations in natural cohesive earth until improvements have been made in calculations relating to those in cohesionless granular earth. It was decided, therefore, to start experimental work with the former material and then to deal with the latter, and to deduce the connection factors that the latter made necessary for the applica-

tion to the former. With laid foundations the pressure from below provides the stability; with the fourth type, with attached platforms, steps are formed, and the stability due to the earth loading is determined.

With models with rectangular or circular foundations it is found that the overturning moment is proportional to the cube of the depth of bedding. With the theoretical hypothesis of absolute plasticity, with uniformly distributed pressure along the depth of bedding, the overturning moment would be proportional to the square of the depth of bedding. Tests are in progress with laid foundations possessing different eccentricities of loading.

Up to the present tests have been carried out on foundations with a horizontal base of square or rectangular section, stressed to overturning. The models had the following shapes: vertical prisms embedded to different depths, horizontal platforms laid on the surface of the ground and vertical prisms attached to larger platforms.

Where the depth of bedding is great enough relatively to the transverse dimensions, the models cover buried foundations where the stability is provided almost entirely by the horizontal pressure or thrust of the rammed earth.

Where the depth of bedding does not exceed two or three times the transverse dimensions we get "block" foundations where the stability comes from the lateral thrust of the rammed earth combined with the vertical pressure

under the base. With laid foundations the pressure from below provides the stability; with the fourth type, with attached platforms, steps are formed, and the stability due to the earth loading is determined.

With models with rectangular or circular foundations it is found that the overturning moment is proportional to the cube of the depth of bedding. With the theoretical hypothesis of absolute plasticity, with uniformly distributed pressure along the depth of bedding, the overturning moment would be proportional to the square of the depth of bedding. Tests are in progress with laid foundations possessing different eccentricities of loading.

FLUORESCENT STREET LIGHTING

EXPERIMENTAL INSTALLATIONS IN TWO LONDON HIGHWAYS

TWO interesting applications of low-voltage fluorescent tubes to street lighting were demonstrated, on Tuesday night, when, at the invitation of Central London Electricity, Ltd., a representative of *THE ELECTRICIAN* inspected their installations in Old Bond Street and Brompton Road.

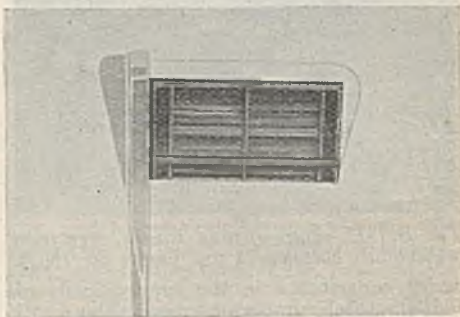
Believing that tungsten lighting had been developed to its scientific limit before the war, and that the high-pressure type of discharge lamp, with its monochromatic light, was unsuitable for shopping centres where a high intensity, combined with accurate colour rendering, was required, the B.T.H. and G.E.C. were invited to design street lighting fixtures employing 80 W, 5 ft. fluorescent tubes.

Preliminary tests were carried out by both companies to ensure that the life of the tubes would be unaffected by heavy traffic vibrations, and that performance would not materially suffer as a result of cold-weather conditions.

The Old Bond Street installation, by the B.T.H. Co., was described in *THE ELECTRICIAN* of September 13 and 27 last. The lanterns, slung on catenary wires 25 ft. above the centre of the roadway, are spaced at intervals of 80 ft. Inside each, three "warm-white" tubes are

traversing gear, arranged to pull the fittings along the catenary wires to the side of the road, permits safe maintenance even under heavy traffic conditions.

Eight lanterns are employed, giving a light output of 8 550 lumens per 100 ft. of road, with a combined power consumption of 2 400 W. This compares very



One of the G.E.C. seven-tube lanterns, as used in Brompton Road

favourably with the "economy" lighting which the new installation supersedes, with a consumption of 2 250 W, and gives a lighting of appreciably better quality than the pre-war installation, which was rated at 3 750 W.

The Brompton Road installation, designed by the G.E.C., has involved far more constructional work, since the lanterns are larger and are mounted on concrete poles. The lighting has been installed on a 220 yard stretch of double-carriage roadway, and "daylight" tubes are employed throughout. Ten lanterns, mounted at a height of 30 ft., provide about 25 000 lumens per 100 ft. of road, with a total consumption of 6 300 W. Four of the concrete columns, each with one lantern, are sited on the outer curbs and three more columns, carrying a pair of lanterns mounted one over each carriageway, are erected on the traffic islands.

Once again, the inverted triangle construction is used, with seven tubes in each fitting, each with a curved and polished reflector. The lanterns are constructed almost entirely of light alloys and are glazed with sliding Perspex panels. Although there would be ample room within the body of each lantern for the necessary control gear, this has been



Night view of the Brompton Road installation giving 25 000 lumens per 100 ft. of road

arranged in the form of an inverted triangle, to give controlled cut-off distribution in a suitable form, and for "half-night" lighting, a serviceable degree of illumination is obtained from the tube at the bottom of the "V" alone. Chokes, suppression condensers and thermal-type starter switches are housed within the body of the fitting. A simple

mounted, at pavement level, within the bases of the columns.

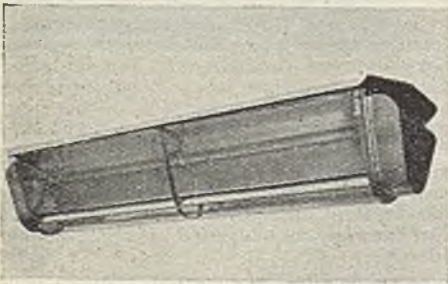
The circuits employ glow-type starter switches and flat, untapped chokes which introduce a power loss of only 10 W per lamp. No other unusual features are incorporated, beyond the employment of



The B.T.H. centre-of-road scheme, seen from a Piccadilly balcony—8 500 lumens per 100 ft.

series capacitance in the supply leads of half the total number of tubes. This gives a power factor, over the whole installation, approaching unity, and reduces, to an extent, the tendency to stroboscopic flicker. "Half-night" switches are provided, which switch out individual tubes on the basis of three and four in alternate lanterns, thus preserving the evenness of the illumination.

The impression gained from a view of the two installations is that both represent a considerable advance, at least from the standpoint of the pedestrian and driver, on existing forms of lighting. The obvious advantages are freedom from glare,



The B.T.H. fitting, as used in Old Bond Street

occasioned by the relatively low surface brightness of individual tubes, the close approximation, in colour quality, to normal daylight, and a considerable reduction of "dazzle" reflections from wet road surfaces. It was admitted, however,

by one of the engineers responsible, that the comparatively high replacement cost, as compared with high-pressure discharge lamps, was likely to confine the use of fluorescent lighting of the hot-cathode type to busy shopping centres, at least for the present.

During the winter months, both the supply company and the manufacturers intend to carry out extensive tests with the provisional installations. The view taken by Central London Electricity, Ltd., is that, although further experience has yet to be gained in the application of the fluorescent lamp to street lighting, there can be no doubt that, in principle, the system has come to stay.

Post-War Economy

AT a meeting of the N.W. Centre of the I.E.E., on November 26, Messrs. G. L. E. Metz, and R. L. Davies gave a reading of their paper, "The Electrical Engineering Industry in the Post-War Economy." The two questions implicit in the paper, which has already been published in the institution's Journal, are: (1) how is the electrical industry (i.e., the manufacturing side) going to resolve the two conflicting demands of the home and export markets? and (2) how can it build up an effective export trade which is urgently needed to serve the national economy?

The discussion which followed showed that those present had not yet come to any workable agreement on the solution to the problems. Among the many points made by speakers were the serious fall in the intake rate of apprentices envisaged on the raising of the school-leaving age, and the adoption of conscription; a plea for co-operation in trade instead of competition; that the industry should export only those goods requiring a minimum of imported raw materials for their production; the need for co-operative market research; that industries being set up in the development areas should be given over to new industries and not established ones. One speaker stressed the need for more engineers to be employed at the design stages.

The prevailing mood of most of the speakers was that the present flood of orders was an unhealthy state of affairs resulting from the war, and the industry was unable to orientate itself in this atmosphere; that statistics could create an optimistic or pessimistic view depending on the way one interpreted them; the need for maintaining the high quality of British products; and the view that more concrete facts and relevant statistics were required before any kind of long-term policy could be formulated.

Electricity and Building

Importance of Wiring for Future Needs

THAT the achievement of full domestic electrification in the future depended, to a great extent, upon the provision of adequate circuit facilities in the homes being built to-day was one of the main themes of a well-attended conference, held at the Connaught Rooms, London, on Monday. The occasion was a meeting of representatives of the building industry, sponsored by the S.E. and Eastern Area branch of the Electrical Development Association.

Mr. G. P. Dixon, chairman of the Eastern Committee, E.D.A., opened the conference by saying that in the present hurry to get the maximum number of houses built there was a danger that the necessity for a complete electrical installation might be overlooked. In the absence of a planned use of electricity, there was bound to be extra cost, and it was dangerous to leave the wiring work to unskilled contractors. Good installation work required long experience, and builders would be advised to seek the help of their local undertakings.

The electrical work in a house, Mr. Dixon said, should be part of the structure itself. Plumbing could be considerably simplified by the employment of electric water heating.

An address on "The Influence of Electricity on Building Design and Construction" was then delivered by Mr. A. L. Osborne, who began by referring to the mediocre supplies of equipment at present available. In view of current shortages of cable, those who planned housing sites without first ascertaining what supplies of electricity were available were likely to meet considerable difficulties.

HOUSE SERVICE UNIT

The E.D.A. house service unit, Mr. Osborne said, would considerably improve the appearance of an installation, but it should be placed in a position where the consumer and the coin collector could easily reach it. The maximum economy of street cable was effected if the unit were placed in the front of the house, but internal wiring was simplified when it was near the kitchen. A compromise had been reached, and the official recommendation was to put it below the stairs. If supplies of the unit were not available for new housing, the same layout should be followed, so that the components could be installed, with the minimum of alteration, later.

After describing some of the advantages of electric water heaters, and saying that, as time went on, it might be necessary to do without solid fuel heating altogether, Mr. Osborne emphasised the importance of getting skilled advice before immersion heaters were installed in existing water tanks. Lack of attention to points of detail, such as the position of the element in the tank, the position of the tank itself, and the design of pipework, could seriously increase water-heating costs.

PLEA FOR CO-OPERATION

Mr. Osborne then mentioned the desirability of a satisfactory entry channel for the supply cable, and the advantages of good thermal insulation of floors and ceilings, and he concluded with a plea for co-operation between architects, builders, electrical contractors and the local supply authorities.

In the discussion which followed, keen interest was shown in the ring main circuit, and questions were asked about the feasibility of multiple ring mains where the domestic load was likely to be heavy. The advantage of using powered building tools at low voltages was also the subject of questions.

After luncheon, Mr. V. W. Dale, general manager and secretary, E.D.A., made a short speech, in which he said that the purpose of his association was to instruct all types of consumer in the uses of electricity. Together, the building and electricity supply industries could contribute timely and much needed service to the public.

The report of the Simon Committee, Mr. Dale thought, had laid too much emphasis on the use of solid fuel, and it had raised several points that the supply industry could not afford to ignore. A challenge had been prepared, and would be issued in a few days.

If builders would get in touch with their supply authorities at the planning stages of their work, many problems could be overcome. The suggestion had been made, Mr. Dale concluded, that architects, builders and electrical engineers should meet together shortly. That, he thought, would be a very profitable conference.

The conference ended with the showing of three short E.D.A. films, among which "Their Invisible Inheritance" illustrated the importance of planned installation work, with a generous quota of socket points, in new housing schemes.

Architects and Electricity

Northern Counties E.D.A. Conference at Newcastle

THE seed for future co-operation between architects and the electrical industry in the design of new buildings was sown at a conference for architects at Newcastle-on-Tyne on November 28, arranged by the Northern Counties of the British Electrical Development Association.

Following a luncheon at the Royal Station Hotel, Mr. A. L. Osborne delivered an address on "Electricity and the Architect," based on his experience of the electrical industry in an advisory capacity for about 12 years.

ELECTRICITY IS CHEAP

Opening the proceedings, Mr. T. E. Daniel, borough electrical engineer, Darlington, who presided, said that any idea that electricity was expensive and could only be regarded as a luxury for the higher class type of dwelling, was a fallacy. Architects should compare the costs and advantages in relation to other fuels. In a three-roomed flat in Darlington, occupied by people whose average income was about £5 weekly, there were six lighting points, a 3-kW immersion water heater, a 1½ gal. self-contained type water-heater, a cooker and a 2 kW fire, the overall average weekly consumption of which was 39.6 units at a cost of 2s. 4½d. In the case of a five-roomed house where there were 10 lighting points, immersion water heater, 1½ gal. self-contained water-heater, cooker, wash-boiler, three 2 kW fires and a 600 W bowl heater, the average weekly cost was 2s. 10d. for 46 units. Mr. Daniel added that costs in the area of supply of the North-Eastern E.S. Co., Ltd., were much the same.

Mr. Osborne said that it was the responsibility of the electrical industry to enlighten architects and for architects to enlighten the industry, in order that each could provide the best service for the community. Electricity would continue to be generated, no matter what the political situation was, and more and more people would be using it. Dealing with fluorescent lighting, he said there was much to be said for it. It was most efficient in large spaces where continuous lighting was necessary and where it was not switched off at frequent intervals. It was supreme in factories and commercial offices. With regard to the use of electricity for heating schools, while this was not at present considered economical, preparation should be made for its development in the future. On the subject of buildings,

Mr. Osborne added that large areas of glass resulted in loss of heat, and he suggested that windows should not be taken down to the level of the floor, but should start about 18 in. above the floor so that tubular heaters could be placed under them to reduce draughts. Electric water heating was not yet, in his view, fully appreciated, and he quoted instances where current had been wasted through attempting to heat water in an uninsulated tank. He stressed the need for lagging.

Mr. S. I. Ellis (heating and lighting department, North-Eastern E.S. Co., Ltd.) asserted that electricity failures were caused either through ignorance or lack of co-ordination and co-operation between the architect, builder, and electrical engineer. If they could get together more, it was bound to be reflected to the advantage of the community, the consumer of electricity, and the architects' clients. Mr. Ellis said there should be more joint meetings with ventilating and illuminating engineers and architects.

Mr. Stanley Milburn, a Sunderland architect, said that there was room for development in interior lighting. He would like to see well illuminated rooms wherein the lighting points were not themselves seen.

Mr. Percy Dalton, city engineer, Carlisle, referred to the erection of new schools under the new Education Act, and asserted that it had been stated that the system of ventilation should be so arranged that the air was changed six times an hour. He suggested that a conference of school architects, ventilating and heating engineers should be called to discuss the matter of heating generally, especially that applicable to schools.

Mr. Osborne replied that consultations were already taking place along these lines in London. Changing the air six times an hour was a practical proposition, but this figure was not being insisted upon.

LIAISON WITH ARCHITECTS

Mr. R. N. MacKellar, president of the Northern Architectural Association, said that he had never had the courage to persuade anyone to go "all electric" in new house construction. He announced that the association had decided to appoint Mr. J. H. Napper, one of its prominent members, to act as liaison officer between the Architectural Association and the E.D.A.

The Heat Pump

Discussion at I.E.E. Informal Meeting

THE revival of interest in the heat pump was evident from the large attendance at the informal meeting of the I.E.E. on November 25, when Mr. J. A. Sumner, opened a discussion on the subject. He pointed out that the principle of the heat pump was first enunciated by Kelvin nearly a hundred years ago. Cheap coal had retarded any great development in Great Britain, but the position was now very different. It had once been practically impossible to get manufacturers interested in the problem, but there were now signs of an awakening interest on their part in view of the fuel position.

After giving a brief outline of the theory and operation of the principles of the heat pump, Mr. Sumner said that the common application of heat pumps was to effect refrigeration, but it was often difficult to get refrigeration engineers to think in terms of making something hot. It was not readily understood that the heat pump combined both operations. The Norwich heat pump was now being widely discussed among engineers and their attention was drawn to the possibility of producing small units combining domestic heating, water heating and also refrigeration. One of the big fields of development in this country might be in industry, where large quantities of heat were required at a moderate temperature.

The average efficiency of a coal boiler for a central heating installation was about 50-60 per cent., using a good quality coal. A heat pump maintaining the same output would use electricity produced in burning approximately 75 per cent. of the weight of coal that the boiler used, thus effecting a very considerable economy in fuel. Moreover, there was no reason why the heat pump should not be made entirely automatic in operation. It also offered great possibilities as a load builder for the electricity supply industry.

OVERSEAS INSTALLATIONS

After describing the Norwich heat pump, which, he said, was working well, Mr. Sumner gave details of plants abroad. In Zürich there was a plant comprising two 1 000 kW turbo-compressor Brown-Boveri pumps, and one 850 kW Sulzer reciprocating pump serving a district heating scheme. Heat was taken from the River Limmat and the output was about 8 000 000 B.Th.U.'s per hour. The temperature of the water circulating in the building was 158-167° F. and the average advantage was 2.86.

There were two air-conditioning and

heating installations in Ohio and they had an output, respectively, of 400 000 B.Th.U.'s and 450 000 B.Th.U.'s.

Discussing the problem of manufacturing costs, which critics had said were prohibitive, Mr. Sumner said that it was not impossible that a heat pump plant could be produced at a price which would compare very favourably with the price of an equivalent boiler with automatic firing.

LARGE AMERICAN UNITS

In the ensuing discussion, information was given with regard to developments in America, where specifications had been issued for units which would be used for heating in winter and cooling in summer. Manufacturers had been asked to tender for 1 000 such units at a time. A specification had also been issued for a much smaller unit for domestic water heating, which would be produced and sold in large numbers, thus enabling mass production methods to be adopted. The larger unit would be produced in two sizes, 48 000 B.Th.U. per hour and 62 000 B.Th.U. per hour, while three sizes were suggested for the small domestic water heating units, supplying respectively, 6 000, 8 000 and 13 000 B.Th.U. per hour. An efficiency of performance figure of 4.5 was contemplated.

The possibility of an air-to air heat exchange cycle was mentioned, thus avoiding the necessity for looking for a water supply. Alternatively, the suggestion was made that the earth itself could be made the original source of low grade heat. It was pointed out that in Switzerland little weight had been attached to capital cost, since there was no surplus of fuel available. However, the large Zürich plant had quickly paid off its capital cost.

Reference was made to the need for some form of compressor other than the piston type, the cost of which, it was said, was much higher than the absorption of adsorption types, and one speaker mentioned that he formed a company in this country in 1939 to build heat pumps, but circumstances had operated against its success.

The interest in this country was becoming more apparent it was stated, and Mr. Sumner mentioned in his reply that a new two-stage compressor would be installed very shortly and would, no doubt, greatly improve the efficiency.

Although there were relatively few speakers in the discussion, a keen interest was shown in the possibilities of the heat pump and apparently not all doubts were dispelled.

Answers to Technical Questions

We produce 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

What is the present position with regard to d.c. power transmission?

For a given maximum voltage to earth, i.e., approximately the same amount of insulation, as much power can be transmitted over two wires carrying d.c. as over three wires of the same section carrying a.c. This results in the cost of a double-circuit d.c. line being about 30 per cent. lower than the cost of a corresponding double-circuit a.c. line for transmitting the same power.

Since generation and distribution will, as far as can be foreseen, continue to be by alternating current, a d.c. transmission scheme will involve transformers, rectifiers and inverters at the terminal stations, whereas an a.c. scheme will only require transformers. Sub-station costs will therefore be considerably higher with d.c. than with a.c. and tend to offset the saving made on the line itself. Present estimates indicate that d.c. would only be cheaper than a.c. for transmission distances of more than about 300 miles.

For such distances voltages of 400 to 500 kV would have to be used (for either a.c. or d.c.) to make the scheme economic and rectifiers and inverters for this voltage are only just being developed and no actual schemes are in operation at such voltages. Three important groups of experiments are, however, being carried out.

In Sweden equipment is installed for transmitting 6 000 kW at 90 kV d.c. over a 30 mile line between Trollhattan and Mellerud—this corresponds to a direct current of 70 A. At each end of the line there are two rectifier/inverter groups connected in series with the mid-point earthed. Each group comprises six single-anode units arranged in a three-phase bridge connection.

In Switzerland, after some three-phase experiments, a single-phase experiment at 30 kV and 400 A is being carried out in order to investigate in detail the behaviour of the rectifier and inverter units.

In America an experimental 3 000 kW, 15 kV line was in use before the war and more recently two 20 000 kW frequency converters have been put in operation linking a 60 c/p.s. and a 25 c/ps. system by means of rectifier/inverter units and a d.c. link. Ignitron rectifier/inverter units are employed.

Elaborate experimental equipment had also been set up in Germany, but this has been destroyed or dismantled.

The difficulty in connection with d.c. transmission is in the development of the rectifier/inverter units—the problem of back-fire has not yet been fully solved or even fully understood, although the various experimental plants appear to be operating with reasonable satisfaction.

The present position is, therefore, that d.c. transmission is on the verge of becoming a practical possibility and there are several places in the world, e.g., Sweden and Egypt, where long distance transmission is urgently required and for which d.c. will be used as soon as it is technically justified. E. O. T.

Electrical Statistics

THE eleventh Monthly Digest of Statistics shows that the weekly average consumption of coal by authorised electricity undertakings increased from 463 000 tons in September to 513 000 tons in October. The figure for the corresponding month last year was 450 000 tons. The distributed stocks held by authorised undertakings expanded from 2 108 000 tons in September to 2 280 000 tons in October. This was considerably less than the stocks held in October last year, which amounted to 3 385 000 tons. Electricity generated reached the total of 3 733 million kWh, compared with 3 105 million kWh in September and 3 179 million kWh in October last year.

The production of electrical appliances classed as building components in October was as follows: cookers, 23.3 thousands; wash-boilers, 19.8 thousands; water heaters (immersion), 41.5 thousands; and meters, 127.2 thousands. For September the totals were: cookers, 13.3 thousands; wash-boilers, 19.3 thousands; water heaters (immersion), 39.8 thousands; and meters, 99.6 thousands. The figures for October last year were: cookers, 6.8 thousands; wash-boilers, 6.3 thousands; water heaters (immersion), 18.3 thousands; and meters, 50.7 thousands.

The value of electrical goods and apparatus exported during October was £4 022 000, compared with the monthly average of £3 257 000 for the third quarter of the year, £2 931 000 for the second quarter, £2 453 000 for the first quarter and £1 119 000 in 1938. Shipments of electrical machinery in October totalled 4.9 thousand tons, as against 2.9 thousand tons in September, and 1.4 thousand tons in October last year.

Book Reviews

Radio Receiver Specifications. (London: Trader Publishing Co., Ltd.) Pp. 24. Price 9d. net.

Radio servicemen, dealers and even the potential customer will be interested in this small book, which contains abridged technical specifications of 138 radio receivers, the products of 55 British manufacturers. The information is correct up to October 29 this year, and thus gives details of the post-war models so far released, and includes numbers and types of valves employed, intermediate frequency, wave-bands, power output, power supplies, provision for external loud-speaker and pick-up, and price.

Electricity in the Building Industry.—By F. C. ORCHARD, M.I.E.E., A.M.I.Mech.E., with Foreword by H. C. Harland, F.I.O.B., Past-President, London Master Builders' Association. (London: Chapman & Hall, Ltd.) Pp. 232 illustrated. Price 15s. net.

Probably no better qualified author could have been found for this volume than Mr. F. C. Orchard, whose work on applications of power tools is now well known. The present priority needs of housing make it essential that more productive methods should be adopted, for the true solution of many present difficulties rests upon a greatly increased use of tools of the self-operative type.

Early chapters deal with the fundamental principles of electricity and electrical machines, and the author then deals in an admirable way with questions of installation, workshop wiring and lighting, power costs, maintenance and research.

Practically every known application of electricity to tools associated with the building industry is dealt with, but there is no mention of builders' hoists and lifts, now becoming of some importance in the erection of large buildings. It is unfortunate that Fig. 100, showing the connection of three-core conductors to portable tools, and thus of paramount importance from the safety angle, is misleading, if not actually inaccurate, and as the book is primarily intended for the building industry, would merit the issue of an errata slip. It is understood that suitable revision will be made in future editions.

In spite of this the book should prove of outstanding value to the building employer and operative, and assist both in the solution of many problems. Echoing the words of the writer of the Foreword, the book can be heartily commended as a mine of information on matters electrical

to all connected with the building industry. Mr. Orchard has produced a work which should become a standard of reference, thus replacing the present scraggy electrical knowledge possessed by most of those engaged in the building industry.—T.C.G.

The World of Industry, by A. P. YOUNG, O.B.E. (London: George Gill and Sons, Ltd.). Pp. 342, with 147 illustrations. Price 12s. 6d. net.

It was in 1901 that Mr. Young joined the B.T.H. company, and he retired, as manager of the Rugby works, early last year. If for no other reason than his vast experience of works organisation, his opinions on modern industry would be read with great respect, but, in addition, he has long been known for his keen interest in the wider problems of labour and management.

His book is difficult to classify. It is at once a most comprehensive account of the day-to-day running of British industry—and young men about to enter the engineering world could have no better introduction to its ramifications—but is at the same time a plea for a new moral outlook. In the author's own words, "the government of the world of industry must follow democratic principles (fundamentally Christian in their origin) which recognise the supreme worth of human personality. This means that the basic principle of industrial partnership—labour, management, capital and consumers—must be implemented in any form of control established for an industrial group.

"Management," he continues, "must be recognised as the hub of the world of industry. There should be a nation-wide desire to make it a profession . . . and to ensure that only men and women conforming to the very highest managerial standards are allowed to exercise control."

Pointing out that, in the last two centuries, industry has become the most powerful motivating force within the community, Mr. Young claims that it must largely take upon itself the beneficent work previously accomplished by Church and universities. In short, the object must be not only to make good things, but to make good men.

There will be few to deny that relations between labour and management are to-day approaching a point at which some re-orientation of viewpoint is essential. In both camps, some will contend that Mr. Young's essentially liberal recommendations do not offer a complete solution, but as a sincere and highly qualified contribution to an urgent problem, his book deserves the most careful attention.

Electrical Personalities

LORD FORRESTER, managing director of Enfield Cables, Ltd., headed a delegation of seven British engineers, who went to Norway last week for the study of electricity works.

DR. H. W. H. WARREN has been appointed deputy managing director of



DR. H. W. H. WARREN

Associated Electrical Industries, Ltd., whilst retaining his position of managing director of the British Thomson-Houston Co., Ltd.

MR. E. H. BALL has been appointed deputy managing director of the British Thomson-Houston Co., Ltd.

MR. I. R. COX has been appointed chairman of the directors of the Edison Swan Electric Co., Ltd., and Edison Swan Cables, Ltd., in addition to his position of managing director of the Metropolitan-Vickers Electrical Co., Ltd.

DR. C. J. MACKENZIE, president of the National Research Council of Canada, has been elected a Fellow of the Royal Society.

MR. A. S. HOLLIN, of Halifax, has been appointed by the York Electricity Committee as power station superintendent.

MR. F. SELLEY, chief electrical engineer, St. Marylebone, London, whose retirement was due, is to retain that position for another year, his period of service having been extended by the Electricity Committee.

MR. F. W. FIELD, before retiring from the position of illuminations engineer, received from the Blackpool Electricity Committee, through the chairman, Coun. F. W. Halton, a cheque for 25 guineas. On behalf of the staff, the storekeeper, Mr. E. B. Platt, handed to Mr. Field a cigarette lighter and cigarettes. Mr. Field has been with the Corporation for 47 years.

MR. NORMAN ELLIOTT, general manager and chief engineer of the London and Home Counties J.E.A., has been appointed hon. secretary of the Conference of Joint Electricity Authorities and Joint Boards.

MR. H. E. ANNETT, borough electrical engineer and manager at Bolton, Lanes., is to be re-engaged for a period of 12 months from January 28, the date of his retirement

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.

on superannuation. This is the decision of the Bolton Electricity Committee after further consideration of the question of the appointment of a successor to Mr. Annett. He is to be paid £1 900 a year, plus bonus, in addition to superannuation allowance, as against the £1 600 at which the position was advertised.

DR. P. DUNSHEATH, consulting engineer and a director of W. T. Henley's Telegraph Works Co., Ltd., and Mrs. Dunsheath, set out from Tilbury on Saturday, November 30, on the "Otranto" for a tour of Australia and New Zealand. They will return about the middle of April next. The journey will include visits to Perth, Adelaide, Melbourne, Sydney, Canberra, Newcastle, Brisbane, Hobart, Auckland, Wellington, Christchurch and Dunedin, and at each of those places Dr. Dunsheath will be taking part in meetings and functions arranged by the overseas branches of the I.E.E. in conjunction with the Institution of Engineers of Australia and New Zealand.

MR. H. F. CARPENTER, vice-chairman of the E.D.A. Council, has been appointed president of the Chartered Institute of Secretaries for the year 1947, and at the same meeting his colleague, Mr. C. Heathcock, was appointed one of the two vice-presidents. The occasion is all the more noteworthy since Mr. Carpenter is clerk and manager of the West Midland J.E.A. whose coming-of-age was celebrated last October, and Mr. Heathcock is the vice-chairman of the Authority and chairman of its General and Finance Committee. Mr. Carpenter, besides controlling the affairs of the West Midland's J.E.A., holds the post of honorary secretary of the Electricity Supply Joint Committee. His colleague, Mr. Heathcock is managing director and general manager of the Midland Electric Corporation for Power Distribution, Ltd.

MR. T. JACK, deputy electrical engineer and manager at Bolton (Lanes.), retired on November 30. His first appointment at Bolton thirty-three years ago was at the Spa Road works as charge engineer. After a stay of only a month, he took up a similar post at Back o' th' Bank power station. He was made constructional engineer in 1918, and staff superintendent five years later; in 1927 he was promoted resident engineer, and in 1939 became

deputy head of the undertaking. On November 29, Mr. Jack was presented with a nest of lacquered tables by Mr. H. E. Annett, chief electrical engineer, who, with representatives of various sections of the undertaking, expressed the good wishes of the staff and employees. Mr. Jack is succeeded by Mr. E. W. Hewlett.

MR. H. WEST, chief engineer of the motor and welding departments of the Metropolitan-Vickers Electrical Co., Ltd., since 1940, has been appointed assistant to the chief electrical engineer of the company. He will retain his position as chief engineer of the welding department. During his apprenticeship at Trafford Park, Mr. West was awarded one of the company's scholarships for part-time educa-

chester College of Technology, joining Metropolitan-Vickers as an apprentice in 1918. Subsequently, he was appointed to



MR. H. WEST

MR. A. G. WILLIAMSON

the engineering staff of the motor department, where since 1933, he has been in charge of the d.c. design section; among his activities was the designing and patenting of the Paradyne welding set. During the war Mr. Williamson was responsible for much important work on special machines to meet the requirements of the Admiralty and other Service departments.

SIR LAWRENCE BRAGG, F.R.S., has been awarded a Royal medal by the Royal Society for his researches in the sciences of X-ray structure analysis and X-ray spectroscopy. Other awards by the Society include the Sylvester medal to Prof. G. N. Watson, and the Hughes medal to Prof. J. T. Randall, F.R.S.

Obituary

MR. F. E. SHIPLEY, who has represented Chamberlain and Hookham, Ltd.,



MR. H. F. CARPENTER and MR. C. HEATHCOCK

tion, leading to an associateship of Manchester College of Technology, where he studied electrical machine design. Mr. A. G. Williamson has been appointed to succeed Mr. West as chief engineer of the motor department. Mr. Williamson received his technical education at the Man-



Group taken at the first annual dinner of the Association of Electrical Machinery Traders in London on November 27. Left to right; MR. W. LEONARD, M.P., Joint Parliamentary Secretary to the Minister of Supply; MR. W. E. LAWTON, chairman, A.E.M.T. and MRS. LAWTON, MR. T. A. ATKINSON, vice-chairman A.E.M.T. and MRS. ATKINSON. See page 1600

in the West of England and South Wales for the last 18 years, on November 17, aged 54 years. He joined the staff of the company in 1912.

MR. JAMES McCaffery, formerly Assistant Director of Electrical Engineering at the Admiralty, on Nov. 26. During the war period, from 1939 to 1945, he was president of the Batti-Wallahs' Society. Mr. McCaffery joined the Admiralty as a higher first assistant electrical engineer at Portsmouth on June 18, 1906, and in the following year went to Hong Kong as a higher electrical engineer. His next

appointment was at Sheerness on July 25, 1909, and he remained there until June 21, 1917, when he became acting higher grade electrical engineer, D.W.P., Admiralty. In January, 1919, he went to the Department of Electrical Engineering, Admiralty, and in the following April was appointed acting Assistant Director of Electrical Engineering. He became Assistant Director on April 1, 1922, and held that position until his retirement on September 1, 1937. Mr. McCaffery was awarded the O.B.E. in January, 1918. He was a member of the I.E.E.

The Batti-Wallahs' Society

THE guest-speaker at the luncheon of the Batti-Wallahs' Society at the Connaught Rooms, London, on November 28, was Lt.-Colonel Norman Elliott, general manager and chief engineer of the London and Home Counties J.E.A., who took for his subject "Electricity in the Service of the 21st Army Group." While borough electrical engineer at Gravesend, Mr. Elliott was commissioned with the rank of lieutenant-colonel and appointed by the War Office to take charge of a special R.E. unit, including electrical engineers and sappers, and restore and maintain supplies of electricity essential for the successful advance of the Forces after the landing in Normandy. The work of this unit was described in two articles under the heading, "Power Activities in 21 Army Group," which appeared in THE ELECTRICIAN on August 23 and 30 this year.

Mr. Henly Howard, a past-president, who was in the chair, announced, with deep regret, the death of Mr. James McCaffery, formerly Assistant Director of Electrical Engineering at the Admiralty and president of the society from 1939 to 1945. The company stood in silence for a few moments as a mark of respect.

Lt.-Colonel Elliott gave details of the extensive destruction at the Caen power station and the difficulties that had to be surmounted to provide the much-needed supplies of electricity to the docks. Within the seven weeks scheduled, he said, they had a 6 000 kW turbine running, and ten days later a 10 000 kW high pressure turbine working. Passing on with the advancing Army to Ostend and Antwerp, where the work was carried on under frequent danger from V 1 and V 2 missiles, which caused further damage, the unit then continued its work into Holland and Germany, resorting to all sorts of improvisations due to lack of materials. The speaker also made interesting reference to Krupp's great house, which had its own telephone exchange and 1 900 private lines, and, in

conclusion, said his experience brought home to him very forcibly the dependence of a modern industrial community upon electricity.

A vote of thanks was proposed by Mr. Alan N. East.

Mr. M. Whitgift, the secretary, introduced three new members and announced that the chief guests at the next two luncheons would be Mr. Hugh Quigley, on January 30, and Sir Hartley Shawcross in February.

The A.E.M.T.

THE first annual dinner of the Association of Electrical Machinery Traders was held at Grosvenor House, London, on November 27, when Mr. W. E. Lawton, chairman, presided. Following the Loyal Toast, Mr. Lawton spoke of the achievements of the association during the war years, and referred to a booklet, "The Burden of Other Days," which summarised the activities of the association members during 1939-45.

Copies were available to those attending the dinner, and in the booklet are given details of the part played by member-firms in meeting emergency demands, conversion needs, and so on.

Mr. William Leonard, Joint Parliamentary Secretary to the Ministry of Supply, also spoke, and paid tribute to the electrical industry's efforts during the war. As to the future, he believed that in spite of the problems of reconversion, the settling down period would be handled with efficiency and confidence.

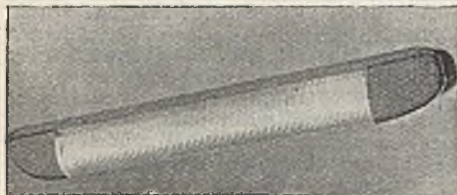
Mr. A. L. Johnson, chairman of the High Conductivity Copper Association, stated that trade associations in his opinion had an important function, and were the best means of communication with Government departments.

Mr. H. Vernon replied for the association. (Picture on p. 1599.)

Equipment and Appliances

Perspex Fluorescent Fixture—Motor Controller

RECENTLY demonstrated at the opening of the Thorn Electrical Industries new Manchester showroom was the attractive "Atlas" fluorescent lighting fixture illustrated on this page. The model shown is for 30 W fluorescent tubes and is now



"Atlas" 30 W fluorescent fixture

under development: a similar fitting for 80 W tubes, is shortly to be marketed. The unit consists of an aluminium channel which can, if desired, contain the control gear, hinged end covers of pressed aluminium and a diffusing cover, with its fluted surface designed to reduce the tube brightness, made in Perspex. The wiring channel and end covers are finished in off-white enamel.

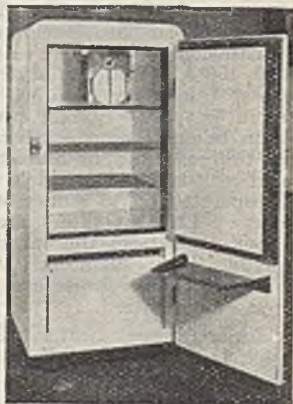
William Geipel, Ltd., of Vulcan Works, London, S.E.1, have recently announced details of their post-war range of motor control gear and other equipment. Amongst their larger products is a series of a.c. star-delta contactors, which are available for three-phase squirrel cage motors of up to 50 h.p., at 100-500 V. The standard units are fitted with a t.p. contactor for line operation, a second t.p. contactor for the delta connection and a d.p. contactor for the star connection. In addition, a timing relay is fitted to ensure delay before changing from star to delta connection. Correct operating sequence is ensured by interlocks, and thermal overload releases are fitted. Separate contactor assemblies are also made, for a.c. or d.c., for currents up to 300 A. The contacts themselves, which are easily removable, are of copper and are self-aligning and non-welding. Continuously rated, vacuum impregnated coils are used. For small a.c. motors of up to 15 h.p., there is a direct-on-line contactor, with push-button control.

The latest heavy engineering product of South Wales Switchgear, Ltd., is a 300 kVA power transformer, one of a range of transformers which are supplied up to 1 000 kVA and with voltage ratings up to 12 kV. The windings are wound on rigid

Elephantide cylinders of good mechanical and electrical strength, and the conductors, of high conductivity copper, are paper insulated. The low tension windings are wound in two layers with the start and finish leads brought out together. The construction gives a mechanically strong coil, while eddy losses and lead reactance are considerably reduced. An oil duct is provided between the two layers to give efficient cooling. The h.t. coils are varnish impregnated under vacuum and are fully shrunk during the process. Welded steel tanks with cooling tubes are used, and are subjected to rigid oil tests during and after manufacture. Scale is removed by shot-blasting. The tapping switch which has ample capacity to withstand any short circuit current it may have to carry, is of the face-plate type, one face-plate for each phase, with a common insulated operating spindle.

A feature of the new refrigerator model manufactured by Articaire, of Sheffield, is a shelf built on the inside of the door, for use

while the contents of the cabinet are being rearranged. The condensing unit comprises a single-cylinder compressor of patented design driven by a motor which is available for 200-250 V a.c., d.c., or, at an additional fee, any non-standard supply. The moving parts are mounted on a floating suspension to ensure vibrationless operation.



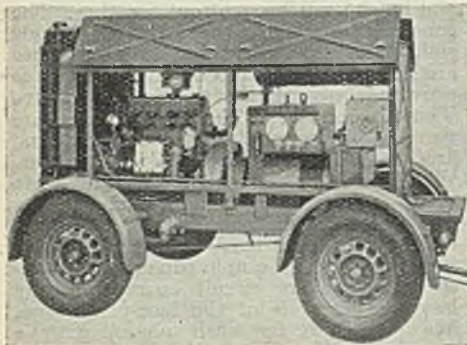
The "Articaire" refrigerator, with loading shelf

With three shelves, giving a total shelf area of 9 sq. ft. and a net food capacity of 5.2 cu. ft., the refrigerator is finished inside with porcelain enamel and has an automatic interior light. The outside finish normally in white stove enamel, may, at extra cost, be provided in pastel shades. All hinges and handles are heavy chromium-plated.

A new electric bed heater which, it is claimed, is suitable also for cars, prams and train journeys, is marketed by Bright-

glow, Ltd., of Pinner, Middlesex. Of burnished copper or aluminium construction, it is supplied with six feet of flex and measures $9\frac{1}{4}$ in. diameter and 2 in. deep. Before use, it is connected to the supply for five minutes only, after which it can be placed in the bed, where it will retain its heat for some hours.

New work which is now being extensively carried out in the oilfields by the



Murex 300/400 A mobile welder

large oil companies necessitates the extensive use of electric arc welding, and in this connection Murex Welding Processes, Ltd., have built large numbers of portable engine-driven arc welding units. The illustration shows the single operation 300/400 A model, one of several types and sizes, which vary from 300 to 600 A maximum output. Special precautions have been taken to ensure satisfactory working in the extremes of ambient temperature and altitude under which they will have to operate and to reduce wear of moving parts. Efficient filters are fitted to remove sand from the air drawn into the engines and generators. Accessibility to all parts and compactness have received first consideration.

Among recent heaters of the convector type is the "Derwil," marketed by the Wilder Instrument Co., Ltd., of 75, Tooley Street, London, S.E.1. With a heavy gauge sheet steel cabinet, which can be supplied in a choice of 12 colours, in hard stove enamel, the heater is designed for home, office or business use. It is fitted with round carrying bars at either end, and has a further bar at the rear, which can be used as a drying rail. The nichrome wire heating element operates at black heat and is mounted in a manner to afford the maximum contact with inflowing air. The present model is available for 200-250 V, and is rated at 1 kW. A 2 kW version is being developed.

A heat resisting plastic moulded handle and porcelain feet are features of a new

electric kettle made by Metalux Electric, Ltd., of 69, King's Cross Road, London, W.C.1. With a highly polished aluminium body, more than $\frac{1}{8}$ in. thick, it has a capacity of 4 pints of water, and fast boiling is ensured by the 1500 W immersion heating element. The kettle is supplied, for mains voltages of 100/110, 200/220 and 230/250 V, with an earthed plug-in type connector and two yards of non-kink three-core flexible cable. The heat insulating properties of the feet make it safe to use on a wood surface.

Additions to the G.E.C. range of studio equipment include a series of lamp-houses rated at 5 kW, 2 kW, 500 W and 250 W, all of which are basically similar in design. The body of the 5 kW lamp-house is of cast aluminium, while pressed aluminium plate is used for the 2 kW model. Both are of "double skin" construction, the cavity between the inner and outer skins forming a "venturi," a form of cooling developed in the

G.E.C. Research Laboratories. Adequate louvres in the units ensure a continuous circulation of air, which reduces lamp blackening and bulb distortion and allows the lamp-houses to be handled without fear of burning. The 5 kW model is designed for use with an Osram bi-post lamp of the flat-grid filament type, and is fitted with a new type of quick-release lamp-holder. The optical system consists of a spun anodised aluminium reflector 11 in. in diameter, with a front lens of the Fresnel type, 14 in. in diameter. In the 2 kW model, similar equipment is provided, the reflector diameter being $7\frac{1}{4}$ in. and that of the front lens 10 in. Focussing in both types may be carried out from either the front or rear. In the 500 W and 250 W versions, the optical equipment is a 5 in. reflector with a curvature of 3 in. radius, with a 6 in. diameter front lens of 4 in. focus. Each model is supplied with 25 ft. of twin-core flexible cable, and a d.p.d.t. switch is mounted on the unit itself.



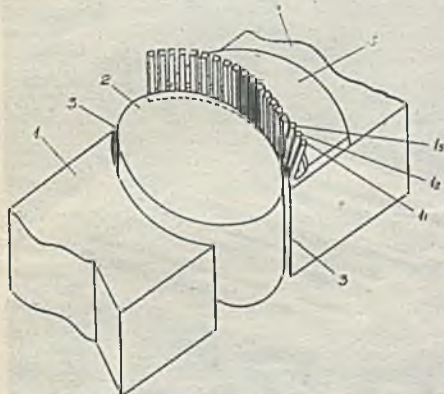
500 W studio lamp

Electrical Inventions

Meter Calibration

If a measuring instrument, such as a moving-coil meter, is provided with a scale marked in advance of assembly, some inaccuracies are likely to occur on parts of the scale, caused by uneven flux distribution in the magnetic gap. Since these variations are likely to be different in any two instruments, the scale cannot be corrected beforehand. The invention seeks to remedy this by providing means whereby the flux distribution can be varied to provide a linear needle deflection over the whole range.

The moving coil, which is not shown, moves around the core 2 between the pole-pieces 1, 1. A part 4 is made of mag-



netic material and carries a number of teeth arranged perpendicularly along the polar arc. By deforming, for example, the teeth 1, 1₂, 1₃, the distribution of the leakage flux is modified in the region of these teeth, thus producing a local variation in the motor couple and, consequently, a variation in the indication made by the apparatus. A second part 4 may be provided on the other pole-piece.

Co. Para la Fab. de Contadores y Mat. Indus., S. A. and P. Viteau, Barcelona. Application date, September 15, 1944. No. 581 611.

Polyphase Motor Protector

The circuit is arranged to prevent the operation of a polyphase induction motor, if any one phase is disconnected from the supply, and also to prevent connection in incorrect phase rotation.

The motor M is connected to the supply lines R, Y and B through the contacts Mc of a switch and contacts Cc of a triple pole contactor. The contactor winding Cw is connected across lines R, Y through a control switch contact Sc and the nor-

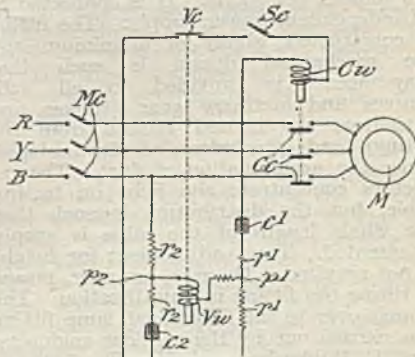
We give on this page abstracts of some recent electrical patents, which are prepared with the permission of the Controller of H.M. Stationery Office. These abstracts are written from the viewpoint of general interest and do not attempt to define the scope of the inventions, nor indicate in which features the novelty lies. Complete specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each inland or 1s. 1d. each abroad.

mally closed contacts Vc of a voltage relay Vw. Connected between the lines RY is a bridge circuit, including c1 and r1 in series and between the lines YB is a second bridge circuit, including c2 and r2.

The resistors r1 and r2 are tapped at P1 and P2, and the winding Vw is connected, in series with a suitable resistance, between P1, P2. The constants of the bridge circuits are arranged so that, under normal conditions, there is no potential drop across Vw, and the contacts Vc accordingly remain closed. If, however, the balance is disturbed by the opening of one supply line, a potential difference will exist between P1 and P2 and the winding Vw will be energised, thus causing the contacts Cc to drop out.

In the event of the motor being connected in incorrect phase rotation, the voltage across P1 P2 will be practically equal to the line voltage, and the relay will respond to prevent the motor from starting.

The voltage relay may be of a d.c. with



a suitable metal rectifier, or an a.c. type. The control switch Sc may be replaced with start and stop buttons.

Igranic Electric Co., Ltd., and J. R. Taylor. Application date, September 14, 1944, No. 581 609.

Industrial Information

Coventry Electric Club

The Coventry Electric Club held its November session at the Electricity Show-rooms on November 26, Mr. F. W. Godden, the city electrical engineer, presiding. Two films—"Colonel Crompton," depicting the life story of one of the pioneers of the electrical industry; and "Their Invisible Inheritance," issued by the Electrical Development Association—were shown and were enjoyed by a large audience.

Lighting an Operating Theatre

A new G.E.C. fluorescent light fitting has been installed in the two operating theatres of Ancoats Hospital, Manchester. The type is as shown in the illustration. It is 6 ft. long, 4 ft. wide and 10 in. deep. It employs five Osram 80 W fluorescent lamps as the main light source, and these are mounted in high-efficiency anodised aluminium reflectors. This combination produces an intensity of 300-400 lumens per sq. ft. when mounted three ft. above the operating table. The fitting also embodies an emergency lighting system consisting of four 100 W Osram lamps mounted in parabolic reflectors fitted with glass diffusing screens, and providing an intensity of 175 lumens per sq. ft. It is connected to an independent power supply. The fitting is constructed wholly of aluminium and the mechanical design is such that easy access is provided to all light sources and auxiliary gear (chokes and capacitors are housed remote from the fitting) and precludes, as far as possible, the accumulation of dust. The reflectors concentrate the light on to the table, but the distribution is such that the whole length of the table is evenly illuminated. Thus, adjustment for height is not required. There is, however, means of tilting the fitting in any direction. The change-over to the fluorescent lamp fitting was carried out by the resident engineers, Mr. J. Wibberley and Mr. E. Graham, without interference or break in the normal theatre schedule.

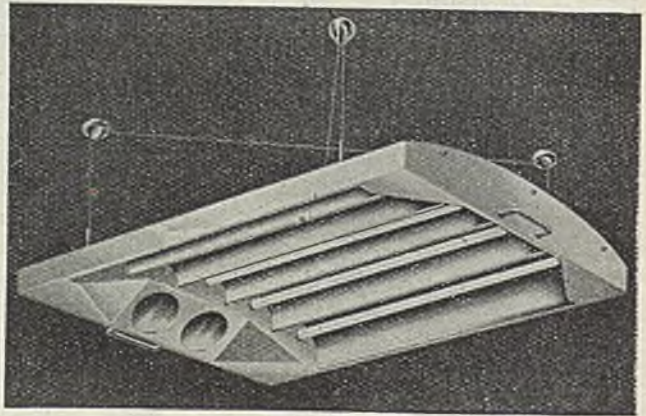
L.C.C. Television Course

A short-course of about twelve lecture-demonstrations an television practice will commence at the L.C.C. South-East London Technical Institute, Lewisham Way,

S.E.4, on Thursday, January 16, at 7 p.m. Following an introduction dealing with electrical data, general principles and some physiological details of the scheme, the lectures will cover production, transmission, reproduction and future trends. They will be given by Messrs. J. E. B. Jacobs, M. Morgan, A. E. Sarson, L. C. Jesty and G. E. Graham. The fee for the course will be £1. Application for admission should be made to the head of the Electrical Department without delay.

Siemens' New Factories

Siemens Brothers and Co., Ltd., have, in addition to their main factory at Wool-



New fluorescent lamp fitting for operating theatres

wich, established a new factory at Spennymoor, County Durham, where over 200 000 sq. ft. of factory space has been occupied. In the new premises 100 000 sq. ft. is taken up in production of dry batteries and in future all batteries will be made at Spennymoor, the Woolwich section of battery manufacture having been already transferred. The remaining area at the Spennymoor factory will be devoted to the output of a light engineering character, mainly connected with telephone exchange equipment and cable accessories. The total number of employees at Spennymoor will be about 1 800 when in full production. A factory is being built by arrangement with the Board of Trade and the North Eastern Trading Estate at Hartlepool. This building of 200 000 sq. ft. area, with space for extensions, will be devoted to the manufacture of telephone exchange equipment, and will be an extension of the existing facilities at Woolwich, where manufacturing capacity is also being increased. The Hartlepool factory will also employ about 1 800 persons when in full produc-

tion. Siemens Brothers have for many years maintained a marine department branch at "K," Exchange Buildings, Quayside, Newcastle-on-Tyne.

Factory Extension Opened

When opening an extension of the factory of Metway Electrical Industries, Ltd., at King Street, Brighton, recently, Mr. D. G. E. Barrie, managing director, stated that in the year 1945-46, the company had been able to increase the bonus to employees from 10 per cent. to 15 per cent. The factory extension is lighted by fluorescent lamps installed by Page and Miles, Ltd.

Production Target Reached

To commemorate the attaining of their production target in the manufacture of immersion heaters and thermostats, Precision-Electric, Ltd., of Birmingham, held a highly successful dance at the Imperial Hotel, Birmingham, on November 26. Mr. A. S. Cheetham, managing director, welcomed all the employees and guests, who included Mr. F. Westerman, of F. Westerman (Wholesalers), Ltd.; Mr. Munday, of J. A. Ryley, Ltd.; and Mr. Andrews, of Electrical Components, Ltd.

A Massive Load

One of the most massive "awkward loads" ever carried by British railways reached its journey's end on Sunday evening, December 1, when the 130-ton stator, forming part of new electrical equipment manufactured by C. A. Parsons and Co., Ltd., at Heaton, for the City of Birmingham power station at Hams Hall, arrived at its destination. Owing to its great weight and width (13 ft. 1½ in.), the stator had a special train, 120 yards long, which was illustrated in our issue of November 1. The 268 miles journey from Newcastle to Coleshill, Warwickshire, was spread over six successive Sundays.

Municipal Radio and Television Sets

Fulham Borough Council has issued a statement to the effect that its policy in relation to the sale and servicing of radio and television equipment is the same as that adopted by other municipal undertakings, and is to provide to the public radio and television equipment and apparatus of the highest quality at the earliest possible date; to provide a technical service, particularly on television, of high order and so continue the same policy as applies to any other electrical apparatus in the home of the consumer; the price of new equipment will be in relation to the quality of the apparatus supplied and in view of the emphasis on quality, the selling price may be higher than for ordinary receivers, built down to a price level. Before councils decided to market a range of radio equipment to

their own specifications, they endeavoured to collaborate with existing manufacturers, but such manufacturers found themselves unable to deal with municipal undertakings. Every effort was made to make it quite clear that municipal undertakings were prepared to collaborate with radio retailers. The Council wishes to make it clear that they do not wish in any way to curtail the business or living of any *bona fide* retailer.

International Exchange of Students

In its twelfth annual report the Imperial College Union Vacation Work Committee states that the vacation work scheme had not only maintained its service to the students of the college, but had widened the scope of the work offered during the last year. There had been an increase of 142 in registrations, and 36 new firms had been added to the list, while another 19 firms had produced I.C.U. leaflets outlining a scheme of training for students coming to them for vacation work. Arrangements had been made for a certain number of students of the college to carry through their vacation work with firms in Belgium, Switzerland, Sweden, Holland and Norway, and for students from those countries to devote some of their vacation to work with corresponding firms in this country during the coming summer vacation.

Window Lighting Research

Research into the problems of display window lighting is to be encouraged by the establishment of a research fund at the University of Liverpool. Sponsored by Lewis's, Ltd., departmental stores, the value of the fund is £200 a year for seven years. The primary object of the research is to eliminate glare and reflection. The work will be carried out in the Department of Electrical Engineering and Electro-technics, in conjunction with the chief engineer of Lewis's, Ltd.

World List of Scientific Periodicals

Active preparations are being made for the issue of a third edition of the "World List of Scientific Periodicals." The last edition, issued in 1934, and covering the years 1900-1933, is now out of print, though still in constant demand. The new edition, which is designed to include all the scientific and technical periodicals that appeared during the period 1900-1947 as well as the holdings of additional libraries will be considerably larger. Libraries are being asked to co-operate as before by sending particulars of all those journals on their shelves that do not appear in the second edition or are shown there as having no location in this country, to the Secretary, World List of Scientific Periodicals, c/o. the Zoological Society of

London, Regent's Park, London, N.W.8, from which office further information may be obtained.

Silicone Supplies

Supplies of Dow Corning silicone products are expected to be available in this country early in December. Albright and Wilson, Ltd., who are the distributors, have appointed Mr. K. A. M. Barton to manage their silicone department, to which all inquiries should be addressed. A new booklet has been published, giving information on the silicone fluids, greases, resins and silastic rubber.

Metrovick Jet Propulsion Engines

We have received from the Metropolitan-Vickers Electrical Co., Ltd., a copy of their new descriptive leaflet dealing with the full range of Metrovick jet propulsion engines. Two engines of the F. 2/4 type, described in the first part of the leaflet, will be fitted to the new Saunders-Roe SR/AI jet-propelled fighter flying boat, a model of which aroused considerable interest at the Paris Aviation Exhibition. The F. 2/4 was selected on account of its small diameter,

which allows two units to be placed side by side in the hull without increasing its width. Details are also given of the F. 3 thrust-augmented engine, illustrated in our last issue, and the F. 5 jet propulsion engine with open fan augmentor.

London Electric Wire Company

The London Electric Wire Company and Smiths, Ltd., and its associate companies—Frederick Smith and Co., the Liverpool Electric Cable Co., Ltd., and Vactite Wire Co., Ltd.—have appointed Campbell, Gardner and Co., 27, Franklin Street, Belfast, their sales representatives for Northern Ireland.

To Assist Export Trade

To assist users of "Megger" insulation testers in the U.S.S.R., Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4, have published a Russian edition of their pocket book on insulation testing. The book gives instruction on the making of insulation tests on all types of electrical equipment and appliances and explains the principle upon which the "Megger" instrument works.

Central Line Eastern Extension

THE first section of the eastern extension of the Central Line of the London Passenger Transport Board, running from Liverpool Street to Stratford, was opened on Tuesday, by Mr. Alfred Barnes, Minister of Transport.

Mr. John Cliff, chairman of the L.C.C., and a member of the L.P.T.B., deputising for Lord Ashfield, chairman of London Transport, who was prevented from attending by influenza, and Sir Ronald Matthews, chairman of the L.N.E.R., were among a party of 150 who travelled with Mr. Barnes in the special train over the new line. Stops were made for the inspection of the stations at Bethnal Green, where the illumination is wholly by fluorescent lighting, Mile End and Stratford.

Speaking at the Abercorn Rooms, Liverpool Street, Mr. John Cliff said that but for the war extensions not only to Shenfield, Loughton and Ongar in the East, but also to Edgware, Bushey Heath and Amersham in the North and North-West, as well as to Ruislip in the West, would have been accomplished five years ago and the London Transport Board and the main line companies would have been engaged on further plans for improving London's local transport. The relatively short section opened that day had cost about £3 500 000. Before the war it cost about £800 000 to build and equip a

mile of Tube railway; to-day the cost was nearer £1 500 000.

Mr. Barnes said that the number of passengers using the Transport Board's services, apart from those travelling on the suburban services of the main line companies, had increased from 3 500 000 000 a year in 1933, to 4 225 000 000 in 1946, and compared with 1939 the present weekly mileage showed an increase for railways of 450 000.

Sir Ronald Matthews said that they, of the L.N.E.R., were still looking forward to the completion of their own electrification scheme to Ilford and Shenfield, work upon which was resumed some months ago.

To provide the additional power, the capacity of the generating station at Greenwich is being increased to nearly double its present rating, while the Lots Road and Neasden stations are being improved. The Greenwich station will supply the eastern extension of the Central Line and the electrified L.N.E.R. lines over which the Tube trains will run. The western extensions will be served by the Metropolitan Electric Supply Co., Ltd. Twelve new sub-stations have been built for the new eastern extensions, which will, within two years, run to Loughton, Ongar, Newbury Park and Hainault, and there is a re-designed sub-station at Notting Hill Gate for the Central Line.

Electricity Supply

Newcastle-on-Tyne.—In view of the nationalisation plans, the City Council has decided to apply for an order extending for a further twelve months the authority's right to take over the local undertakings of the North-Eastern Electric Supply Co., Ltd., and the Newcastle-on-Tyne District Electric Lighting Co., Ltd.

Southall.—After attention had been drawn at a recent Committee meeting to the danger created by the use of unearthed two-point plugs and to the need for the general adoption of three-point plugs, it was decided to request the Housing Committee to instal three-point plugs on existing and future housing schemes.

Tottenham.—The Northmet Power Co. have informed the Housing Committee that as electricity would be required at the Asplins and Allington estates for purposes in addition to lighting, it was proposed to offer a supply at an all-in rate, because it was considered that in the circumstances this rate would be the most economical. The Committee has agreed to this and will arrange for the collection of electricity charges with the rents.

Workington.—The annual report of the electricity undertaking shows a loss of £1 775, which is stated to be due to abnormal conditions in the first post-war year. The curtailment of industrial demand had reduced revenue by £2 500, but the demand for the town supply had resulted in an increase in revenue of £1 700. The report states that the development of the peace-time load for industrial and domestic purposes should help to bridge the gap between income and expenditure.

Scarborough.—A new agreement drawn up by the C.E.B. proposes that the Council's generating station at Seamer Road be operated under the Board's direction from January 1 next. The Council has deferred consideration of the letter announcing this. A loan of £18 213, which has been sanctioned by the Electricity Commissioners, includes £11 448 for mains and services, £2 000 for meters, £1 500 for unspecified sub-stations and equipment; and £3 265 for sub-station equipment for the housing estates.

Stepney (London).—The Prime Minister opened on November 30 the first block of flats to be completed under the post-war housing scheme of Stepney B.C., and interest in the occasion is found in the fact that each flat is provided with an extensive electrical wiring installation. Constant hot water is assured by the provision of an immersion heater in the water tank

of each flat, and facilities are provided in each room for the use of an electric heater. Other electrical apparatus—cooker, kettle, iron, wash-boiler, and radiators—may be hired under the Council's scheme. Current is supplied through a prepayment meter at 3d. per unit, plus a weekly charge, col-



A kitchen in one of the flats in the first permanent block completed by Stepney Borough Council, opened by the Prime Minister on November 30

lected with the rent, of 6d. for the two-bedroom and 8d. for the three-bedroom flats. The tenant is given freedom of choice with regard to cooking and facilities are provided in each flat for any change-over to electricity.

Bromley.—The combined report of the Borough Electrical Engineer and the Borough Treasurer, for the financial year ending March 31, 1946, shows a net revenue from electricity supply of £152 695, against £136 123 in the previous year, and a capital expenditure of £526 642. The revenue from meter rents amounted to £4 000 and from cookers, water heaters and wash boilers, £5 826. The total working costs were £131 066 and the year's gross profit £34 717, leaving, after deduction of loans interest, repayment of principal and other charges, a deficit of £6 982. With 62 801 kW connected, the number of units sold was 22 339 354, an increase of 3 373 402 above the 1944-45 figures, and an average of 354 units per kW connected. The average price obtained was 1.64d. per unit, against 1.722d. The working costs show an increase from 1.387d. to 1.408d. per unit,

and the total costs (including loan charges) a decrease from 1.861d. to 1.800d.

Leicester.—A report has been made to the City Council by the Electricity Committee, which suggests that the proposed increases in charges for current in the city will not be as large as originally thought probable. The Committee reports that the Electricity Commissioners have suggested revised proposals to produce additional revenue of £100 000 to £120 000, instead of the original figure of £168 700.

Chester.—Amendments are proposed in the supply tariffs to meet the increased expenditure of the undertaking. The Town Clerk and Electrical Engineer have been asked to take such action as is necessary to obtain variations in the tariffs payable by any bulk or other special consumers, in accordance with the terms of their agreements. As part of the undertaking's silver jubilee celebrations, in December, it is hoped to arrange a display of fluorescent street lighting in Eastgate Street. This is a result of the recent visit of the Chairman of the Electricity Committee to London, where he was impressed by the experimental display in Old Bond Street. The Minister of Fuel and Power is to be invited to open an electrical

exhibition in the town hall on December 11.

London.—At a meeting of the London and Home Counties J.E.A., held on November 28, the annual estimates of the authority for the year ending December 31, 1947, were presented. The estimated income for the year was £1 907 000, against £1 801 000 for 1946, which, after expenditure, including interest and sinking fund contributions and provision for taxation, was expected to leave a net deficit of £1 000, compared with £5 000 surplus in the current year. The total accumulated surplus at the end of the year would be £159 000. Sales of current were expected to reach 245 million units, at an average price of 1.74d. per unit. In addition to these estimates, the authority anticipated selling in bulk a total of nearly 700 million units, at an average price of 0.75d. per unit, for the year 1946. It was stated at the meeting that, despite rising costs, no increase in charges to consumers was contemplated at present. Domestic consumers on two-part tariff, who comprised the vast majority of consumers, would be paying less than 1½d. per unit, including fixed charges.

Electricity Sales in Great Britain

The statistical summary below, prepared by the Electricity Commission, analyses sales of electricity by all authorised undertakings in Great Britain during the years 1944-45 and 1945-46. The figures refer to the years ending December

31, 1944 and 1945, for companies and J.E.A.'s, March 31, 1945 and 1946, for public authorities in England and Wales; and May 15, 1945 and 1946, for public electricity supply authorities in Scotland.

CLASS OF SUPPLY	PUBLIC AUTHORITIES (EXCLUDING THE C.E.B. BUT INCLUDING J.E.A.'s)				PUBLIC AUTHORITIES (EXCLUDING THE C.E.B. BUT INCLUDING J.E.A.'s)			
	1945-46		1944-45		1945-46		1944-45	
	UNITS SOLD	REVENUE	UNITS SOLD	REVENUE	UNITS SOLD	REVENUE	UNITS SOLD	REVENUE
	Units	Percent- age of total	Amount	Average per unit sold	Units	Percent- age of total	Amount	Average per unit sold
	Millions	%	£	Pence	Millions	%	£	Pence
Lighting, heating and cooking ...	8 387.7	44.5	47 695 806	1.365	7 663.6	40.2	44 249 787	1.386
Power ...	9 752.2	51.7	34 955 221	0.860	10 836.8	56.9	35 791 215	0.792
Public lighting ...	168.6	0.9	841 610	1.198	30.4	0.1	267 161	2.107
Traction ...	547.0	2.9	2 144 720	0.941	526.9	2.8	1 993 631	0.908
Totals ...	18 855.5	100.0	85 637 357	1.090	19 057.7	100.0	82 301 794	1.036
	COMPANY UNDERTAKINGS							
Lighting, heating and cooking ...	3 936.9	31.3	30 557 294	1.863	3 559.7	26.9	28 587 923	1.927
Power ...	8 134.2	64.7	30 139 377	0.889	9 207.0	69.6	31 258 408	0.815
Public lighting ...	31.1	0.3	250 682	1.937	4.2	—	87 817	4.956
Traction ...	468.0	3.7	1 485 993	0.762	464.3	3.5	1 410 994	0.729
Totals ...	12 570.2	100.0	62 433 346	1.192	13 235.2	100.0	61 345 142	1.112
	ALL AUTHORISED UNDERTAKINGS (INCLUDING C.E.B.)							
Lighting, heating and cooking ...	12 324.6	39.0	78 253 100	1.524	11 223.3	34.6	72 837 710	1.558
Power ...	17 886.4	56.5	65 094 598	0.873	20 043.8	61.7	67 049 623	0.803
Public lighting ...	199.7	0.6	1 092 292	1.313	34.6	0.1	354 978	2.462
Traction ...	1 246.7	3.9	4 356 523	0.839	1 171.4	3.6	3 937 323	0.807
Totals ...	31 657.4	100.0	148 796 513	1.128	32 473.1	100.0	144 179 634	1.066

In Parliament

Some Electrical Questions Asked and Answered

Electricity Poles.—Lieut.-Colonel Kingsmill asked the President of the Board of Trade whether he would consider releasing the 30 000 poles suitable for electricity purposes to those electricity companies who were unable to extend existing supplies owing to shortage of this particular article. Mr. Marquand said that it had already been agreed to release 10 000 of these poles to the Electricity Commission. The remainder were required for Post Office purposes.

Electrical Fittings.—The Minister of Works was asked by Mr. Medlicott if he was aware that the provision of electricity in a large number of cottages in Norfolk, particularly in the area of the Smallburgh R.D.C., was being held up owing to the non-availability of works licences from the regional and local authorities; and if he would, in conjunction with the supply departments, take the steps necessary to put the local authorities in a position to grant the licences referred to. Mr. Tomlinson replied that the licences would not at present be given because the supply of approved electrical fittings was insufficient to provide for the requirements of buildings already occupied. The Minister of Supply was doing all he could to increase production so that such demands might be met.

Gauge and Tool Council.—The Minister of Supply was asked by Mr. Berry whether he was now in a position to make an announcement about the setting up of a Gauge and Tool Advisory Council. Mr. Wilmot said that he had now appointed a Gauge and Tool Advisory Council in order to provide a means of regular consultation between the Government and the industry on measures for promoting a gauge and tool industry capable of making the maximum contribution to security, industrial efficiency and export. The Council would be concerned with gauges, cutting tools, jigs and fixtures and engineers' measuring instruments. Mr. S. F. Steward, formerly Director-General of Machine Tools in the Ministry of Supply, would be the official Chairman. The Government Department principally concerned would be represented.

Radio Valves (Price).—Mr. Cobb asked the President of the Board of Trade when the report of the Central Price Regulation Committee on the price of radio valves would be published; and what action would be taken as a result of the report. Sir Stafford Cripps replied that the report

was being published on November 28 as a non-Parliamentary publication. The findings did not disclose a case for special action to control the price of radio valves at the present time. The prices of valves would, however, be kept under review. The question of a further inquiry, which would have regard to the effects and the desirability, from the point of view of the public interest, of the practice of maintaining by agreement higher prices for valves for replacement than for valves sold to set makers would be considered when the conditions affecting the industry became more normal.

Railways, Radio Signalling.—Sir W. Wakefield asked the Minister of Transport what steps had been taken to provide crews of trains and those controlling train movements with modern wireless communication equipment so that they could talk with other trains and control stations in the same way as ships and aircraft. In reply, Mr. Barnes said that the possibilities of wireless communication had been the subject of experiment by the railways for some months past. Certain difficulties required to be overcome and when the necessary equipment became available, the tests would be continued.

Atomic Energy Research.—Sir R. Glyn asked the Minister of Supply if he was now in a position to make a statement in regard to the nature and condition of the water to be returned to the Thames after having been used at the Atomic Energy Research Station, Harwell. Mr. Wilmot replied that all water returned to the Thames would comply with purity standards fixed by the Medical Research Council and already agreed by the other authorities concerned. Most careful arrangements would be made to guard against any accidental discharge of radioactive water into the Thames.

Nationalisation and the Companies.—Mr. Shinwell, Minister of Fuel and Power, discussed the Government's plan to nationalise the electricity supply industry with representatives of the privately owned companies, at Millbank on Monday. The organisations represented were the Incorporated Association of Electric Power Companies, the Provincial Electric Supply Association, and the London Electric Supply Association. The discussion lasted two hours and at the close it was learned that the companies' spokesmen had decided to report back to their governing councils.

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:—

Portsmouth, December 9.—Electrical work in conversion of Annesley House and Kent Cottage, Queen's Crescent, Southsea. Particulars from City Architect, Municipal Offices, 1, Western Parade, Southsea. Deposit, £2 2s.

Bury, December 9.—Supply and delivery of: (1) 1 250 kVA, 6 500/400/230 V, three-phase transformer, and (2) 625 kVA, 6 500/400/230 V, three-phase transformers. Specifications from Engineer and Manager, Electricity Department, Market Street, Bury.

Kingston-upon-Thames, December 9.—Supply and delivery of p.i. cables. Particulars from Borough Electrical Engineer, 17, High Street, Kingston-upon-Thames, Surrey.

Cardiff, December 10.—Supply and delivery of (a) 11 kV switchgear; (b) 500 kVA transformers; (c) 11 kV and l.v. underground cables, for work at Whitchurch. Particulars from Electrical Engineer and Manager, 2, Park Place, Cardiff. Deposit, £1 1s. each.

Keighley, December 11.—Supply and delivery of four 400 kVA, 11 000/6 600/420 V, and four 800 kVA 11 000/6 600/420 V, three-phase transformers. Specification from Engineer and Manager, Electricity Offices, Coney Lane, Keighley.

Manchester, December 13.—Supply, delivery and erection at Stuart Street power station of soot blowers for Nos. 65 and 66 boilers. Particulars from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2. Deposit, £1 1s.

Heston and Isleworth, December 13.—Supply, delivery, erection and setting to work of one 10 000 kVA transformer, 21/11 kV, with on-load tap change equipment suitable for remote control. Particulars from Borough Electrical Engineer and Manager, 11, Staines Road, Hounslow, Middlesex.

Stone (Staffs), December 14.—Conversion of Longton Road pumping station from steam to electricity, for R.D.C. Particulars from Engineer, Town Hall, Stone, Staffs.

South Westmorland, December 14.—Supply of centrifugal pumps and motors,

with switchgear in duplicate, for R.D.C. Particulars from Engineer's Department, Council Offices, 30, Lowther Street, Kendal.

Epsom and Ewell, December 16.—Supply, delivery and erection of (a) one 500 kVA three-phase transformer, and (b) one ten-panel 11 kV, 150 MVA truck type switchboard. Specifications from Town Clerk, Town Hall, The Parade, Epsom, Surrey. Deposit, £1.

Cleethorpes, December 20.—Supply of four 500 kVA transformers. Specification from Borough Electrical Engineer and Manager, Showrooms and Offices, Grimsby Road, Cleethorpes, Lincs.

Essex, December 20.—Applications invited for electrical installations in two new schools, at Chingford and Chigwell. Contracts will be in the region of £2 000 each. Specifications and drawings will later be forwarded to selected contractors. Apply to: County Architect, County Hall, Chelmsford.

Leeds, December 30.—Supply and delivery of electrically operated pumping plant, with motors, switchgear, etc. Particulars from Sewerage Engineer's Office, Civic Hall, Leeds.

Camberwell, January 20.—Supply of electric lamps for 12 months. Particulars from Engineer and Surveyor, Town Hall, Camberwell, S.E.15.

OVERSEAS

New South Wales, Australia, December 23.—Supply of steam raising plant and 12 500 kW turbo-alternator and auxiliary equipment, for Port Kembla power station. Particulars from New South Wales Government Offices, London.

Victoria, Australia, January 15.—Supply of 1 500 kW automatically controlled rectifier units, for Victoria Railways. Particulars from Agent-General for Victoria, Victoria House, Melbourne Place, London, W.C.2.

Victoria, Australia, January 22.—Two 50 000 kW turbo-generators, with condensing plant, etc. Specification from State Electricity Commission of Victoria, 22, William Street, Melbourne. Deposit, £4 4s.

Mr. Emanuel Shinwell, Minister of Fuel and Power, has agreed to perform the opening ceremony, to-morrow, of the £1 000 000 extension to the Hull electricity undertaking's generating station.

Company News

DRAKE AND GORHAM.—Net prft. for yr. to June 30, £13 554 (£12 104), div. 5% (same), fwd. £34 743 (£27 439).

MONTREAL LIGHT, HEAT AND POWER CONSOLIDATED.—The company, whose properties were expropriated two years ago by the Quebec Government and are still not paid for, have declared a dividend of 25 cents, payable on January 2. This makes a total of 75 cents declared this year, compared with 45 cents in 1945.

EDMUNDSON'S ELECTRICITY CORP., LTD.—The interim dividend on the £6 750 000 ordinary capital is to be increased by $\frac{1}{2}$ % to 3% on account of the year ending March 31 next. The net profit for the half-year ended Sept. 30 last is stated as £263 596, against £206 239 for the period April-September, 1945.

YARROW AND CO., LTD.—At the annual meeting, the chairman (Sir Harold Yarrow, Bt.) said that the land boiler department was engaged on important contracts for Yarrow boilers, both home and export, for power stations and industrial establishments, and the orders on hand and anticipated would keep this department busy for some time.

ONTARIO HYDRO-ELECTRIC POWER COMMISSION.—In an interim report presented as a basis for consideration to the Ontario Municipal Electric Association, the Commission has expressed the opinion that a sum of \$200 000 000, spread over twenty years, would cover the cost of changing the present 25 c.p.s. supply in the Niagara district to 60 c.p.s., thus bringing it into line with other districts in Canada and the U.S. The proposed change, it was stated, would not materially increase wholesale rates for power, and retail consumer rates would not be raised.

ADELAIDE ELECTRIC SUPPLY Co.—A Bill has been passed by both Houses of the South Australian Parliament transferring to an electricity trust the overseas assets which the company held. The Premier described the legislation as being extremely fair to shareholders. As the trust would now have the whole undertaking, the Government considered preference shareholders should be paid the scheduled market value of their shares without deduction, and ordinary shareholders should receive the financial benefits which would accrue to them under the principal Act if it remained in its present form. The Premier emphasised that legal questions regarding the locality of the assets might cause prolonged litigation, and a valuation of the assets would be difficult and would take a long time.

FALK, STADELMANN AND Co., LTD.—Presiding at the annual general meeting, Mr. Gustav Falk, chairman and joint managing director, remarked that it was the 60th annual meeting of the company. The business had been founded by the late Mr. S. Falk in 1882; it was formed into a private limited liability company in 1887, and into a public company in 1928. Since those early days, the company had steadily progressed in all branches of its trading, and they had planned their manufacturing facilities so that they were in a position to continue development both technically and commercially to meet ever-changing conditions. The works were well equipped with plant and machinery of the most modern types, which would enable them to participate and contribute to the full in their spheres of activity pertaining to lighting, heating and cooking apparatus for domestic, industrial and commercial requirements, not only in this country, but throughout the world. Export trade was making satisfactory progress, and, whilst every effort was being made to foster this, home requirements could not be neglected where goods were still in short supply.

Metal Prices

	Monday, Price	December 2 Inc. Dec.
Copper—		
Best Selected (nom.)... per ton	£96 10 0	—
Electro Wire bars	£98 0 0	—
H.O. Wires, basis	£112 5 0	—
Sheet	£138 10 0	—
Bronze Electrical quality		
1% Tin—		
Wire (Telephone) basis per ton	£134 0 0	—
Brass (60/40)—		
Rod basis	10½d.	—
Wire	1.3½d.	—
Iron and Steel—		
Pig Iron (E. Coast Hematite No. 1) ... per ton	£8 19 0	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.	£33 0 0	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.)	£21 15 0	—
Lead Pig—		
English	£50 10 0	—
Foreign and Colonial... ..	£55 0 0	—
Tin—		
Ingot (minimum of 99.9% purity)	£384 0 0	—
Wire, basis	per lb. 4s. 10½d.	—
Aluminium Ingots ... per ton		
Spelter	£55 0 0	—
Mercury (spot)	per bott. £25 0 0	—

Prices of galvanised steel wire and steel tape supplied by C.M.A. Other metal prices supplied by B.I. Callender's Cables, Ltd. The latter prices are nominal only and do not include any allowances for tariff charges.

Commercial Information

Mortgages and Charges

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

ELECTRONIC INSTRUMENTS, LTD. (formerly ELECTROTEST, LTD.), Richmond (Sy.).—Nov. 11, assignment securing to Barclays Bank, Ltd., all monies due or to become due to the Bank; charged on certain contract moneys. *Nil. June 28, 1946.

"GLOWGEN" ALL ELECTRICS, LTD., London, W.—Nov. 8, £210 first deb., to W. Hodges, East Finchley; general charge.

Orders for Discharge

DREW, Sidney Frank, 2, Carmel Street, Abertillery, Monmouth. Radio and cycle

dealer. Court—Tredegar, Abertillery and Bargoed. Date of Order—October 17, 1946. Discharged subject to consent to judgment being entered against him in the Tredegar, Abertillery and Bargoed County Court for the sum of £33 together with £1 10s. for costs of the judgment.

BARLOW, Alfred James (trading as Barlow Brothers), 9, Brunswick Place, City Road, London. Electrical and general engineer. Court—High Court of Justice. Date of Order—October 17, 1946. Bankrupt discharged.

Receiving Order

LAWSON, Lancelot Ernest, residing at House Boat "Jean," Sheppards Boat Yard, Salford, near Bristol, and previously residing and carrying on business at 1, Northam Road, Six Dials, Southampton, under the name of Lawson's Radio, as a radio and electrical engineer. Court—Southampton. Date of Receiving Order—November 8, 1946. Debtor's Petition.

Coming Events

Friday, December 6 (To-day)

I.E.E.—London. Measurements and Transmission Sections. Discussion on "Desirable Features of Protective Relays," opened by C. Ryder and F. H. Birch. 5.30 p.m.

ILLUMINATING ENGINEERING SOCIETY, BIRMINGHAM.—Debate: "Can the I.E.S. Code be Profitably Applied to Industry?" 6 p.m.

INSTITUTE OF PHYSICS.—London. "The X-ray Examination of Radio Valves," G. Croxson, followed by "Magnified Images" (Industrial Radiology Group).

Saturday, December 7

JUNIOR INSTITUTION OF ENGINEERS.—Manchester. "Short Circuit Testing Stations for the Proving of Circuit Breakers," R. J. Birkinshaw. 2.30 p.m.

Monday, December 9

I.E.E., N.E. CENTRE.—Newcastle-on-Tyne. "The Development of the Gas-Cushion Cable System for the Highest Voltages," T. R. P. Harrison. 6.15 p.m.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—London. "The Circuit Laboratory in War-time," C. H. Wright. 5 p.m.

I.E.E., W. CENTRE.—Bristol. Summary of Papers and Lectures at the Radiolocation Convention, Dr. R. A. Smith. 5 p.m.

Tuesday, December 10

I.E.E., SCOTTISH CENTRE.—Glasgow. "De-gaussing," W. C. Potts and I. S. Fraser. 6.15 p.m.

I.E.E., N.W. CENTRE.—Manchester. "The Analysis of Vibration Problems," A. J. King.

I.E.E.—London. Radio Section. Discussion on "The Design and Performance of Receiving Aerials for Television," opened by E. C. Cork.

I.E.E., N. MIDLAND CENTRE.—Leeds.

Installations Section. Discussion on "Earthing of Low and Medium Voltage Installations, Including Telecommunications Systems." 6 p.m.

BRITISH KINEMATOGRAPH SOCIETY.—Newcastle-on-Tyne. "Fluorescent Lighting," A. G. Penny. 10.30 a.m.

BRITISH KINEMATOGRAPH SOCIETY.—Manchester. "Fluorescent Lighting," W. A. R. Stoyle. 10.30 a.m.

INSTITUTE OF PHYSICS.—Glasgow. "Beta-trons," Prof. M. L. Oliphant.

Wednesday, December 11

INSTITUTE OF WELDING.—Glasgow. "The Development of Welding Electrodes," J. H. Paterson. 6.45 p.m.

I.E.E.—London. Transmission Section. "Lightning Surges on Transmission Lines in Ireland," R. C. Cuffe. 5.30 p.m.

Thursday, December 12

BRITISH INSTITUTION OF RADIO ENGINEERS.—Glasgow. "Aircraft Radio," Flt.-Lt. C. Bovill. 6.45 p.m.

INSTITUTE OF WELDING.—Sheffield. "Developments in Resistance Welding," R. W. Ayers.

ELECTRICAL ENGINEERING SOCIETY.—London. "The Power Transformer," R. V. Darton. 5 p.m.

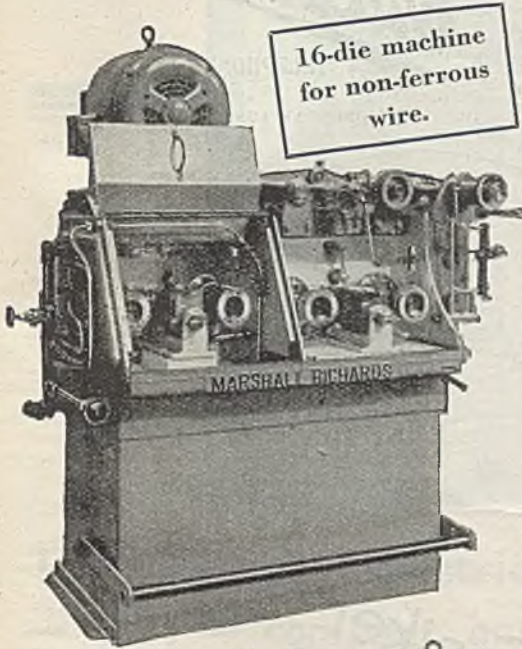
I.E.E.—London. Installations Section. "Growing Importance of Plastics in the Electrical Industry," G. E. Haefely. 5.30 p.m.

Friday, December 13

INSTITUTE OF WELDING.—Birmingham. "Electronic Controls for Resistance Welders," B. G. Higgins.

INSTITUTE OF ECONOMIC ENGINEERING.—London. "Industrial Heating," J. R. Kell. 7 p.m.

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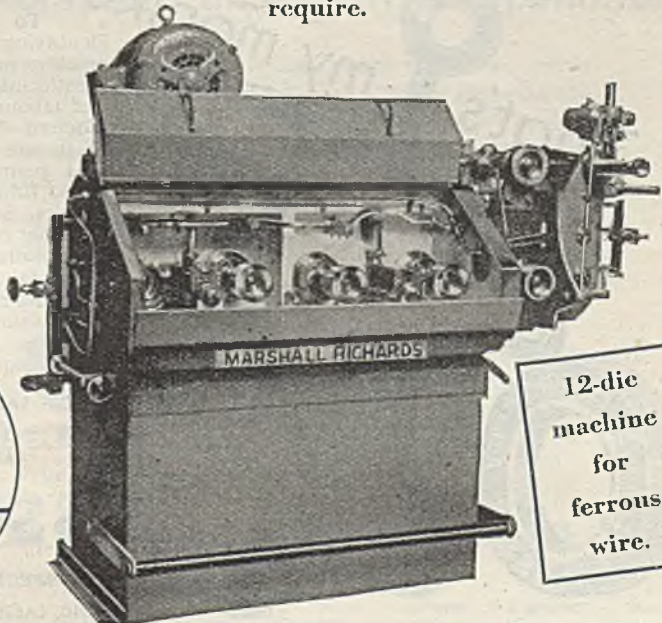


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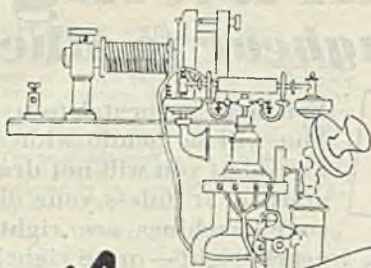


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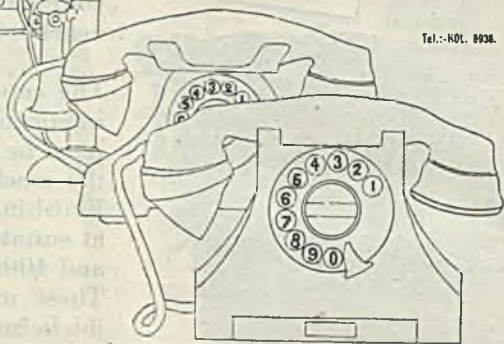


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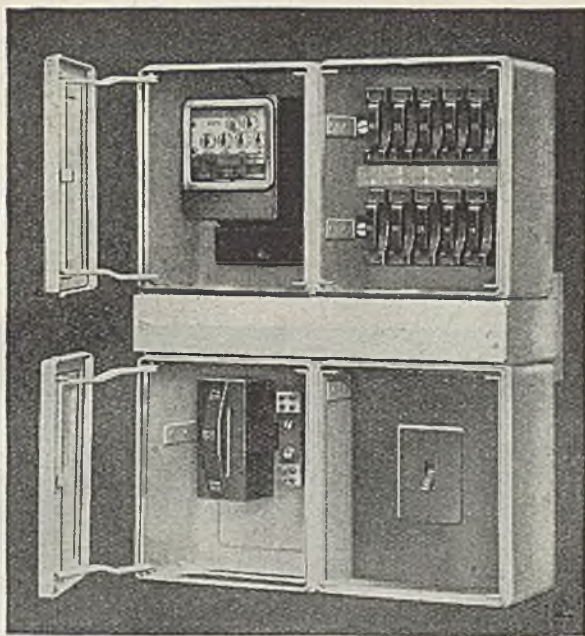
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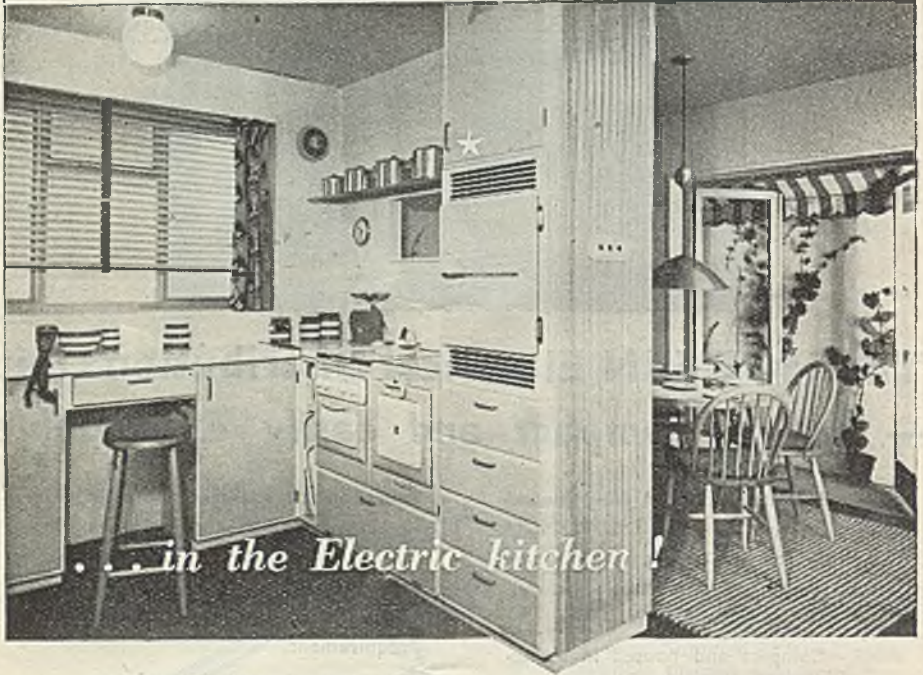
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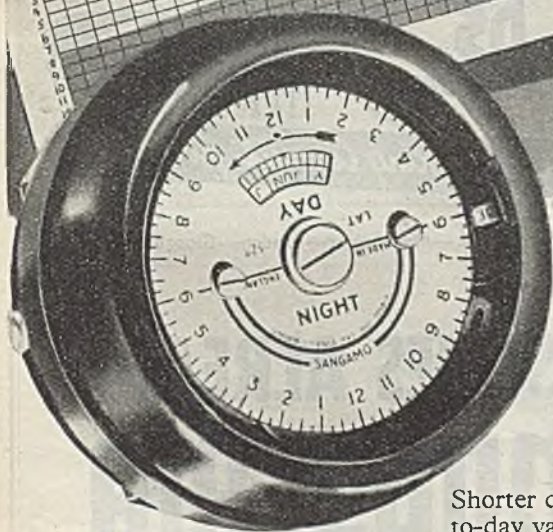
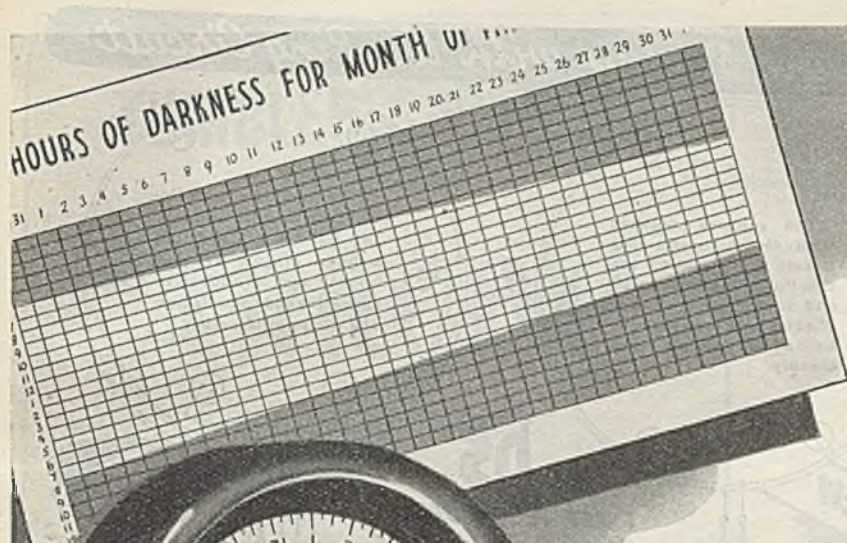
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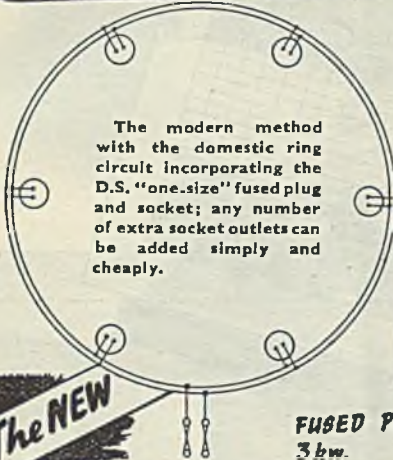
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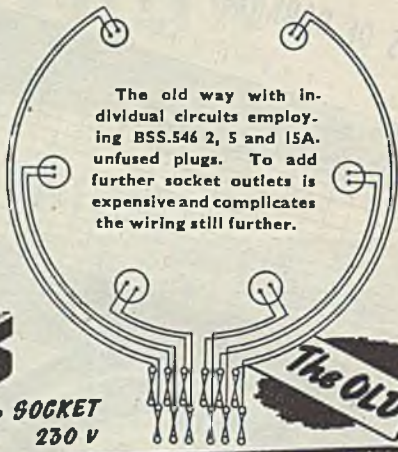
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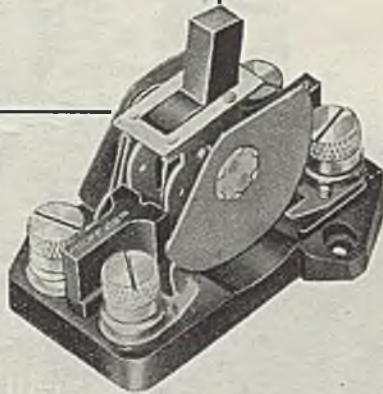
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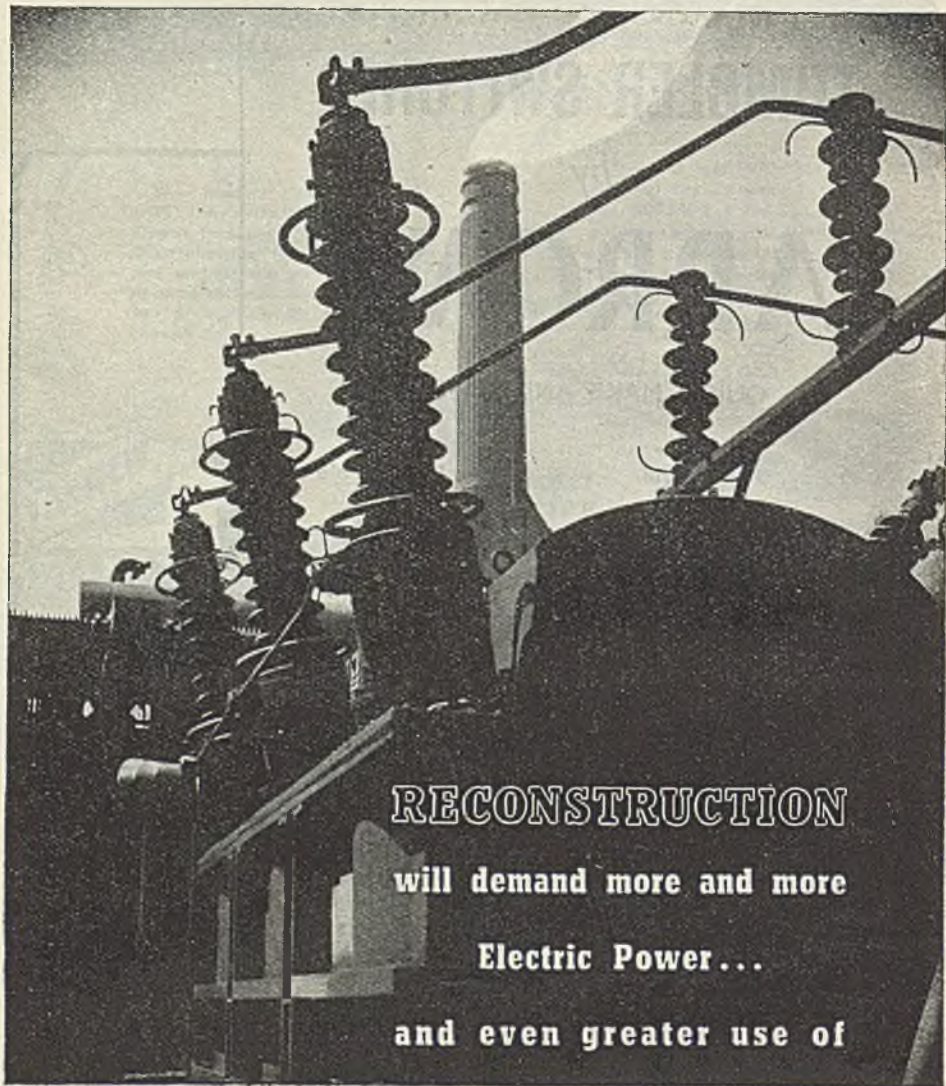
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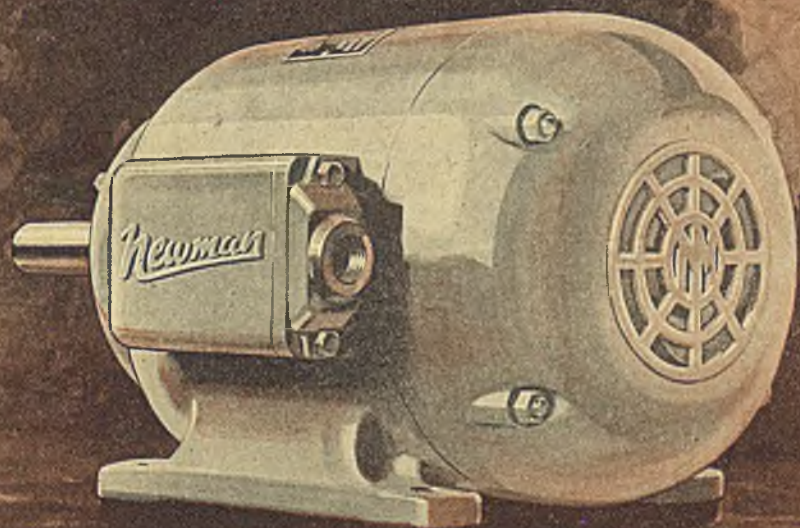


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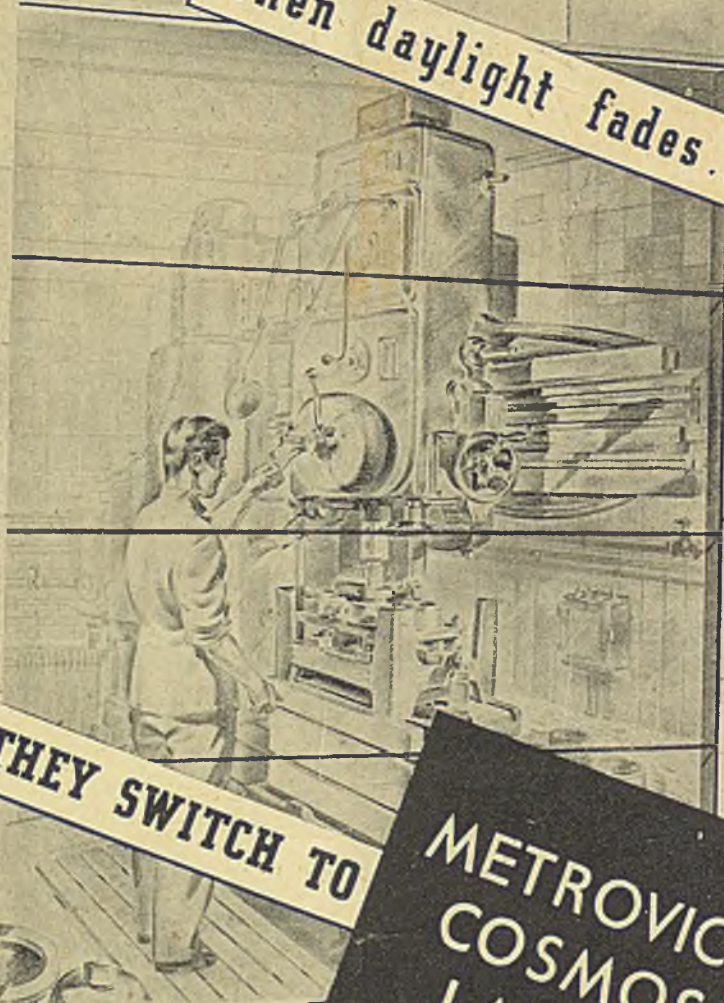


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