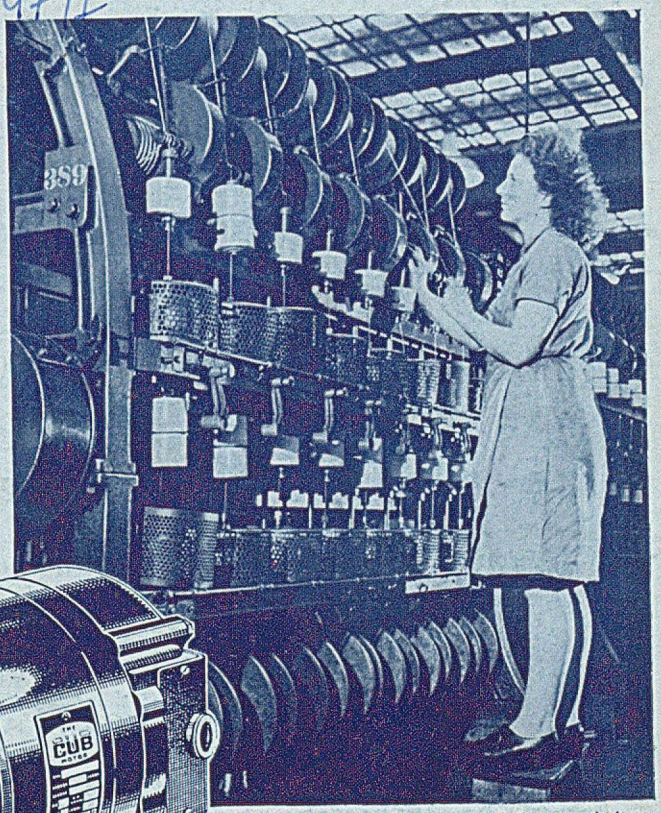
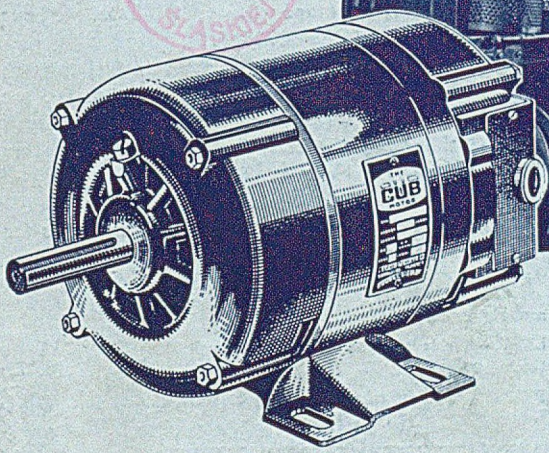
ELECTRICAL REVIEW

VOL. CXL JANUARY 17, 1947 NO. 3608

A MOTOR A MINUTE

This machine is one of a battery, insulating the wire used for stator winding. Double Cotton, cotton and enamel, or one of the nylon insulators may be used, according to the type and duty of the motor. Ten tons of wire are needed each week to maintain the output of one motor every minute.

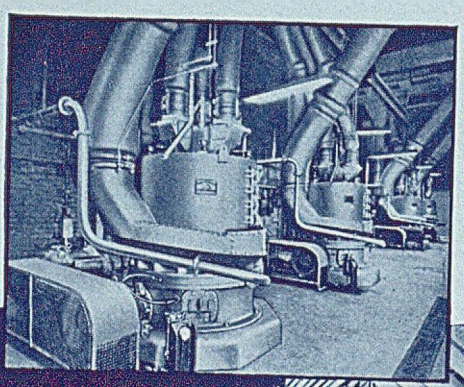


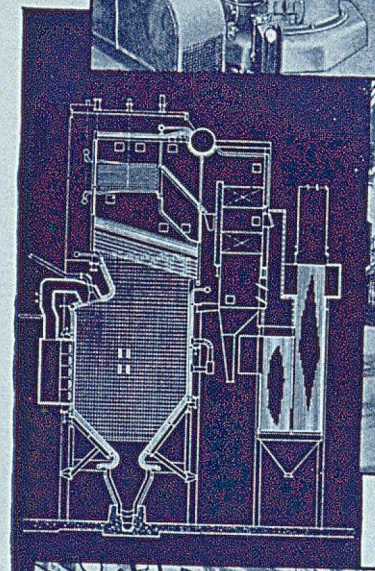


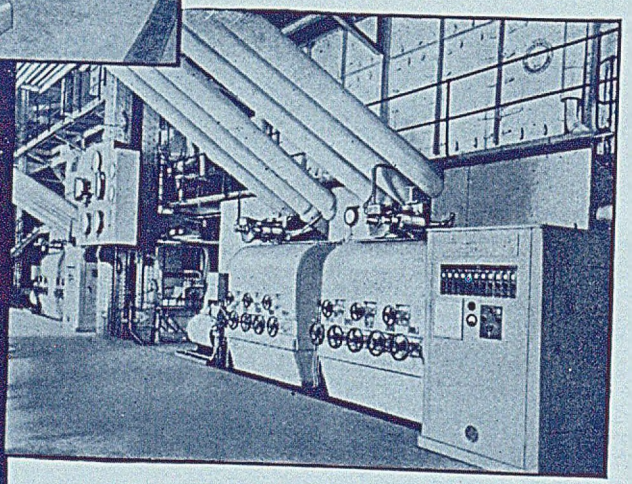
Double Covering of Copper Wire.

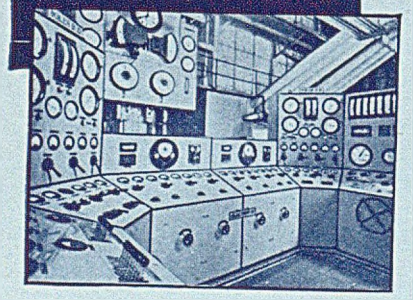
BABCOCK BOILERS

at NORTH TEES Power Station









AT the North Tees "B" Power Station of the North-Eastern Electric Supply Company Ltd., there were recently installed two B. & W. High Head Boilers each for an evaporation of 180,000 lb. per hour at 475 lb. per sq. inch and 725° F.

The boilers are fired with pulverised fuel through vertical burners direct from Type "E" Mills and are equipped with Bailey Hopper Bottom Furnaces, Self-draining Superheaters, Flash welded Economisers and Tubular Air Heaters, the boiler drums being of fusion welded construction.

Messrs. Merz & McLellan acted as Consultants for the extensions at this Station.

THE ILLUSTRATIONS SHOW :—

TOP. A view of the B. & W. Type "E" Mills in the basement.

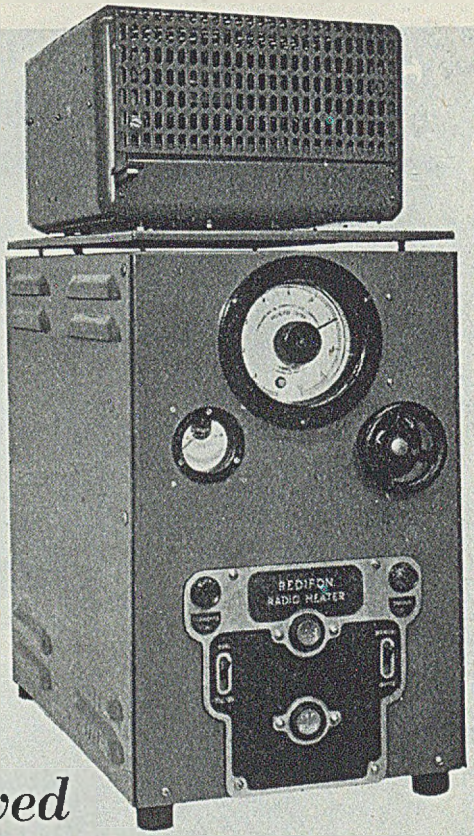
RIGHT.—A view in the firing aisle showing the burner controls and some of the automatic electrically operated soot blowers with the soot blower control panel.

LEFT.—A side sectional elevation through the boiler.

BOTTOM.—One of the boiler control panels.

BABCOCK & WILCOX LTD., BABCOCK HOUSE, FARRINGDON ST., E.C.4

BABCOCK & WILCOX LIMITED



The new Redifon R.H.23., which is equipped with an automatic process timer

New and improved low-rating Redifon Heater

Years of steady work, under the most trying production and laboratory conditions, have proved the efficiency of the Redifon 250 watt radio heater.

Now even greater use can be made of the latest model, the Redifon R.H. 23. Retaining all the features that have made the earlier model so popular for small-load production work, the new R.H. 23 is equipped with an automatic timer with ranges of up to 50 minutes in suitable divisions.

The improved circuit now gives a continuous output of over 300 watts. This output is capable, for instance, of raising 4 ozs. of normal wood-filled phenolic moulding powder through 100°C in one minute. *And power consumption is only about half a unit per hour.*

The new heating chamber, fitted with automatically adjusting electrodes and air-gap arrangements, will take loads up to 6-inches square and 2½ inches deep.

Full details of the new Redifon R.H. 23 heater, price £150 (ex works), can be obtained from our Industrial Electronics Division.

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Designers and Manufacturers of Industrial Electronic and Radio Communication Equipment

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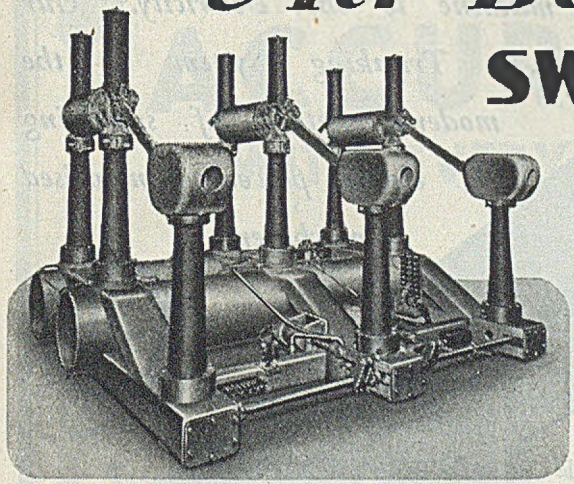
'ENGLISH ELECTRIC'

Air-Blast SWITCHGEAR

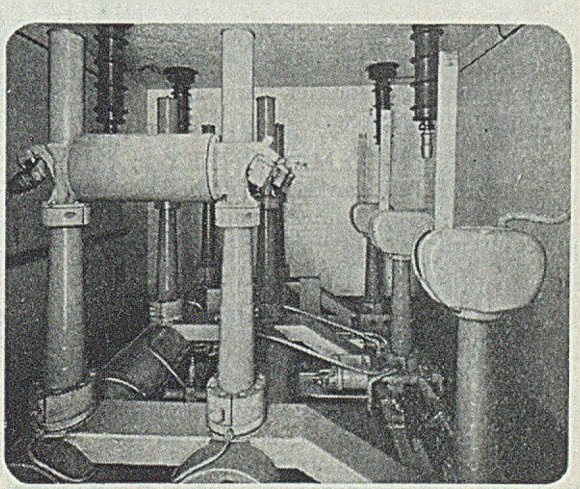


66 kV. 800A. 1500 MVA. Air-Blast Circuit- Breaker

"ENGLISH ELECTRIC," Air-Blast Switchgear can be employed for all duties to which Oil-Break Switchgear is applicable, and for all standard voltages from 3.3 kV to 275 kV.

Important features

Elimination of oil fire hazard.
High speed operation.
Rapid arc interruption.
Consistent performance.
Extremely low arc energy.
Minimum maintenance.
Minimum contact erosion.
Mechanical simplicity
Compact and space saving.
All parts easily accessible



Interior view of a block-house containing an 'English Electric' 66 kV. Air-Blast Circuit-Breaker forming part of an outdoor substation installation.

Publication SG/105B obtainable on request from Switchgear Dept. Stafford.

THE ENGLISH ELECTRIC COMPANY LIMITED

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By the way — J & P are Foundation Members of the C.M.A and have always been to the fore in the manufacture of high quality cables — worth remembering!

JOHNSON & PHILLIPS LTD.

Electrical Engineers and Cable Makers since 1875

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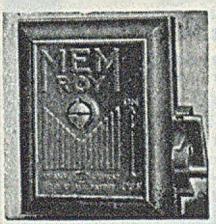
The mark that means that "little more" in quality

If it rained cats and switches

If switchgear rained from the skies, M.E.M. could forget shortages, controls and restrictions and supply the present heavy requirements without delay. Yet even in these hard, practical times, output is being steadily increased and the goods are going out with all possible speed to the wholesalers. They in turn are doing a splendid job of work in distributing all available supplies fairly and equitably. You'll get your supplies more quickly through your wholesaler.



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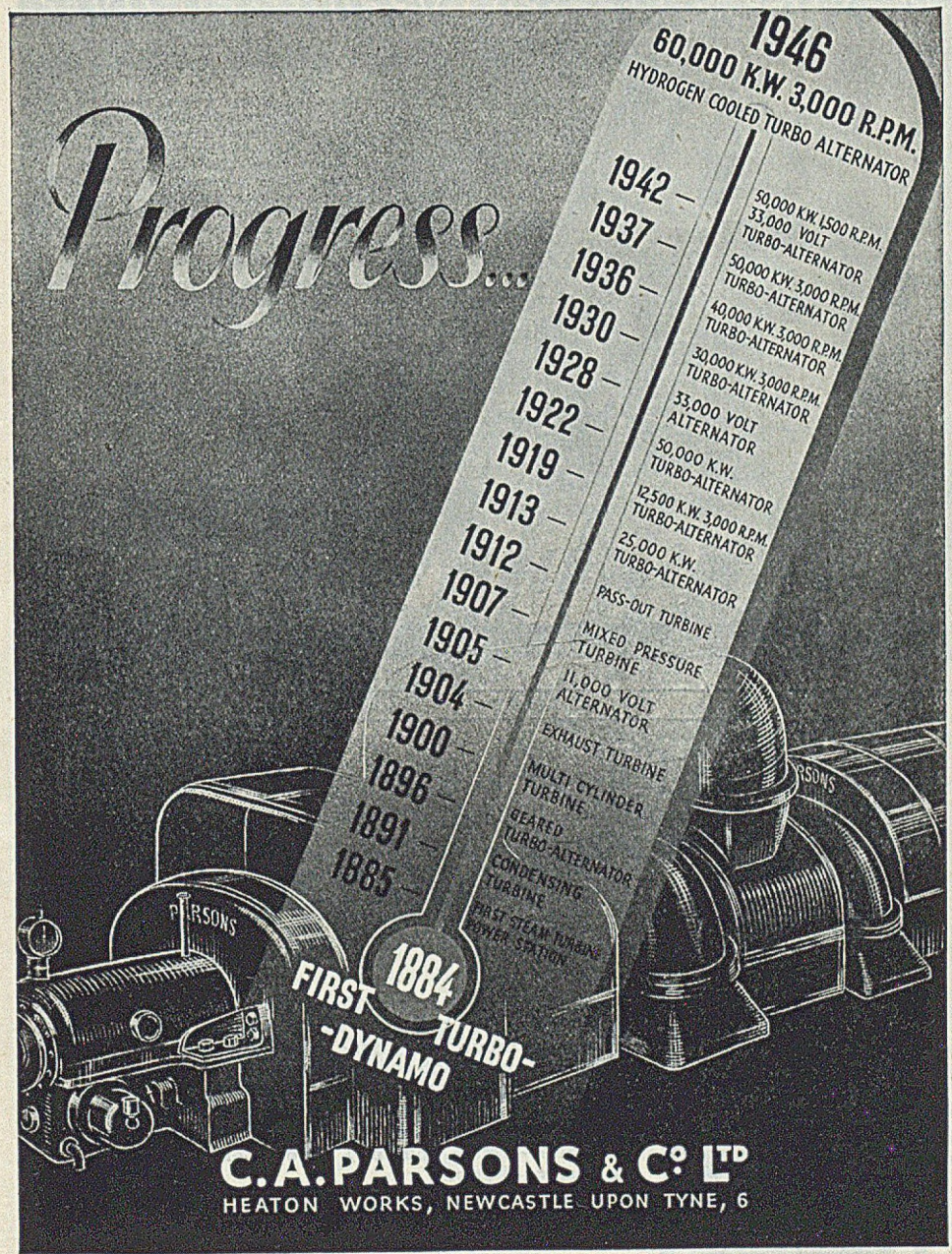
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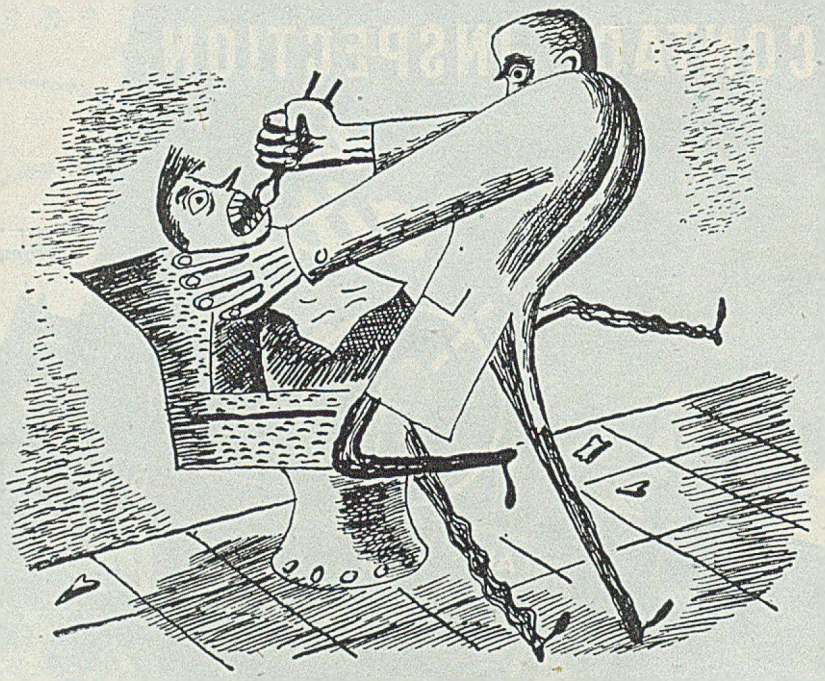

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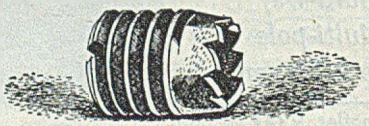

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ELECTRICAL REVIEW

January 17, 1947

Managing Editor :
Hugh S. Pocock, M.I.E.E.

Technical Editor : C. O. Brettelle, M.I.E.E.

Commercial Editor : J. H. Cosens

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXL. No. 3608 JANUARY 17, 1947 9d. WEEKLY

Electricity Nationalization

Doubts and Fears

AT last the Bill has appeared, setting at rest many doubts but raising many more. It is a comprehensive, complicated measure. Details of the Bill are given elsewhere in this issue; here we deal with some of the numerous questions which arise from it.

A main feature is the separation of generation and main transmission from retail distribution by the setting up of a British Electricity Authority and fourteen Area Boards. The North of Scotland Hydro-Electric Board remains both a generating and distributing authority and is separately treated in most respects.

Areas have been so delimited as to attempt to secure a balance of rural and urban territory (except in the case of the London area) and probably for this reason seem unduly large. The "personal" contact which is essential in the business of electricity supply is to be preserved by local committees or representatives.

Manufacturing Powers

The British Electricity Authority will exercise control over the Area Boards. It is also given powers to manufacture "electrical plant and electrical fittings." This is not a pleasant prospect even though a verbal assurance may be given by the Minister that these powers will not be exercised unless manufacturers prove "awkward." If this provision may be regarded as a bargaining device, it is to be hoped that it will remain so, and not be unfairly used. But in our opinion a permanent threat to the manufacturing industry such as this clause provides ought not to be incorporated in the Act. It cannot fail to create uncertainty and mistrust as to the future.

The Authority may also sell, hire or otherwise supply and install plant and fittings: the Area Boards' powers in this respect are confined to fittings. In the cases of both Authority and Boards there is an omnibus clause which appears to offer unlimited scope for activities in any direction. Existing undertakings possess the powers invested in the Area Boards but not all of them have gone into the appliance and installation business. We may expect the Boards to take greater advantage of these powers but they will be wise if they find contractor-retailers already serving the public efficiently to leave well alone.

Inadequate Compensation

In the acquisition of existing undertakings by the Central Authority several questions remain open. Compensation terms are somewhat on the lines adopted for transport; at least they are based on Stock Exchange quotations at specified dates. The Minister considers this to be a fair arrangement but it is the general opinion that on the dates in question stocks and shares were greatly undervalued by reason of fears of early nationalization. It is estimated that about £370 million of the new British Electricity Stock will have to be issued for the companies' assets: it will probably bear interest at the rate prevailing on Government stocks at the date of vesting, and holders will inevitably suffer a serious loss of income.

Many municipalities will be displeased at the omission to take rate relief into account in providing for the acquisition of their undertakings (at a cost of about £200 million), but little sympathy can be felt for them on this account.

Ministerial Control

THE Minister of Fuel and Power will dispense a great deal of "patronage." He will appoint all the members of the Authority and Boards (something like 120) but as he will desire the scheme to succeed he will no doubt choose the members for their ability rather than from political considerations. He will also appoint the (unpaid) Consultative Committees. Under Clause 5 he will have wide powers of direction over the Central Authority and may suppress disclosure of any direction in the "national interest" —a somewhat sinister provision which should be deleted. Misgivings regarding the potentialities of this close Ministerial control are inevitable. We can only hope that the present Minister and his successors will be sufficiently realistic to appoint the best available men to the new authorities and interfere with them as little as possible.

Possible Hardship

THE disappearance of the individual supply undertakings — municipal, company, joint authority and joint board—will render their representative associations redundant. The Electricity Bill includes provisions for compensation for loss of employment or worsening of conditions suffered by employees of the merged undertakings but no account is taken of the possible effect of reorganization upon a wider circle. No doubt the principal officers of the associations will be offered appropriate positions with the new authorities, but provision must be made to prevent hardship to their staffs. It is possible that sufficient funds will be available for this purpose upon the winding-up of the associations; otherwise some other arrangements should be made.

Development Propaganda

WHILE the terms of appointment of the Central Authority and the Area Boards appear to permit them to engage in development propaganda if they think it "requisite, advantageous or convenient" there is no direct reference to this subject. Reliance appears to be placed mainly upon the cheapening of supply and appliances. This leads to speculation regarding the future of the British Electrical Development Association, whose funds are drawn from undertakings which are now to disappear. That there is a need for such a body to educate the public in electrical matters has been recognized by the Central Electricity Board which has afforded substantial support. Will the new Central Authority, which supersedes the Board, keep this useful institution in being? There is a possibility that Clause 13 (7), which relates to the taking over of authorities' obligations, may cover such a case as this.

Output in 1946

DURING the past twelve months, the 10 per cent that has come to be generally regarded as the normal rate of growth of power station output has been well maintained. The 41,240 million kWh shown by the Electricity Commissioners' returns to have been generated (38,922 million sent out) was 10 6 per cent above the 1945 figure and rather more than twice the output of ten years ago. If the accelerated growth represented by last month's increase is a criterion for the immediate future, however, the rate of growth this year may well be higher, as the 4,372 million kWh generated (3,679 million sent out) was 18·8 per cent above the figure for December, 1945.

Drilling in Mines

ELEVEN ignitions of fire damp during the past six years that have been associated with the use of electric drills have had two features in common, viz., defective ventilation and concurrent open sparking due to electrical faults. In M. F. P. Circular No. 153, Mr. J. R. Felton, Chief Inspector of Mines, refers to inadequate maintenance of electrical apparatus as the root cause of the second feature, coupled with misuse and unauthorized interference with its functioning. He urges the need for the frequent examination of drilling equipment by properly qualified electricians and for the instruction of workmen in its careful use. Such precautions to be entirely effective should be accompanied by a greater use of electricity to provide more and better ventilation.

The Electricity Bill

Summary of Provisions and White Paper

THE full text of the Electricity Bill, which was introduced into Parliament by Mr. Shinwell on December 20th, as reported in the *Electrical Review* of December 27th, is now available (Stationery Office, 1s. 6d. net). Its purpose is declared to be the co-ordination under public ownership of the electricity supply industry and it provides for the establishment of a British Electricity Authority and Area Electricity Boards, to which would be transferred the property and obligations of all electricity supply undertakings.

The function of the British Electricity Authority, referred to in the Bill as "the Central Authority," is to maintain and develop an economical system of electricity supply for all parts of Great Britain except the area of the North of Scotland Hydro-Electric Board. Its main duties are fivefold, viz.:—To generate or acquire supplies of electricity; to give bulk supplies to Area Boards; to co-ordinate the distribution of electricity by those Boards and exercise general control over their policy; to supply consumers directly when authorized to do so; to conduct research into matters affecting the supply of electricity.

Area Boards' Functions

Fourteen Area Boards, are to be established for distribution in their own areas or, by mutual agreement, in each others' areas. They may also purchase electricity from other Boards or persons, subject to the approval of the Central Authority. Included in their functions are the simplification of consumers' tariffs, the standardization of systems of supply and types of electrical fittings and the training and safety of employees.

Apart from provisions relating to the regulation of the electricity supply industry, the Bill seeks to invest the Central Authority with additional powers, undefined in their scope, to manufacture electrical plant and fittings and also to authorize Area Boards to sell or hire electrical fittings but not plant unless authorized to do so by the Central Authority. Plant is defined as equipment used for generating, transmitting and distributing electricity excluding electrical fittings. The latter term covers consumers' lines and apparatus for all purposes for which electricity can be used.

The Central Authority is to be composed of a chairman and not more than six other members appointed for their special qualifications by the Minister of Fuel and Power; not more than four of these may be chairmen of Area Boards. Every Area Board will consist of a chairman and not more than seven other members, similarly appointed by the Minister, and the chairman of the Consultative Council to be set up in each Area. Remuneration is to be determined by the Minister with the approval of the Treasury. The Minister may make regulations regarding the appointment and the tenure and vacation of office of the members of the Central Authority and Area Boards; subject to these provisions the Central Authority and Area Boards will regulate their own procedure.

Consultative Councils

Each Consultative Council will consist of from twenty to thirty persons appointed by the Minister. Not less than half shall be appointed from a panel nominated from among members of local authorities by representative associations; the remainder will represent consumers and others interested in electrical development in the Area concerned. These Councils will be charged with the duty of considering any matter affecting the distribution of electricity in their Areas including the variation of tariffs and the provision of new services and they may submit schemes to the Minister for the appointment of local committees or individuals to report on distribution matters.

As regards the acquisition of land, the expression "land" includes easements and an Electricity Board may purchase compulsorily a right to place an electric line across land, above or below ground, and to repair and maintain it without purchasing any other interest in the land.

Vesting Arrangements

On a date to be named by the Minister, the assets and liabilities of the following bodies are to be transferred from their present ownership:—Authorized undertakings including the Central Electricity Board; companies not being authorized undertakings where

their business consists mainly in constructing, owning or operating power stations; holding companies other than authorized undertakings, three-quarters of whose assets before 1946 comprised interests in the two previous types of bodies. The Central Authority will take over the Central Electricity Board, power station and holding companies, together with all generating stations and main transmission lines and the Area Boards will take over the remainder. The transfer of electricity undertakers' rights, liabilities and obligations are provided for.

Terms of Acquisition

Holders of securities of any body transferred, other than a local authority, are to be compensated in the form of British Electricity Stock of such an amount as the Treasury shall consider to be a value equal on the date of issue to the value of the securities. The latter will be taken as the average market value on November 1st, 4th, 5th, 6th, 7th and 8th last, or the average market value on February 15th, March 15th, April 16th, May 15th, June 15th and July 16th, 1945, whichever is the higher. Local authorities are to be compensated by payments to cover interest and sinking fund charges on the debts of their undertakings and, in certain circumstances, capital expenditure incurred after November 19th, 1945.

Restrictions on Companies

Interest and dividend payments by transferred bodies after January 10th, 1947, are limited to 4 per cent per annum or the annual rate paid as final dividend for the last complete financial year before that date, whichever is the higher. Arrangements are included to prevent the disposal of assets between January 10th, 1947, and the vesting date. Modifications are made in income tax provisions to allow for the financial arrangements included in the Bill. No body to be transferred may acquire foreign investments and those in existence are to be disposed of in such manner as may be prescribed. An arbitration tribunal of four to be appointed by the Lord Chancellor and the Lord President of the Court of Session, will be established to determine any question or dispute relating to the transfer of undertakings.

The Central Authority will be required to ensure that the combined revenue of itself and of the Area Boards is not less than sufficient to meet their combined outgoings, taking one year with another. It may require the Boards to contribute towards obligations arising out of payment of compensation or the borrowing of money.

British Electricity Stock issued by the Central Authority in respect of compensation will be guaranteed, both as to principal and interest, by the Treasury, which may on its own conditions also guarantee other borrowings by the Central Authority. The Area Boards may also raise temporary loans under Treasury guarantee. At any time the total sum outstanding in respect of stock and loans is not to exceed £700 million.

The Central Authority will form and manage a central reserve fund. Area Boards will also contribute to this fund and may, out of surplus revenues, form and manage local reserve funds; one purpose of these reserves will be the prevention of fluctuations in charges for electricity.

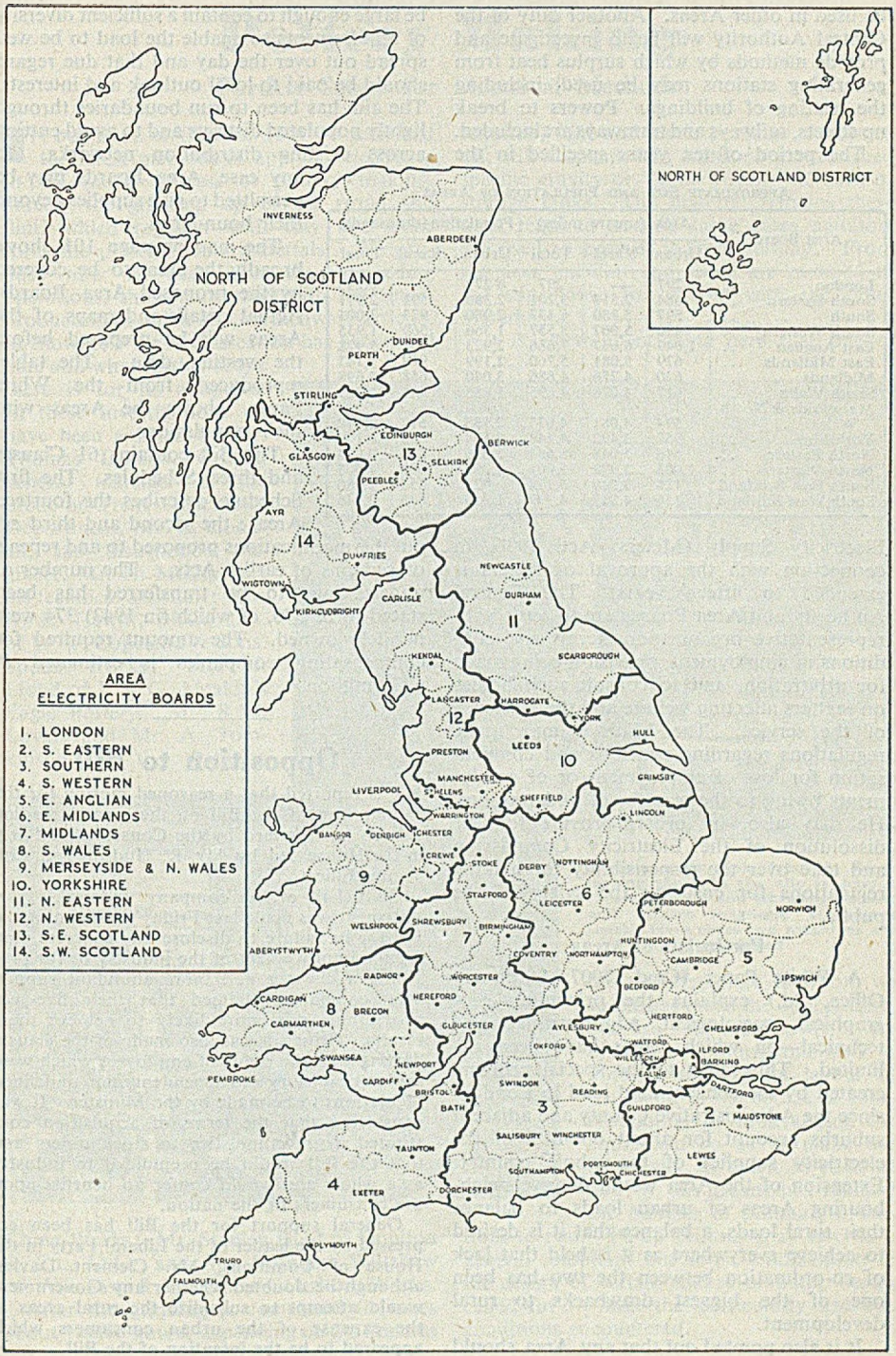
Scottish Hydro-Electric Board

The North of Scotland Hydro-Electric Board will exercise the functions of both Central Authority and Area Board and will be responsible to the Minister of State for Scotland and not to the Minister of Fuel and Power, and numerous references are made to it in the Bill. Thus its powers are to be extended from the generation of electricity by water to generation by any other means and the £30 million fixed as the upper limit to its borrowings under its Act of 1943 is raised to £100 million.

The Minister of Fuel and Power is authorized, after consultation with the Central Authority, to give general directions to the Authority as to the exercise of its functions in relation to matters that appear to the Minister " to affect the national interest," and in its Annual reports the Authorities will set out any such directions unless it is notified by the Minister that it is against the national interest to do so. In framing programmes of reorganization or development involving substantial capital outlay, the Central Authority will act on lines settled from time to time with the approval of the Minister.

Railway Supplies

Among other provisions of a miscellaneous character is one that requires the Central Authority to supply electricity to railways on terms to be settled by regulations made jointly by the Minister and the Minister of Transport. An Area Board may give supplies to railways only with the consent of the Central Authority and such supplies may


NORTH OF SCOTLAND DISTRICT
INVERNESS
ABERDEEN
NORTH OF SCOTLAND DISTRICT
DUNDEE
PERTH
STIRLING
EDINBURGH
BERWICK
GLASGOW
13
SELKIRK
PEEBLES
AYR
14
DUMFRIES
NEWCASTLE
WIGTOWN
CARLISLE
DURHAM
KIRKCUDBRIGHT
11
KENDAL
SCARBOROUGH
AREA
ELECTRICITY BOARDS
1. LONDON
2. S. EASTERN
3. SOUTHERN
4. S. WESTERN
5. E. ANGLIAN
6. E. MIDLANDS
7. MIDLANDS
8. S. WALES
9. MERSEYSIDE & N. WALES
10. YORKSHIRE
11. N. EASTERN
12. N. WESTERN
13. S.E. SCOTLAND
14. S.W. SCOTLAND
LANCASTER
HARROGATE
YORK
12
HULL
LEEDS
PRESTON
10
MANCHESTER
GRIMSBY
LIVERPOOL
ST HELENS
SHEFFIELD
WARRINGTON
LINCOLN
BANGOR
DENBIGH
CHESTER
CREWE
STOKE
DERBY
NOTTINGHAM
9
STAFFORD
LEICESTER
6
PETERBOROUGH
NORWICH
WELSHPOOL
SHREWSBURY
BIRMINGHAM
7
HUNTINGDON
ABERYSTWYTH
COVENTRY
NORTHAMPTON
CAMBRIDGE
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RADNOR
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HEREFORD
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BRECON
HERTFORD
CARMARTHEN
GLOUCESTER
AYLESBURY
CHELMSFORD
WATFORD
OXFORD
ILFORD
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NEWPORT
BARKING
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EALING
PEMBROKE
CARDIFF
SWINDON
READING
DARTFORD
BRISTOL
BATH
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GUILDFORD
2
MAIDSTONE
SALISBURY
WINCHESTER
TAUNTON
LEWES
SOUTHAMPTON
PORTSMOUTH
CHICHESTER
4
EXETER
DORCHESTER
PLYMOUTH
TRURO
FALMOUTH

be used in other Areas. Another duty of the Central Authority will be to investigate and provide methods by which surplus heat from generating stations may be used, including the heating of buildings. Powers to break up streets, railways and tramways are included.

The period of ten years specified in the Electricity Supply (Meters) Act, 1936, in connection with the approval of meters is extended to fifteen years. The Central Authority and Area Boards are to settle with representative organizations terms and conditions of employment, provision being made for arbitration, and to consult such bodies on matters affecting welfare and the efficiency of the service. The Minister may make regulations regarding pensions and compensation for loss of employment or of emoluments owing to the transfer of undertakings. He may also, by order, provide for the dissolution of the Electricity Commission and take over the responsibility for making regulations for ensuring the safety of the public.

APPROXIMATE SIZE AND POPULATION OF AREAS

Area Board	Area (square miles)			Population (thousands)		
	Urban	Rural	Total	Urban	Rural	Total
London	297	—	297	6 273	—	6,273
South Eastern ..	684	2,517	3,201	2,380	591	2,971
South	597	5,880	6,477	2,080	923	3,003
South Western ..	490	5,067	5,557	1,366	569	1,935
East Anglian ..	1,049	6,637	7,686	2,923	1,005	3,928
East Midlands ..	679	5,081	5,760	2,199	948	3,147
Midlands	630	4,256	4,886	3,040	658	3,698
South Wales ..	617	4,078	4,695	1,485	444	1,929
Merseyside & North Wales	594	4,081	4,675	2,153	517	2,670
Yorkshire	952	3,492	4,444	3,584	595	4,179
North Eastern ..	616	5,048	5,664	2,336	538	2,874
North Western ..	1,003	3,998	5,001	4,097	408	4,505
South East Scotland	126	3,048	3,174	923	357	1,280
South West Scotland	156	4.843	4,999	1,913	633	2,546

Particulars of Areas

A White Paper (Cmd. 7007, Stationery Office, 2d.) explains the principles—geographical, sociological, administrative and technical—on which Areas have been delimited. This refers to the special problem created by the concentrated load in London, since the Administrative County and adjacent suburbs account for about one-fifth of the electricity supplies of the whole country. Extension of the Area would deprive neighbouring Areas of urban loads to balance their rural loads, a balance that it is desired to achieve everywhere as it is held that lack of co-ordination between the two has been one of the biggest drawbacks to rural development.

It is also pointed out that any Area should be large enough to contain a sufficient diversity of requirements to enable the load to be well spread out over the day and that due regard should be paid to local outlook and interests. The aim has been to run boundaries through lightly populated districts and to avoid cutting across existing distribution networks. In any case, Area Boards may be permitted to give supplies beyond their boundaries.

The map on page 101 shows broadly the areas to be covered by the proposed Area Boards. Actual details and maps of the Areas will be prepared before the vesting date. The table, reproduced from the White Paper, shows the Areas with their populations.

The Bill contains 61 Clauses and three Schedules. The first Schedule describes the fourteen Areas; the second and third set out the modifications proposed to and repeals of sections of earlier Acts. The number of undertakings to be transferred has been stated to be 570, of which (in 1943) 374 were publicly owned. The amount required for compensating companies is estimated at £370 million.

Opposition to Bill

IT is reported that a reasoned motion for the rejection of the Bill on the second reading will be put forward by the Conservative Party in the House led by Mr. R. Hudson and Col. Walter Elliott.

On behalf of the company undertakings a statement was made last Friday condemning the Bill for its failure to disclose any concrete plan for the improvement of the industry or for providing a cheaper and more abundant supply. The companies claimed that their five-year programme was more likely to achieve these results. Criticism was also made of the clauses dealing with the rights of employees which were said to be illusory and dependent upon undefined regulations to be made by the Minister. It was considered that the terms of acquisition constituted a grave injustice to stockholders and that the Bill would be prejudicial to industry as a whole and would confer no benefits upon the consumers or the nation.

General support for the Bill has been expressed by the leader of the Liberal Party in the House of Commons, Mr. Clement Davies, although he doubted whether any Government would attempt to subsidize the rural areas at the expense of the urban consumers which appeared to be the intention of the Bill.

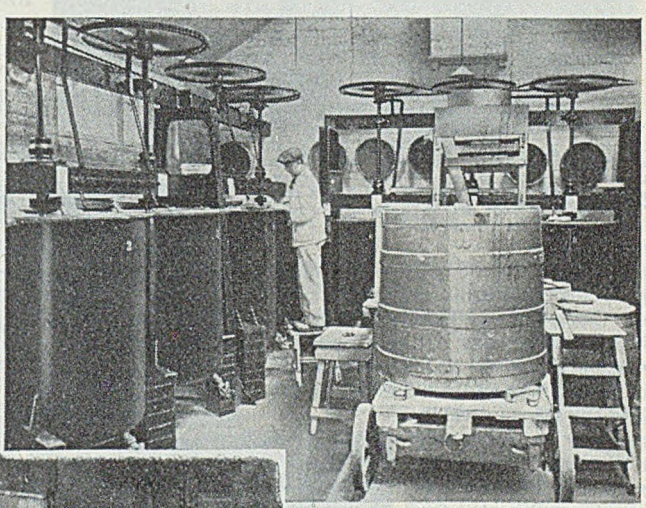
Pottery Making

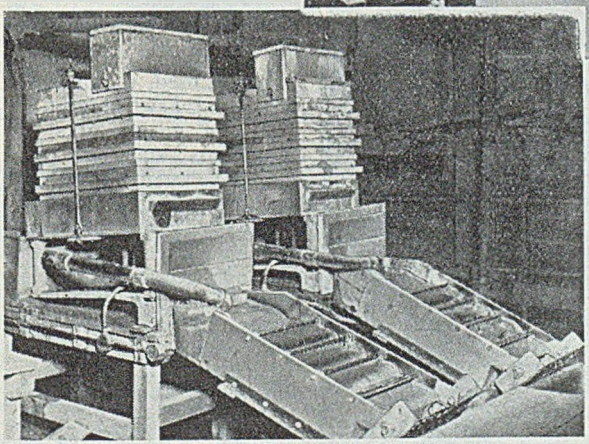
Further Scope for Electrical Methods

IN our issue of October 11th we described the latest methods of applying electricity to the initial process of pottery making, namely the grinding up of the stone and flint, which together with clay and bone form the principal raw materials. We propose now to deal with the succeeding operations, those concerned with the actual production of china and earthenware articles, to show how far electrification has proceeded here and what further scope there is for its adoption. In these investigations we have been assisted by Mr. Thomas Lockett, O.B.E., general manager of the Stoke-on-Trent Electricity Department, Mr. L. Goodall, his distribution engineer, Mr. H. McCartney, his technical assistant; Mr. A. E. Hewitt, M.C., J.P., of W. T. Copeland & Sons' Spode Works; Mr. H. Lloyd of J. & G. Meakin's Eagle Pottery; Mr. R. J. Lovatt and Mr. A. Tomkinson of the Paragon China Works; Mr. Stanley Hind of Doulton & Co., Ltd.; and Mr. Cuthbert Wiltshaw of Wiltshaw & Robinson's Carlton Works.

After the grinding is completed (it takes about twelve hours, depending on the fineness required) flint and stone particles are drawn off, still suspended in water to a prescribed specific gravity or "pint weight," to arks or storage tanks. The material remains there until required and in some cases agitators are used to prevent it from settling. From the arks the flint and stone are pumped to the slip house for mixing with the other ingredients.

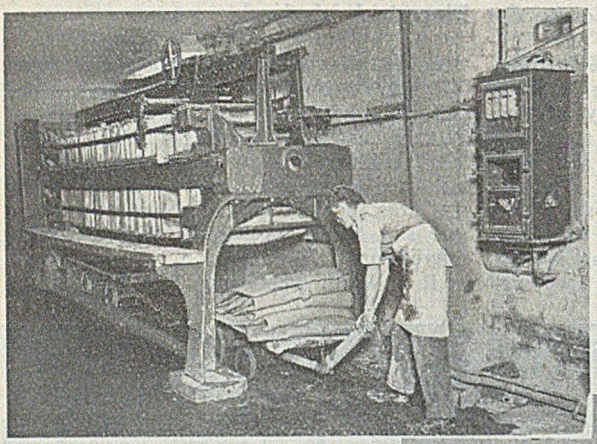
It is worth mentioning here that one of the manufacturers to whom we spoke has taken the opportunity, because of breakdowns with older type pumps and also to improve the general layout of the plant, in the course of some rebuilding, of re-arranging the equipment so as to make use of gravity as much as possible and by this means has reduced the number of pumping operations to two. Pump failures may not be a general complaint but some modification in the design of certain makes of pump seems called for to meet the particularly arduous conditions encountered.

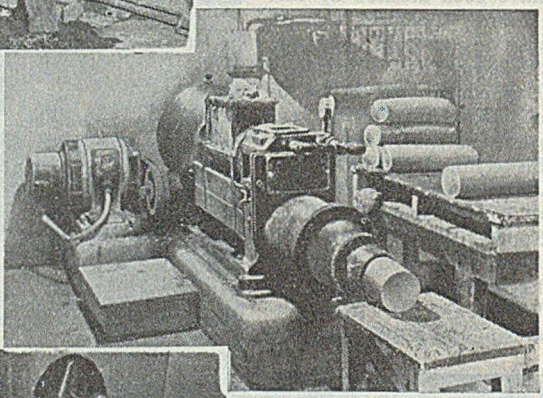




Glaze storage tanks (above). After leaving the arks the slip is passed through sifters and vibrating screens and electro-magnetic separators (left). Here these two machines are combined

For earthenware, approximately equal proportions are used of stone, flint and two varieties of clay—ball clay, generally obtained from North Devon or Dorset, and the lighter, more brittle china clay from Cornwall. Considerable use is now made of electric hoists and winches for handling the skips in which the raw materials are transported about the works. Before the clays are ready for mixing with the stone, flint or calcined bone, they have to spend from half an hour to two hours in blungers or rotary kneading pans where they are reduced by means of agitators to a fine cream. The pans are of various sizes with capacities of between 10 and 40 cwt each and in the older factories are generally belt driven from a line shaft or countershaft from a central steam engine, which also provides steam for drying the ware and for factory heating. In the more up-to-date potteries, however, the practice is to use individual drive for these as well as for practically every other mechanical aid which is employed. One by one the obsolete steam engines, some of them fifty or more years old and still working, are being discarded and the large amount of space which they occupy is being more profitably used for productive work. Pottery manufacturers also achieve big savings in operating costs through the change-over to electricity. • A 7½-H.P. motor, which in view of the high starting torque must be of the slip-ring type unless a clutch is used, is ample for driving a 20-cwt blunger.





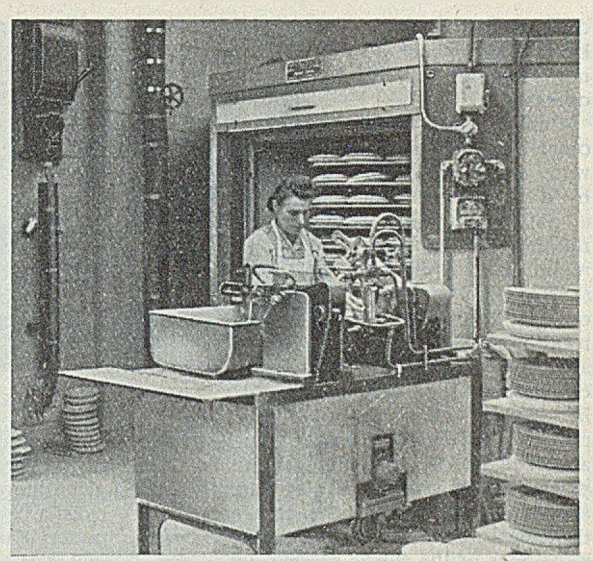
Above: Electrically operated and fully automatic clay press. Right: Pugging mills knead the clay and force out the air. The 12-H.P. motor drives the machine and its compressor

In the mixing arks the ingredients are kept constantly agitated. Here, too, there is a strong tendency to change from group to individual electrical drive employing vertical squirrel-cage motors with integral gear boxes. From intermediate arks where it is stored to await further treatment, the material, or slip as it is called, goes on to sifters or vibrating screens incorporat-

"Thrower" making cups on a potter's wheel. Infinitely variable speeds over a wide range are obtainable by means of two cones incorporated in the drive

ing fine lawn filters, normally of 100, 110 and 130 mesh. Most of these sifters have an output varying from 300 to 500 gallons per hour and incorporate motors of about ¼ H.P. transmitting the shaking motion by means of a cam.

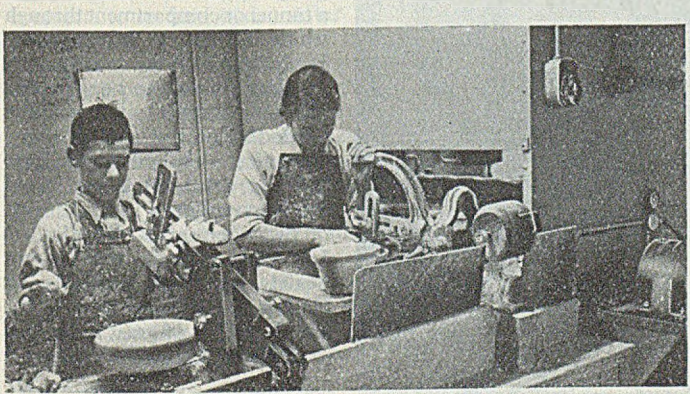
Separators, embodying magnetic bars over which the slip passes, then remove any iron or steel particles. For this apparatus, rectifiers provide direct current and as a safety precaution automatic arrangements are made for the slip to be returned to the arks should the electricity supply fail. Alarm bells and signal lights are also frequently used in order to draw immediate attention to faults developing in any particular apparatus.



Experimental electrically operated automatic plate jigger which does not require a skilled operator. In the background is a drying machine

From the electro-magnetic separators, the slip goes to the finished ark (constantly agitated) whence it is taken as required by displacement type pumps (with porcelain rams) to filter presses consisting of calico bags placed and, when filled, squeezed between metal or wooden plates. Most of these presses are still worked laboriously by hand, although some manufacturers have installed fully automatic presses fitted with small geared motors. With most of the water squeezed out, the clay, now in plastic slabs about 2 ft square, is transported to pug mills, which are something like giant sausage machines. By means of rotating cutters in the form of a worm wheel these pugs knead the clay in a sealed container and with the aid of an exhaust pump force out the air. For an 8-in. diameter pug a 12-H.P. motor is suitable for the drive with a separate 2-H.P. motor for the air pump. As the starting torque of the pug is high and a steady start is essential, particularly when the container is partly full, a slip-ring motor is necessary unless a clutch is employed.

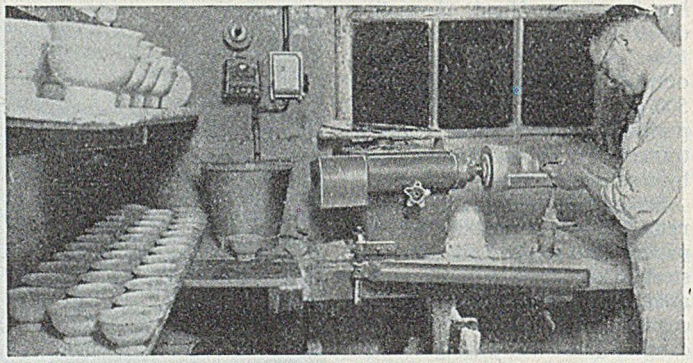
Leaving the pugging machines, the wads of solid clay go in skips to the potters' shop, where they are dealt with in various ways according to the article being made. For plates, the clay is first reduced to a convenient shape by means of a spreader and then finished on a plaster of paris mould with the aid of a jigger or profile press. Like many other processes in the pottery industry this is an extremely skilled job and shortage of trained operators has resulted in a narrowing down of production. To meet this situation experiments are now proceeding in the



Making cups on a jolley: continuous dryer in the background

development of automatic jiggers which do not require skilled operators.

Cups, vases and other kinds of hollow-ware are made either by a "thrower" on a potter's wheel, a rotating circular table mounted on a vertical shaft, or by a "jollier" on a "jolley," or rotating mould. Some articles are simply cast from slip clay in plaster of paris moulds; the moisture in the slip is rapidly absorbed as it comes into contact with the plaster and a coating of clay forms on the inside of the mould, the thickness being dependent on the time elapsing before remainder of the slip is poured out.



Finishing off cups on a turner's lathe

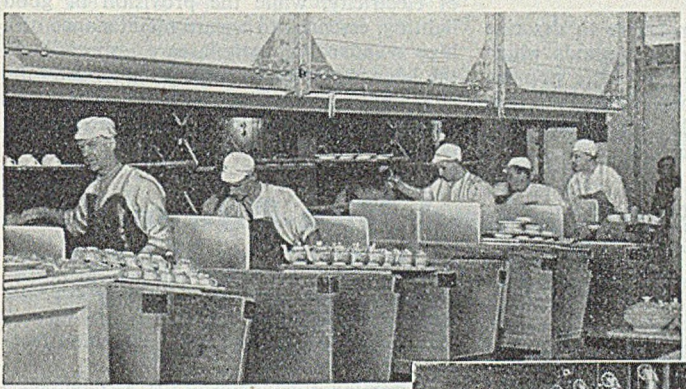
Some of the rotating devices mentioned above are still operated by foot treadle, a somewhat laborious business for the operators' assistants, but in most up-to-date works electrical drive has been adopted as standard. In some cases several machines are driven by the same motor but in the later installations each machine has its own individual motor, generally of ½ to 1 H.P. With group drives the machines are generally driven through a knee-operated clutch from a continuous rope. Infinitely variable speeds over a wide range are obtainable on the potters' wheels by means of two cones incorporated in the drive, the relative position of these being controlled by a foot pedal.

Leaving the potters' bench, the ware in its "green" state is dried either in a drying room, usually heated with steam pipes, or in the more modern works by specially designed drying chambers incorporating electric circulating fans. These are usually warmed by steam pipes but there would appear to be a good case for the adoption of electricity here. Some of the dryers operate on the continuous system, being arranged in either a circular or horizontal formation composing a series of compartments or trays. These are gradually moved round through a tunnel or compartment through which warm air is circulated. By means of these special units the drying time can be very considerably reduced, the amount depending on the type of body, its water content and its plasticity.

When dried, cups, etc., from the throwers need to be finished off by turners on reversible lathes. Individual electric drive scores heavily for these machines by always maintaining a constant speed which is of great assistance in ensuring a uniformly good

After drying, certain articles go to towing machines where the rough edges are removed

product. When quite dry, certain articles such as plates and saucers go to towing machines, where the rough edges are removed by a sharp tool held against the article as it revolves. These machines are fitted with exhaust fans to remove the dust. Articles which require handles or spouts have these put on whilst the ware is in the hard " green " state, that is before being completely dried, then go to another drying room or " greenhouse," remaining for a few hours to ensure that the appendages have been stuck on securely.



Vertical rotary dryers or " mangles," electrically driven but steam heated, are commonly used for drying the glaze ; they are being displaced to some extent by infra-red units

After complete drying the ware is given its first firing at a temperature of 1,250 deg C for earthenware, or up to 1,320 deg C for china, in a biscuit oven. In this firing the ware contracts to its final size. After the biscuit firing, the ware is either prepared for " underglaze " decoration or passed on directly to the glaze dipping house. Underglaze decoration takes various forms, one of which is done by means of transfers prepared on electrically heated copper engraving plates. This process is known as printing. Colours may now be added and in this case the ware is passed through a decorating kiln operating at between 650 and 700 deg C for earthenware or up to 760 deg C for china. This firing hardens the colours on to the biscuit surface before glazing.

Both ware with and without underglaze decoration is now hand dipped into a tub of glaze and then dried. Vertical rotary dryers, or " mangles," electrically driven but steam heated, are commonly used for this drying process. It usually takes about a quarter of an hour, the articles being loaded on constantly moving trays attached to an endless chain which goes up one side of a chimney-like erection and down the other.

Recently another electrical device has been making its appearance with the object of speeding up the glaze drying process, namely the infra-red dryer. We saw two examples of this at Stoke. One was of the conveyor type with sixteen 700-W heaters in reflectors above and a similar number below a 2 ft 3 in. wide wire mesh conveyor which can be regulated to travel at between 1 and 3 ft a minute. Drying takes about four minutes, the apparatus normally dealing with forty-five cups or five and a half 10-in. plates a minute. The other type of infra-red dryer is circular or octagonal in shape and about 10 ft across. After dipping, the ware is loaded on to a wire mesh framework, which is rotated round a central pivot through a tunnel with twelve 700-W heaters above and twelve below. Two and a half minutes is usually long enough to dry the ware sufficiently for

handling. Another firing in a glost oven with a temperature of about 1,050 deg C fixes the glaze and any underglaze decoration.

Any "overglaze" decoration which is required is now added. This may be either hand painted, gilded, lithographed or printed and enamelled, and there are many varieties and combinations of these methods according to the finish required. Further firing is now necessary in a decorating kiln, the decorating stage of the process being completed by removing any blemishes by polishing on a carborundum wheel and then smoothing on a hard felt wheel.

Space does not allow us here to describe in detail the electrical firing methods which are now becoming more and more popular but we shall shortly be publishing an article dealing specifically with this highly important aspect of pottery manufacture.

As the result of our visit we have come to the conclusion that while considerable strides have been taken in the application of electricity to the potteries, modern production calls for a considerable extension of its use if output is to be stepped up to meet present-day demands. Individual electric drive, besides being more economical and convenient and saving fuel, gives better control (particularly important in the potters' shop) and consequently better products. The drying and firing operations perhaps offer the greatest opportunities for increased use of electricity, while the provision of good lighting, essential to ensure maintenance of a high standard of manufacture, especially in the later processes, is being facilitated by the availability of fluorescent tubes, which are already installed in large numbers in many potteries.

Production and Man-Power

A REALISTIC survey of the present industrial position in this country was made in a B.B.C. talk last week by Mr. G. Chelioti, a director of the General Electric Co., Ltd. Mr. Chelioti expressed "a good deal of alarm" at the present trend towards shorter working hours. It was easily seen that British production was insufficient. There were three ways of meeting this: first by setting a bigger proportion of the people to work; secondly by inducing those now available to turn out more; and a third possibility was to induce or compel the consumer to do with less than he considered necessary.

During the war the labour force in the manufacturing industry was increased by a million, mainly women, and these left after the war and apparently could not be attracted back. The four million people in commercial or professional jobs and in the entertainment or distributive trades were hardly likely to be drawn to industry nor any of the two million in national and local government services. Furthermore, the raising of the school-leaving age would rob industry of two whole age groups of our younger population.

Thus the problem of management was how to get a bigger result from a stationary or diminishing labour force. Logic and arithmetic combined to tell us that this could only be done by enabling the workers to produce more in the same time or, alternatively, by working longer hours. The first was always one of the main concerns of management and to it was devoted unceasing technical and organizing effort. During the inter-war years the rate of production per man in industry was progressing at an average of 1½ per cent yearly. That rate could have been improved to some extent if we had invested more freely in power plant, new machinery, etc. But now our plant and equipment were in a bad state and any new machinery had to be obtained in the face of the export drive and intense competition from other manufacturers.

It was not true that wartime developments had meant an immense increase in industrial efficiency. For various reasons there was a tendency to lose efficiency and only manufacturers with improved plant or producing on a much larger scale than before were to-day making at the same rate per head as they did in 1939.

Against this background the trade unions were aiming at reducing working hours from 47 or 48 to 40 per week with an additional week's holiday. This would reduce working hours in industry by about 16⅔ per cent and thus to make up the loss the rate of output per hour must be 20 per cent greater. The arguments put up to refute this simple sum were that absenteeism would be reduced and by virtue of a long week-end rest men would do a better week's work. But this would probably result in only a 5 per cent improvement. If the remainder were to be achieved by standardization, rationalization and re-equipment the process might take seven or eight years. Overtime could be worked but that would be a tacit admission that we were not yet ripe for the shorter working week. Anyhow, overtime was becoming increasingly unpopular.

Mr. Chelioti concluded by suggesting that once the 40-hour week was secured steps would be taken towards a further reduction. Possibly our powers of recuperation were as great as they were assumed to be and we could afford to take these risks, but this he doubted.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

N.A.L.G.O. and Electricity

I AM astounded to see in the electrical press that the National Association of Local Government Officers is offering a home for the technical and administrative staffs of electricity undertakings and I am wondering what the Electrical Power Engineers' Association and the Electrical Trades Union are doing in the matter.

I am a member of the E.P.E.A. and N.A.L.G.O., and I consider that the E.P.E.A. is the proper organization for the technical staff, the E.T.U. for the working staff, and the N.A.L.G.O. for the administrative or clerical staff.

The ratio of technical engineers in the E.P.E.A. to those in N.A.L.G.O. I would estimate at 500 to 1, but like myself many are members of both.

MAINS ENGINEER.

A.C. Motor Starters

REGARDING the reply of "Rotor" to my letter in your issue of January 3rd, my firm has specialized in all kinds of starting gear for polyphase motors for over forty years and has never made a practice of supplying over-current releases with *time-limit fuses* for either squirrel-cage or slip-ring motors.

For squirrel-cage motors time-limit fuses are condemned generally out of hand, whether the machines controlled are small or large. As regards slip-ring motors, where the starting torque is not more than full-load torque there is not the same necessity for time lags of the oil-dashpot type, although by far the majority of engineers would not hear of time-limit fuses for various reasons, not the least of which is the corrosion of the fuse wire over a period of time. The statement of "Rotor" that the provision of the third over-current release is a "safeguard against the leakage trip failing to trip for any reason" does not account for the absence of provision on most motor starters for five releases. As far as my own experience goes, leakage gear is very rarely required on industrial motor starters whatever the size and voltage.

I realize that time-limit fuses are sometimes supplied on large motor starters by other than specialist starter makers, but on these occasions it will probably be found that the current transformers which operate the over-current releases must also energize a watt-hour meter. Further, the tenderers are obsessed with notions of economy rather than with the technical considerations.

Manchester. W. BRIGGS.

Motor Control

IN his very interesting article on maintenance of motor control gear, in your issue of January 10th "Rotor" has made some recommendations on which I would like to comment.

Control gear makers will view with particular concern the reference to the filing of contacts. Not even the "smooth file" is to be recommended. The zealous use by the conscientious maintenance man soon reduces the contacts to an alarming extent, yet obviously giving a good impression on inspection. An analysis of contactor failures, due to overheated or welded contact, shows that in many cases the contact pressure has been reduced excessively by filing. Contacts should not be touched. Only beads of metal caused by interruption of a heavy fault current and obstructing the operation of the contacts may be removed. The thin oxide film developing under ordinary operating conditions is crushed or wiped away by the closing action of the switch. Excessive oxidisation points to some fault on the switch and should be traced back to its origin.

Contacts should always be carefully watched for wear and their pressure checked periodically. As soon as the contact is worn to about half its original thickness, it should be replaced. Similarly, oiling or greasing is not to be recommended, nor polishing with metal polish. The surface should be left slightly rough, a finish that might be obtained by occasional use of very smooth emery cloth.

A further small point on which I would like to comment occurs in the diagram, Fig. 1. The maintaining switch R is connected to the dead side of the contactor. This may cause excessive currents to flow via push-button and auxiliary switch if poor contact happens to exist on the main pole of the contactor to which R is connected. It is preferable to connect R to the live side of the contactor to avoid such trouble.

Finally, some makers prefer connection of the over-current relays to the dead side of the contactor. With the latter open these relays are dead and adjustments may be carried out without having to isolate the starter.

Chester. B. FELTBOWER.

"First Course for Electricians"

YOU were good enough to publish in your issue of January 3rd a review of the new edition of our book "First Course for Electricians" by T. C. Gilbert, A.M.I.E.E. Your reviewer rightly pointed out that some details of wartime practice were now out-of-date and in fairness to Mr. Gilbert we feel that we should point out that this reprint was put in hand many months ago when wartime conditions were as applicable as at any time during the war.

Entirely due to printing delays, the book has only just appeared, but we felt that in the present shortage of good textbooks we should not be justified in withholding so much valuable material simply because a few details were somewhat "dated."

As Mr. Gilbert's professional reputation may be affected if a wrong impression is given to your readers, we should appreciate it very much if you would publish this explanation as we naturally do not wish this book, which is helping so many young electricians, to bring anything but good to its author.

*London, W.C.*1. G. R. WORKMAN.
(Morgan, Laird & Co., Ltd.)

Textile Mill Conversion

AT a meeting of the Lancashire Section of the Textile Institute last week MR. W. E. SWALE, speaking on behalf of the British Electrical Development Association, contended that the electrification of the steam-driven textile mills in Lancashire would save 750,000 tons of coal a year.

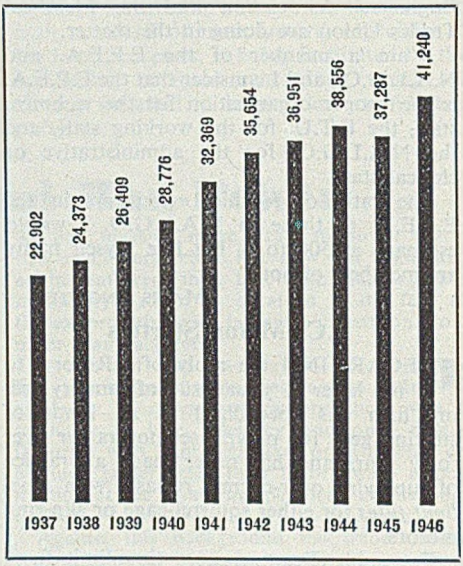
According to a *Manchester Guardian* report, Mr. Swale said that a deterrent to conversion to electric drive was that a large proportion of the steam drives had been written off, but there was a compelling need to save coal and to increase output by modernization. The recommendations of the Cotton Working Party for the replacement of 9,000,000 mule spindles by 3,000,000 ring spindles, and the modernizing of 8,000,000 existing ring spindles might lead to the installation of 240,000 H.P. of new motors. In 1945 only about 30 per cent of the power used in textile mills was furnished by public electricity supply.

Electricity Output

Increase of 10 per cent in 1946

THE official returns rendered to the Electricity Commissioners show that 4,372 million kWh of electricity was generated by authorized undertakers in Great Britain during December, 1946, as compared with the revised figure of 3,679 million kWh in the corresponding month of 1945, representing an increase of 693 million kWh or 18·8 per cent.

During the twelve months of 1946 (*i.e.*, up to the end of December) the total energy generated by authorized undertakers was 41,240 million



Ten years' electricity generation (in millions of kWh)

kWh as compared with the revised figure of 37,287 million kWh for 1945, representing an increase of 3,953 million kWh or 10·6 per cent.

The total number of kWh sent out from the generating stations of authorized undertakers during December, 1946 (i.e., generated less consumption in the stations by auxiliary plant and for lighting, etc.) was 4,140 million. The total quantity of electricity sent out from these stations during the past twelve months was 38,922 million kWh.

Electricity generated during the past ten years is illustrated by the accompanying "pillargraph."

Shawinigan Power Scheme. — The Quebec Government has authorized the construction by the Shawinigan Water & Power Co. of a new generating station with a total capacity of 195,000 H.P. at Shawinigan Falls. The estimated cost is $12,500,000.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT its first meeting in 1947 the Governing Council of the British Engineers' Association (Inc.) elected for a second annual period **Lt.-Col. H. Riggall**, J.P. (Ruston & Hornsby, Ltd.), as president of the Association, and **Mr. C. K. F. Hague**, M.I.Mech.E. (Babcock & Wilcox, Ltd.) and **Mr. K. Fraser**, M.A., A.M.Inst.C.E., A.M.I.Chem.E. (W. J. Fraser & Co., Ltd.), as vice-presidents.

Mr. W. J. Drummond, M.Inst.C.E., M.I.Mech.E., deputy chairman of the North-Western Divisional Coal Board, has been appointed hon. secretary of the British National Committee of the World Power Conference in succession to the late Mr. C. Rodgers, O.B.E. Mr. Drummond has been a member of the British National Committee for many years.

Mr. J. E. Flower, A.M.I.E.E., has been appointed chief engineer and manager of the St. Austell & District Electric Lighting & Power Co., Ltd., in succession to **Mr. C. Culmer Hodges**, M.I.E.E. whose retirement we have already announced. Mr. Flower was a student at the Manchester College of Technology, and received his technical training with the Lancashire Electric Power Co. He has since held various appointments with the Edmundson Group and for the past ten years has been engineer and manager to the Newmarket Electric Light Co., Ltd.

Mr. J. E. Flower

Mr. J. Hinshelwood, Assistant Controller of Telephones, London Telecommunications Region, has retired after forty-three years' service.

Sir Robert Watson-Watt, who played an important part in the development of radio-location has relinquished the full-time appointments which he held as Vice-Controller of Communications Equipment under the Ministry of Aircraft Production and Scientific Adviser on Telecommunications under the Air Ministry. Sir Robert is taking up private work, but will also continue to devote part of his time to consulting work for the Government, and will act as Scientific Adviser on Telecommunications to the Ministry of Supply, Air Ministry, Ministry of Civil Aviation and Ministry of Transport. According to the *Manchester Guardian*, he is forming a private company, Sir Robert Watson-Watt & Partners, Inc., which will give technical advice to A.C. Cossor, Ltd., Sylvania Electric Products, Inc. (United States), the J. Arthur Rank organization and Ferranti, Ltd.

The General Electric Co., Ltd., announces some new appointments at its Witton Engineering Works, Birmingham. **Dr. C. C. Garrard** has been appointed resident director at Witton, and has relinquished his position as joint general manager of the engineering group of works at Witton. **Mr. J. J. Gracie**, M.I.E.E. has been appointed general manager of the engineering group of works at Witton, and **Mr. C. J. O. Garrard**, M.Sc., M.I.E.E., becomes manager of the Switchgear Department. The Witton engineering group includes all works on the Witton Estate other than the moulded insulation works and the carbon and battery works.

Dr. C. C. Garrard

Mr. J. J. Gracie

Mr. L. A. Walker, who has retired from the service of the General Electric Co., Ltd., has established a record in the history of the company by having been a member of the staff for fifty-seven years. He joined the G.E.C. in 1889 (the year in which the firm was formed into a public company with a nominal capital of £60,000) and was employed in the repair of gas lighters. The head office of the G.E.C. was then in Queen Victoria Street where he served successively in the Bell, Estimating and Bought Ledger Departments. He was subsequently transferred to the publicity organization, where he has worked in an administrative capacity for the past thirty-five years. Mr. Leslie Gamage, vice-chairman and joint managing director, made presentations to Mr. Walker and three other members of the staff

Mr. L. A. Walker

who have retired—Mr. W. B. Steggall, counter manager, and Mr. S. T. Gill, of the Dispatch Department, who have each served the company for fifty years, and Mr. H. N. Castledine, of the Export Department, who has served for thirty-six years.

Mr. G. Turnbull, chief electrical engineer of the Horden Collieries has retired at the age of sixty-eight. Before he joined the Horden Co. he was in the service of Scott & Mountain, electrical engineers, Newcastle, and then with the Westinghouse Brake & Signal Co., Ltd.

Mr. H. E. Blackiston, borough electrical engineer of Swansea, was welcomed back at a recent meeting of the Electricity Committee after his stay in South Africa for health reasons.

Mr. J. F. Wright, chief technical assistant with the Swansea Corporation Electricity Department, has been appointed generating engineer at a salary of £847 rising to £913.

The Southampton Town Council at its meeting on December 18th, confirmed the recommendation of the Electricity Committee that **Mr. H. T. Egan** should be appointed to the position of chief assistant engineer of the electricity undertaking. Mr. Egan, who received his training at the London Passenger Transport Board's generating station, Greenwich, and attended at the same time Goldsmiths' College, London, later joined the Rees Roturbo Manufacturing Co., Ltd., Wolverhampton. He has been on the staff of the Southampton undertaking since 1920, and has held the successive positions of chief draughtsman, constructional engineer and engineering assistant to the borough electrical engineer.

Mr. H. T. Egan

Mr. S. Lowey, who has retired from the position of meter and test superintendent with the Liverpool Corporation Electricity Department, has been presented with a watch and a cheque by the staff of the Department. The presentation was made by Mr. J. Eccles, the city electrical engineer. Mr. Lowey is succeeded by **Mr. W. B. Parkinson,** B.Sc., A.M.I.E.E.

Mr. Arthur Marks, director of A. B. Metal Products, Ltd., has left for the United States on the S.S. *America* to study production methods. He will stay four or five weeks.

Mr. G. Pearce, acting on medical advice, has resigned from Watson & Sons (Electro-Medical), Ltd., of which he was managing director, and he has been succeeded in that position by **Mr. A. J. Minns,** formerly deputy managing director and chief engineer, who has been with the company for twenty-one years. Mr. Pearce entered the firm of W. Watson & Sons, Ltd., in 1900, and became managing director of Watson & Sons (Electro-Medical), Ltd., when a separate company was formed in 1915.

At the meeting of the F.B.I. Grand Council on January 8th, **Sir Frederick Bain,** M.C., deputy-president of the F.B.I., was nominated president of the Federation. This nomination will come before the annual general meeting of the Federation in April, when **Sir Clive Baillieu,** K.B.E., C.M.G., will retire from the presidency, having held office for two years. Sir Frederick is a deputy-chairman of Imperial Chemical Industries, Ltd., and from 1941-1944, was chairman of the Chemical Control Board, Ministry of Supply, and chairman of the Chemical Planning Committee of the Ministry of Production.

Mr. E. P. Perkins, A.M.I.E.E., borough electrical engineer of Aberystwyth, retired on December 31st, and a presentation was made to him by the staff and employees at an informal gathering. Mr. Perkins has occupied the position of head of the electricity undertaking for over forty years, first as chief engineer and manager to the Chiswick Electricity Supply Corporation, Ltd., and for the past nine years as borough electrical engineer to the Aberystwyth Corporation which acquired the local electricity undertaking from the company in 1935. Tribute was paid to the happy spirit which had at all times prevailed. One of the oldest members of the staff then presented Mr. Perkins with an inscribed silver coffee pot.

Mr. W. Hartley has retired on superannuation from the position of mains superintendent with the Nelson Corporation Electricity Department, where he commenced as an articled pupil in May, 1902, and he has been succeeded by **Mr. J. Sunderland,** B.Sc.Tech., who received his technical training at Manchester University where he graduated in 1932. Mr. Sunderland was formerly employed by the Burnley Corporation Electricity Department in the generating station and later as an assistant in the mains department.

Mr. E. Broughton, A.M.I.E.E., mains assistant to the Altrincham Electric Supply, Ltd., has been promoted to the position of mains superintendent as from January 1st. Mr. Broughton joined the undertaking in October, 1945.

Mr. H. Parkin, Graduate I.E.E., of Imperial Chemical Industries, Billingham, has been appointed junior mains engineer with the Stockton-on-Tees Corporation Electricity Department.

Mr. F. W. Osborn has been appointed Midland branch manager of the British Aluminium Co., Ltd., in place of **Mr. C. G. Pountney,** who resigned from the staff of the company on December 31st. Mr. Osborn has taken up his duties at Lansdowne House, 41, Water Street, Birmingham, 3.

Mr. N. B. Brooks, M.C., has been appointed a director of Richard Johnson & Nephew, Ltd.

Mr. Gordon McK. Campbell retired from the board of the British Thomson-Houston Co., Ltd., at the end of last year. **Mr. C. F. Trippe**, M.I.E.E., who joined the B.T.H. Co. in 1927 as manager of sound-reproducing sales, also retired at the end of the year. **Mr. W. S. Steel**, manager of the Marine Department of the company, has been appointed manager, Home Sales, and is succeeded by **Mr. R. G. A. Dimmick.**

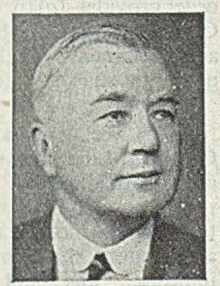
Mr. A. M. Tustin, M.Sc., M.I.E.E., assistant chief engineer to the Metropolitan-Vickers Electrical Co., Ltd., has been appointed head of the Electrical Engineering Department of Birmingham University in succession to **Professor D. M. Robinson**, B.Sc., Ph.D., M.I.E.E.

On January 2nd over 500 children of employees of the Manchester Corporation Electricity Department were the guests of the Department's Sports and Social Club at a Christmas party held at the Co-operative Hall, Ardwick. The programme included a variety concert and a Punch and Judy show. **Mr. R. A. S. Thwaites** (president of the club) and Mrs. Thwaites were present.

The annual staff dinner of Frank Westerman (Wholesale), Ltd., was held at the Grand Hotel, Birmingham, on January 4th. The company included a number of guests. **Mr. F. Westerman**, in proposing the toast of the staff, said that he was proud of the high degree of loyalty, self discipline and fair play existing among them. Mr. Ford, sales manager, also spoke. Games and entertainment concluded an enjoyable party.

Obituary

Mr. S. H. Richards.—We record with regret the death of Mr. Samuel Hope Richards, chief meter examiner to the Electricity Commission, which occurred on January 9th at the age of sixty-three. He was at work in his office during the day, but had a stroke the same evening and died the following day. Mr. Richards was born in Bangalore, India, and received his training at Chelsea Polytechnic. His first appointment was in 1902 at the Board of Trade Standardizing Laboratory, and in 1907 he became testing superintendent to the Calcutta Electric Supply Corporation. Twelve years later he joined Ferranti, Ltd., as publicity manager. From 1930 to 1933 Mr. Richards was with the Electrical Research Association and from then until taking up his appointment with the Electricity Commission in 1937 he was manager of the Southern Areas Electric Corporation, Ltd. He was chairman of the Measurements Section of the Institution of Electrical Engineers in 1945-46, and was a member of the American Institute of Electrical Engineers.



The late Mr. S. H. Richards

Sir George Hamilton, Bt.—We regret to report that Sir George Hamilton, Bt., died on January 12th at the age of sixty-nine. Sir George, after education at Aysgarth and Charterhouse, was apprenticed to Scott & Mountain and represented the firm in a number of overseas countries. Later he became a director of Drake & Gorham, Ltd., and chairman of the Expanded Metal Co., Ltd. He was a Member of Parliament for a number of years.

Wills.—**Alderman R. Mayne**, late chairman of Newcastle-on-Tyne Transport and Electricity Committee, and president of the Municipal Tramways Association in 1921-22, who died on June 5th last, left £1,783 gross, with net personalty £1,584.

Mr. E. Beaumont, electrical contractor, who died on October 31st last, left £1,915 (net personalty £1,212).

Mr. E. H. Freeman, M.I.E.E., of Tyler & Freeman, who died on July 1st last, left £15,099 gross, so far as at present can be ascertained, with net personalty £14,906.

Mr. W. Silk, of South Norwood, S.E.25, telegraph instrument maker, who died on November 2nd last, left £1,258 gross, with net personalty £1,222.

Iron Powders

THE properties of iron powders prepared in different ways, and of compacts made therefrom, are dealt with in a paper compiled for the Iron and Steel Institute by Messrs. C. J. Leadbeater, L. Northcott and F. Hargreaves (Armament Research Department).

Part I describes studies undertaken for standardizing methods of determining the densities (particle, apparent and tap-vibration) of powders while their flow behaviour has been assessed and their oxygen, hydrogen and nitrogen contents have been determined.

Part II is concerned with the properties of commercial powders, showing that those prepared electrolytically are generally purer, softer when annealed and are slightly more compressible than powders made by the oxide-reduction process.

Part III deals with the properties of sintered compacts formed by compressing such powders, those made of electrolytic powders being of slightly less tensile strength and greater elongation than the oxide-reduced varieties.

Part IV discusses the results and additional data are adduced, making it clear that the behaviour of pressed and sintered compacts is not solely dependent upon the properties of the powders. Small particle size and freedom from surface oxidization are necessary for increased tensile strength.

Views on the News

Reflections on Current Topics

POWER from submarines for land purposes, as is now being provided at three dockyards, is no new thing. Such a scheme was used at Naples during the war. I am reminded of the Southend German submarine generating sets put into commission shortly after the 1914-18 war which caused much argument in that seaside town, culminating in an inquiry by the Electricity Commissioners in 1925. These sets, which were favoured by the engineer of that day, Mr. Robert Birkett, met about half the demand which at the inquiry was put at just over 7,000 kW for the winter of 1925-26. It was a little pessimistic of those responsible to think that Southend would obtain all the power it needed by this means for any length of time. During the two intervening decades the demand has gone up to about 20,000 kW. It is met mainly by a bulk supply.

* * *

While this is a coal- (not necessarily fuel-) saving measure, it would be instructive to compare the overall costs (allowing for new connections) of the two sources of power. Figures would have to be corrected for the load factor of the Diesels which, in order to achieve the expected saving of 400 tons per week for an output of 1,000 kW per vessel, would reach about 50 per cent. A greater average output per set is presumably envisaged for the ultimate scheme for saving 2,000 tons per week by providing power from twenty-six submarines to three dockyards, as otherwise a higher plant load factor is implied than is likely to be achieved in practice.

* * *

Political relations between Northern Ireland and Eire are generally uncordial because of the fundamental difference between them. It is pleasing to see that this difference does nor affect the Electricity Boards of the two States. The power position in Northern Ireland, owing mainly to lack of coal, is as critical as it is in this country and so the Northern Ireland Board has explored the possibility of securing power from Eire. The Electricity Supply Board there has adopted a most sympathetic attitude although conditions in its own area are often precarious. It has promised, however, to do what it can, particularly if serious industrial dislocation is threatened. It is unfortunate that the peak times in both States coincide for there is said to be ample power available from the Shannon during nights and at week-ends.

* * *

Power cuts dictated by the Central Electricity Board are tolerable because they are known to be necessary. It is doubtful whether the same can be said of the methods of a London landlady, which were drawn to the attention of a London rent tribunal last week. This lady fitted a master switch in the premises. She charged a shilling in the rent for electricity and when the tenants had used their quota cut off their supply.

* * *

In the *Electrical Review* of September 20th last, I referred to the use of the well-known initials "B.E.A." by British European Airways and made some general observations on the subject of initials. Now, with the advent of the Electricity Bill, there is another claimant to these letters—the British Electricity Authority—and in the interim I have been reminded of the British Esperanto Association. This set of letters seems to be altogether too popular.

* * *

I notice that Clause 51 (1) of the new Electricity Bill states that "the Minister may by order provide—(*a*) for dissolving the Electricity Commissioners." I have occasionally heard acid comment on the Commissioners but never the suggestion of an acid bath.

* * *

Last week when comparing Forrest's Overhead-Line Charts to the automatic computating engine, I too readily assumed that they would be well enough known not to require more explicit reference. That assumption, the contents of my mail bag indicate, was not altogether justified. Actually the charts with explanatory matter first appeared as a series in this journal from June to September, 1945. At that time paper rationing was even more severe than it is now and the demand for additional copies of the issues containing them could not be met. They have therefore been republished, with a good deal of additional information, as a half-a-crown booklet.

—REFLECTOR.

Feed-Heating Cycle

Influence on Performance of Turbo-Alternators

By G. Oldroyd,
Graduate I.E.E., A.M.Inst.F.

WHEN determining the performance of large turbo-alternators, incorporating four or more stages of regenerative feed-water heating, it is essential that the test be conducted with all feed heaters in commission, so that the designed quantities of steam are flowing through the turbine at all points, otherwise stage efficiencies will be adversely affected.

To find the Rankine-cycle efficiency ratio and the quantity of steam bled to each heater, it is necessary to construct the turbine-condition curve on a Mollier diagram. As it is not practicable to test the turbine without the feed heaters in operation, the orthodox method of deducing the actual condition of the steam at the turbine exhaust from a knowledge of the Rankine-cycle efficiency ratio breaks down. Some alternative method of plotting the turbine condition curve is therefore necessary before the efficiency ratio and actual Rankine-cycle steam consumption can be estimated.

Assuming that four stages of feed-water heating are employed, these will usually consist of: two high-pressure heaters working on superheated steam, one intermediate pressure heater working at or near saturation temperature and one low-pressure heater working on wet steam.

The procedure for constructing the condition curve on the Mollier chart is as follows. First find the initial state point A in Fig. 1 corresponding to the temperature and pressure at the turbine throttle. If the turbine is working at part load, throttling will occur across the throttle valve, and as this process is carried out at constant enthalpy, the state point A will move horizontally to the right to some point A′, corresponding to first-stage or nozzle-bowl pressure. From this point the vertical isentropic or adiabatic line should now be dropped to the state point B on the pressure line corresponding to the absolute pressure at the turbine exhaust. Reading off the enthalpy of the steam at A′ and B, the heat drop, or the heat available for conversion into work, in a perfect turbine operating under the same initial and final steam conditions, will be found as (H — h). From this figure the ideal Rankine-cycle steam consumption, W_{ideal}, is determined and will be equal to $\frac{3{,}412}{(H - h)}$, 3,412 being the number of B.Th.U. in a kWh.

Adiabatic expansion is only approximated in the actual turbine, due to steam friction slightly reheating the steam in its passage through the various stages. In consequence of this and other factors the heat drop in the

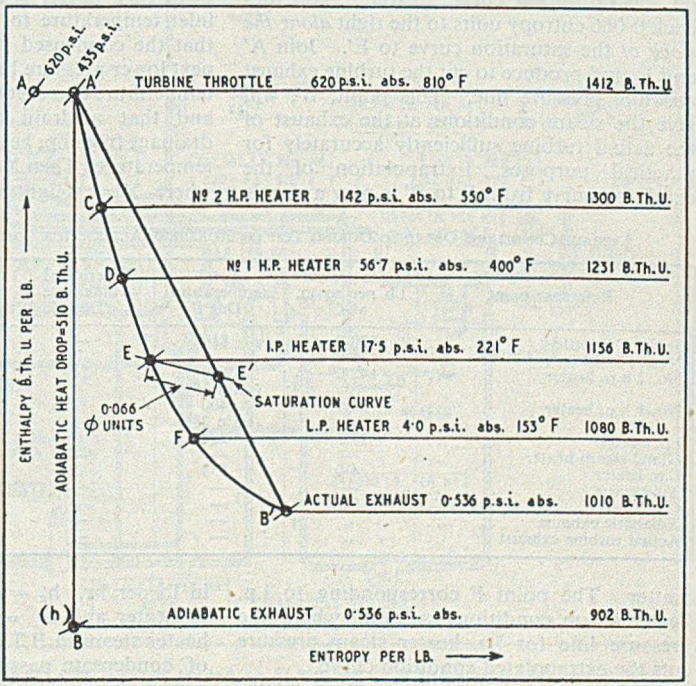


Fig. 1.—Heat-drop diagram

actual turbine will be less than the ideal figure. Thus the steam at the turbine exhaust will be slightly drier, causing the state point B to move along the exhaust absolute pressure line to some point B′. To find the position of B′, the efficiency ratio and actual Rankine-cycle steam consumption of necessity being unknown, the following procedure may be adopted.

Locate state points on the Mollier diagram corresponding to the pressures and temperatures of the bled steam at the two h.p. heaters. These two points C and D in Fig. 1 will lie on the turbine condition curve, as will also the state point E for the i.p. heater steam conditions. If point E lies in the superheat region, it will usually be close enough to the saturation curve to permit of quite accurate extrapolation of the condition curve to cut the saturation curve. Point E is shown as falling on the saturation curve. From E measure back 0·066 entropy units to the right *along the slope of* the saturation curve to E′. Join A′ and E′ and produce to cut the turbine exhaust absolute pressure line. This point, B′, will give the steam conditions at the exhaust of the actual turbine sufficiently accurately for practical purposes. Extrapolation of the condition curve from E to B′ is now a simple matter. The point F corresponding to l.p. heater steam conditions is found where the pressure line for l.p. heater steam pressure cuts the extrapolated condition curve.

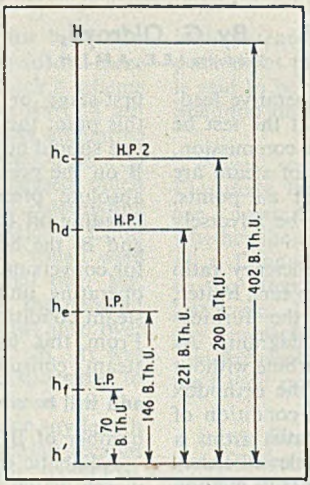


Fig. 2.—Turbine heat-condition line

Having found the steam conditions at the actual turbine exhaust, the actual heat drop is given by (H − h′). Therefore the actual Rankine-cycle steam consumption, $W_{actual,} = \frac{3,412}{(H - h')}$, and the Rankine-cycle efficiency ratio $= \frac{W_{ideal}}{W_{actual}}$.

The quantity of bled steam to each heater may now be computed. Read off the enthalpy of the steam at points C, D, E, and F. Then, for each heater, knowing the condensate discharge temperature and (from the Venturi-meter reading) the amount of condensate flowing, a simple heat balance may be drawn up and the extracted steam quantity determined. It should be noted that the condensate quantity flowing will not be the same for each heater if any direct contact heaters or heater drain pumps are incorporated in the circuit.

The following assumptions are permissible: That the condensate discharge temperature from each heater is equal to the condensate inlet temperature to the next heater in line, that the condensed steam is cascaded to the next lower pressure heater and is at saturation temperature corresponding to heater pressure, and that a drain cooler cools combined drainage from l.p. heater to exhaust saturation temperature. Then $X(h_x - h_L) = W(h_2 - h_1)$, where X = weight of bled steam to heater in lb per hr, h_x = enthalpy of bled steam to heater and h_L = enthalpy of condensed heater steam in B.Th.U. per lb, W = weight of condensate passing through heater in lb per hr, h_2 = enthalpy of condensate leaving heater and h_1 = enthalpy of condensate

AVERAGE CONDITIONS OBTAINED DURING TEST ON 30,000-kW ALTERNATOR LOADED AT 24,500 kW

Reference point	Steam pressure Lb per sq in. abs.	Total temperature Deg F	Terminal difference Deg F	Enthalpy B.Th.U. per lb	Condensate. Deg F at outlets
Turbine throttle	620·0	810	—	1,412	—
Nozzle bowl (A′)	435·0	,,	,,	—	—
No. 2 h.p. heater	142·0	550 (sat'n 354)	14	1,300	340
No. 1 h.p. heater	56·7	400 (sat'n 289)	12	1,231	277
l.p. heater	17·5	221	7	1,156	214
Gland-steam heater	—	—	—	—	151
L.p. heater	4·0	153	5	1,080	148
Air-ejector	—	—	—	—	85
Condenser	0·536	—	—	—	80
Adiabatic exhaust	,,	—	—	902	,,
Actual turbine exhaust	,,	—	—	1,010	,,

entering heater in B.Th.U. per lb. Steam flow to any live steam heaters, such as ejectors and gland-steam heaters, can be found in a similar manner, steam conditions to these heaters being known.

When the amount of steam extraction has been determined for each heater, these figures must be obtained in terms of steam at the turbine throttle, because temperatures and pressures at the various extraction points and consequently the steam enthalpy will differ considerably from that of the steam which will have to be added at the turbine throttle to compensate for extraction.

In order to assist the computations a diagrammatic sketch of the actual turbine condition line should be drawn, Fig. 2. Then, extraction flow to each heater in terms of steam at the turbine throttle will be:—

Added throttle flow for h.p. heater (C) (B.Th.U. per lb) $= X_c \left(\frac{h_c - h'}{H - h}\right) = x_c$, for h.p. heater (D) $= X_d \left(\frac{h_d - h'}{H - h'}\right) = x_d$, for i.p. heater (E) $= X_e \left(\frac{h_e - h'}{H - h'}\right) = x_e$ and for l.p. heater (F) $= X_f \left(\frac{h_f - h'}{H - h'}\right) = x_f$. Total added flow $= x_c + x_d + x_e + x_f = S_x$.

Assuming that no steam is used for auxiliaries, the throttle flow working under extraction conditions (S_e) will be that registered by the boiler steam flow meters. Therefore the throttle flow non-extracting will be $(S_n) = S_e - S_x$. As the load on the turbine is known, S_n should also be equal to (W_{actual}) multiplied by turbine load in kW. The two figures should check reasonably closely. Then, $S_n + S_x - X = W_e$, where X = sum of actual quantities of bled steam at each heater point in lb per hr. W_e = exhaust flow to condenser in lb per hr. The turbine Venturi-meter reading (W) should equal $W_e + X + M$, where M is the make-up quantity in lb per hr, including any live-steam heater drains.

From this data the flow diagram can be constructed.

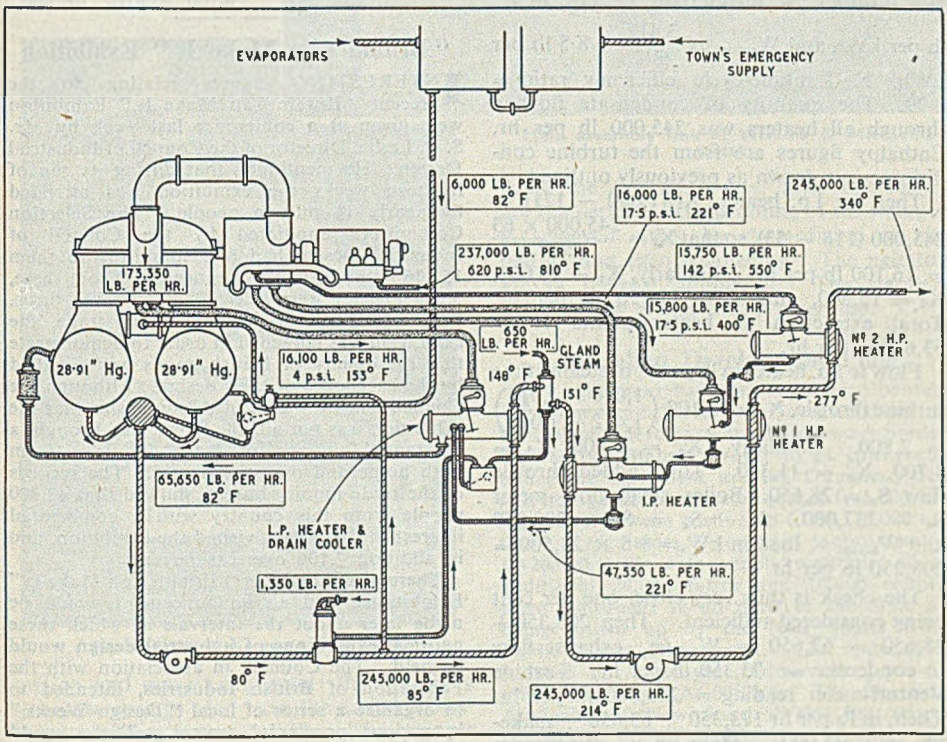


Fig. 3.—Flow diagram for 30,000-kW turbine loaded at 24,500 kW. B.Th.U. per kWh to turbine 10,700; overall boiler efficiency 86 per cent. B.Th.U. per kWh to auxiliaries 850, per kWh generated 12,500 and per kWh sent out 13,350

The saving due to regenerative feed-water heating may now be determined. Gross heat rate, non-extracting, $= \frac{(S_n + S_a)\,[H - (t_n - 32)]}{kW}$ $= H_n$ B.Th.U. per kWh, where S_a = steam flow to any live-steam heaters in lb per hr, and t_n = temperature of condensate returned to boiler in deg F. Gross heat rate, extracting, $= \frac{(S_e + S_a)\,[H - (t_e - 32)]}{kW} = H_e$ B.Th.U. per kWh, where t_e = temperature of condensate leaving last h.p. heater, in deg F. Improvement with heaters in service $= \frac{H_n - H_e}{H_n}$.

As an illustration of the method the figures obtained in a three-hour test conducted on a 30-MW three-cylinder tandem-compound turbo-alternator employing four stages of feed-water heating, is given in the accompanying table. In this pressure drops and radiation losses between bleed points and heaters have been neglected. From table: adiabatic heat drop = 510 B.Th.U. per lb, actual heat drop = 402 B.Th.U. per lb, $\therefore W_{ideal} = \frac{3,412}{510} = 6{\cdot}7$ lb per kWh and $W_{actual} = \frac{3,412}{402} = 8{\cdot}5$ lb per kWh. $\therefore$ Rankine-cycle efficiency ratio = 0·79. The quantity of condensate flowing through all heaters was 245,000 lb per hr. Enthalpy figures are from the turbine condition curve drawn as previously outlined.

Then for l.p. heater, $X_f\,(1,080 - 121) = 245,000\,(116 - 53)$, so that $X_f = \frac{245,000 \times 63}{959}$ = 16,100 lb per hr. Similarly, X_e = 16,000, X_d = 15,800, and X_c = 15,750 lb per hr. Total extraction at heater points X = 63,650 lb per hr.

Flow to l.p. heater in lb per hr of steam at the turbine throttle, $X_f = 16,100 \left(\frac{1,080 - 1,010}{1,412 - 1,010}\right)$ = 2,800. Similarly, X_e = 5,800, X_d = 8,700, X_c = 11,350. Total added throttle flow S_x = 28,650. Boiler steam-flow meter S_e = 237,000. $S_e - S_x = S_n$ = 208,350 and $W_{actual} \times$ load in kW = 8·5 × 24,500 = 208,250 lb per hr.

The check is thus very close, one per cent being considered sufficient. Then 208,350 + 28,650 − 63,650 = W_e, i.e., exhaust flow to condenser = 173,350 lb per hr. Turbine Venturi-meter reading = 245,000 lb per hr. Then, in lb per hr 173,350 + 63,650 + make-up = 245,000. Make-up + live-steam heater drains = 245,000 − 237,000 = 8,000, steam to ejector = 1,350, gland steam = 650, net make-up = 6,000 lb per hr, i.e. $\frac{6,000}{237,000} =$ 2·52 per cent.

Gross heat rate, non-extracting, $= \frac{(208,350 + 2,000)\,[1,412 - (80 - 32)]}{24,500} =$ 11,770 B.Th.U. per kWh. Gross heat rate, extracting, $= \frac{(235,000 + 2,000)[1,412 - (340 = 32)]}{24,500}$ = 10,700 B.Th.U. per kWh. Improvement due to heaters $= \frac{11,770 - 10,700}{11,770} = 9{\cdot}12$ per cent.

From this data the flow diagram and heat balance statement shown in Fig. 3 have been constructed. A tracing of the general arrangement of the cycle, as there presented, may be made and blank spaces left for addition of the various flows, etc., which may be written on the prints, after each particular test, thus enabling comparisons to be made with the results of previous tests. The method may be modified to suit individual circumstances and is intended to act as a general guide rather than as a rigorous proof.

"Britain Can Make It" Exhibition

INTERESTING figures relating to the recent "Britain Can Make It" Exhibition were given at a conference last week by Mr. S. C. Leslie, Director of the Council of Industrial Design. He mentioned that during its run of fourteen weeks the exhibition was attended by nearly 1½ million people. The Selection Committees appointed by the Council of Industrial Design had had submitted to them 15,836 items from 3,385 concerns. From these, 5,259 articles were selected from 1,297 firms. From the point of view of export trade, the exhibition was launched in order to demonstrate that the quality of British goods was equalled by the excellence of their design. Although the Council had been careful to emphasize that the exhibition was not a trade fair, it had brought a substantial volume of trade inquiries from both home and overseas buyers. The records of the trade inquiry bureau showed that 43,300 people from this country with a commercial interest in the goods, visited the exhibition, and in addition 7,106 overseas buyers.

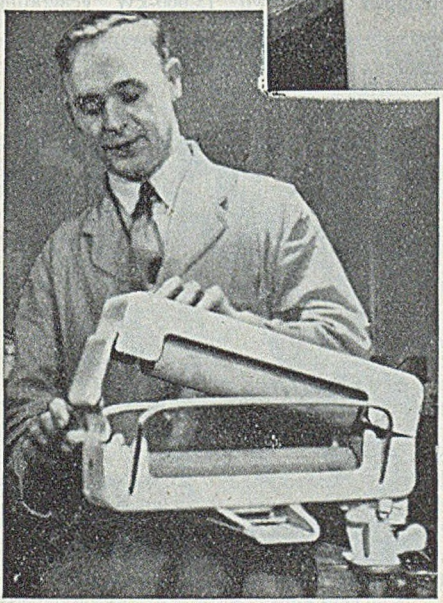
There would be other "Britain Can Make It" Exhibitions, and an announcement would be made later about the intervals at which these national exhibitions of industrial design would be held. The Council, in association with the Federation of British Industries, intended to to organize a series of local "Design Weeks" in various provincial centres. These would include meetings and conferences and possibly window display competitions. An important feature would be a small travelling exhibition.

Electric Washer Production

Pre-war Output Reached at a Darlaston Works

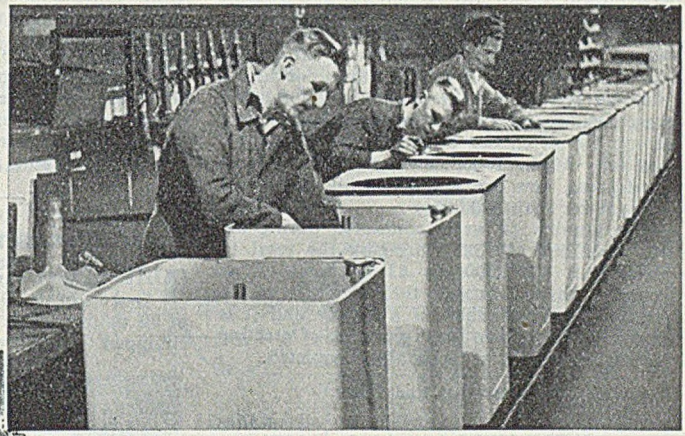
PROBABLY no other electric washing machine manufacturer can claim to have got back into production more quickly, after its wartime interlude on armament work, than Wilkins & Mitchell, Ltd., Darlaston. Pioneer of the cabinet type machine in Great Britain, this company in October attained its pre-war output. Essentially the design of the washers now being made is the same as before the war but several minor improvements have been incorporated.

The chief of these is a new wringer release with a lighter action and more easily reset: the four long pressure springs used have the added advantage of being more durable. The wringer gear box and the automatic water direction control arrangements have also been improved.



Adjusting one of the new type wringers

The formation of the tubs, which are pressed out in one piece, is carried out in two operations and the cabinets after folding are spot welded. Special care is taken for the protection of the metal work from corrosion. The tubs are vitreous-enamelled, while the cabinet bodies, after degreasing, are bonderized. Rustproofing of the wringers is achieved either by sherardizing or zinc plating and then enamelling. The agitators are of die-cast aluminium. The standard finish is now cream with a green top.



Main assembly line at Wilkins & Mitchell's factory

Australian Development Plans

AN agreement has been announced between New South Wales and Queensland for the control and development of waterways bordering the two States. Works to be constructed under the agreement are the Dumaresq dam and storage, at an estimated cost of £A1,000,000, six to twelve weirs costing up to £A120,000 and four "regulators," costing approximately £A20,000. Plans to supply electricity to an additional 24,000 farms and 10,000 country town consumers in all parts of the State are being drawn up by the New South Wales Public Works Department. The undertaking is part of a ten-year Government subsidy scheme, to cost £A6,000,000. The Electricity Authority of New South Wales has sent a circular to supply undertakings dealing with Section 13 of the Electricity Development Act, 1945, under which application may now be made for a subsidy.

Electricity in America

Progress During 1946

THE year 1946 saw a phenomenal growth in the number of consumers of electricity in the United States. In a review of the year Mr. G. C. Neff, president of the Edison Electric Institute, says that despite the housing shortage, and difficulties of obtaining supplies of poles, wire and equipment, nearly 2,000,000 new consumers were added, while over 600,000 applicants were waiting for a supply at the end of the year. In a nation of 40 million families, 90 per cent are now consumers of electricity. The average residential consumption rose during 1946 by 100 kWh to a record of 1,330 kWh per consumer. New consumption records were set up by all classes of consumers except industrial. Most of the new consumers were in rural areas, new connections within city limits being fewer than 400,000.

The number of farms connected during the year was over 500,000, bringing the total to more than 3,400,000, or 63 per cent of all occupied farms. About three-quarters of all farms are within reach of a supply and it is expected that in two years the task of erecting farm lines will be substantially completed.

Consumption and Costs

The total sales of electricity by all utilities was approximately 191,000 million kWh, as compared with 193,500 million kWh in 1945. The fall was entirely due to the decrease in industrial power. Despite the rising cost of living which was 145·9 per cent of the pre-war figure in September, 1946, as compared with 128·9 per cent in September, 1945, the cost of electricity fell from 95·2 per cent to 91·7 per cent.

Production of power by all utilities is estimated at 222,500 million kWh for 1946. This is about the same as for 1945. Of the total, 143,000 million kWh was produced by steam, an increase of 2,500 million kWh. Hydro-electric power production fell by 2,500 million kWh to 77,500 million kWh, while generation by internal combustion engines was about the same at 2,000 million kWh.

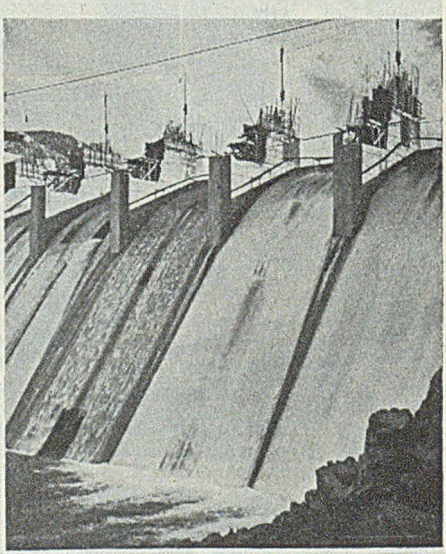
Plant extensions fell far short of the programme of 1,400,000 kW scheduled for installation during 1946, largely due to strikes in the metal producing and other industries. On the other hand the maximum demand rose considerably, and the margin of spare and reserve capacity had fallen to 10 per cent at the end of 1946, as compared with 23 per cent at the end of 1945. The orders of companies, municipal and other governmental power agencies, and industrial establishments for new plant aggregate 11·5 million kW, to be added to the present combined installed capacity of 63 million kW.

Gross revenues of the business-managed, electric power companies rose by about $100 millions, or 3½ per cent. All this gain, however, was absorbed by increased wages which now constitute the largest item of utility expense.

Based on estimates of companies representing two-thirds of the industry, the load for 1947 is expected to increase by 7 per cent and in 1948 by 6 per cent, as compared with a pre-war normal growth of 3 to 4 per cent. The building programme of the electric utility companies (8·5 million kW in the next three years) is planned to keep ahead of this growth, but most companies do not expect to be able to build up their margins of reserve and spare plant capacity before the autumn of 1949.

Moroccan Water Power

THE Im'fout barrage, which is to hold the waters of the Oum-er-Rebia, has a capacity of 90 million cubic metres. The plant is to be equipped with two 15,000-kW generating



Im'fout barrage in course of erection

groups, one in the course of 1947 and the other during 1948. The head is 37 metres. Two lines are envisaged, one at 150,000 V, connected to the general network by three single-phase 13,500-kW transformers. The other, at 60,000 V, will have a carrying capacity of 18,000 kW, and will join the electrified Marrakech-Casablanca railway line, which passes near to the barrage.

Temperature Control

Factors Influencing Performance of Thermostatic Systems

By S. Tweedy

A COMMON method of temperature control embodies a thermostat fitted in such a position that its temperature is equal or related to the temperature to be regulated and having contacts arranged to control the supply to the heaters. Successful operation must depend in the last resort on the characteristics of the thermostat, but many other factors also have a considerable influence. These effects are not always fully appreciated and sometimes reliable thermostats are blamed for faulty operation when the cause of trouble is incorrect engineering of the complete system.

The various terms used in this discussion are defined as follows: *Dead zone* of a thermostat is the temperature range between " contacts open " and " contacts closed " at a given setting; i.e., the temperature variation within which there is no response from the thermostat. This is sometimes referred to as " sensitivity " or as " temperature differential," but it is preferable to confine the latter term to the whole system. *Temperature differential* of a system is the range of temperature obtained at the controlled point at a given thermostat setting, when steady conditions of hunting, are achieved. This is sometimes known as the " deviation."

Capacity lag is the retardation of the change in temperature at the controlled point following a change in temperature at the heaters, resulting from the ability of parts of the system to store up thermal energy. *Transfer lag* is the retardation of the change in temperature at the controlled point following a change in temperature at the heaters, resulting from the thermal resistance of the path between the heaters and the controlled point. These two lags may be collectively referred to as " time lags."

On-off control is such that the whole of the heaters are switched off when the thermostat reaches the upper limit of its dead zone and are switched on when the lower limit is reached. *Two-position control* is such that only a part of the heater is controlled by the thermostat, the rest being on all the time.

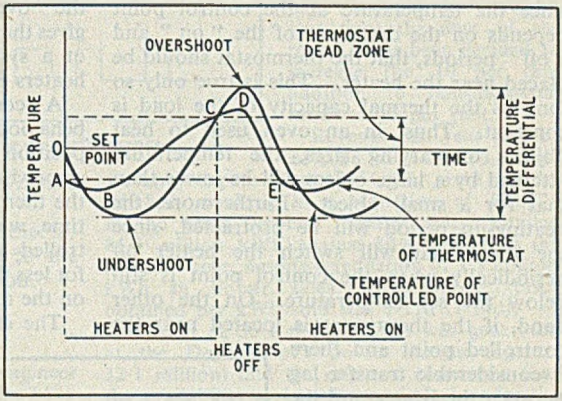


Fig. 1.—Thermostatically controlled system with time lags

Considering the behaviour of a system with on-off control and with capacity lag and transfer lag, Fig. 1 shows the temperatures of the thermostat and the controlled point plotted against time. Suppose that at A the thermostat has cooled to the lower limit of its dead zone and the heaters have just been switched on. Owing to the transfer lag between the heaters and the thermostat, the effect of the heaters will not be immediately felt: the thermostat temperature will continue to fall for some time along the line AB, after which it commences to rise until, at C, the upper limit of the dead zone is reached and the heaters are switched off. Again, due to the lags inherent in the system, the effect is not immediately noticeable, and the temperature continues to rise along the section CD of the curve. It then falls to E, when the heaters are again switched on and the cycle is repeated.

The temperature at the controlled point will not, in general, coincide completely with the temperature of the thermostat, the difference depending on the location and the thermal capacities of the latter and of the medium being heated; that is to say, both the transfer lag and the capacity lag may be different for the medium and for the thermostat. Even in a well-engineered system the temperature differential is greater than the thermostat dead zone.

Fig. 2 shows typical curves for a system similar to the foregoing, but with much larger inherent time lags. The temperature differential is now considerably greater, even though the thermostat operates in exactly the same way. (In a badly designed system, the temperature differential may be as much as 100 times the thermostat dead zone.) The mean temperature at the controlled point is no longer equal to the mean temperature in the thermostat dead zone. In the case shown the mean temperature is below the set point, but the opposite is possible, depending on the relative values of the transfer lags and the capacity lags.

Often the heater is already fixed and the best location for the thermostat only has to be decided. At first sight it might appear, since the temperature at the control point depends on the durations of the " on " and " off " periods, that the thermostat should be placed near the heater. This is true only so long as the thermal capacity of the load is constant. Thus, in an oven used to heat objects of varying sizes, the temperature attained by a large object will be lower than that for a small object. Furthermore, the heating-up period will be protracted, since the thermostat will switch the heater off periodically when the control point is still below the set temperature. On the other hand, if the thermostat is located near the controlled point and there is considerable transfer lag between the heater and the controlled point, the delay between the heaters operating and the effect at the control point will result in a larger temperature differential.

The method of fixing the thermostat is of considerable importance. If it is thermally insulated from large masses, its thermal capacity will be lower and its response to a change of temperature rapid. Should it be clamped in such a way that the path of low thermal resistance to a mass at a lower temperature is provided, however, the effective thermal capacity lag of the thermostat will be considerably increased. This means a larger capacity lag and the thermostat temperature will lag behind that of the surrounding medium. A method of clamping can be chosen so that the lag between the thermostat temperature and that of the controlled point is such as to give the best results. Screening of the thermostat may sometimes have a good effect.

Another factor influencing behaviour is the subjection of the thermostat to direct radiation from the heaters, when its temperature can be considerably higher than that of a nearby object screened from direct radiation or than that of the surrounding air.

Experience shows that best results are usually obtained when heaters are of such a size that they are on for about 70 per cent of the time. If the heaters are too small the rate of heating will be low, and consequently the " under-shoot " (see Fig. 1) will be large and the " over-shoot " small. Too large a heater gives the reverse effect. The relative behaviour of a system with small, correct and large heaters is shown in Fig. 3.

A common method of improving the behaviour of a control system is to use two-position control. A heater of capacity somewhat lower than that required to supply the thermal losses of the system is on all the time, while a smaller capacity heater is controlled by the thermostat, and should be on for less than 70 per cent of the time, depending on the ratio of sizes of the two heaters.

The effect of a large transfer lag between the main heaters and the thermostat can often be greatly reduced by fitting an " anticipator " heater of the correct size near the thermostat, which is itself near the controlled point. The thermostat should be preferably set *in situ*,

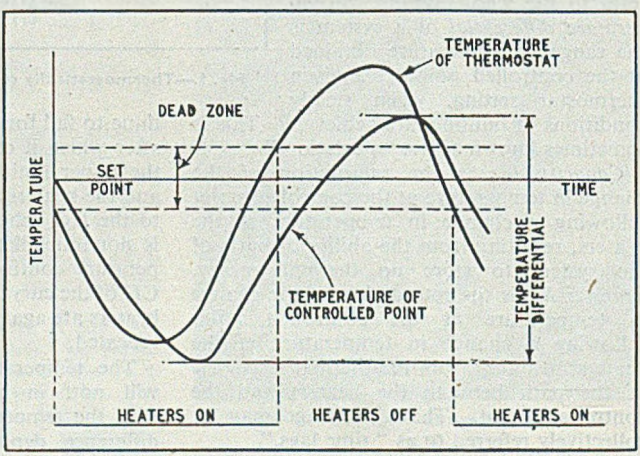


Fig. 2.—Effect of increasing inherent time lags

since the mean temperature of the controlled point depends on the many factors outlined above in addition to the set point of the instrument. Where the thermostats have to be set before fitting, it is still desirable to adjust the first one *in situ* and then to measure its setting point in the apparatus used for the purpose. This measured value is then used for setting the remaining thermostats.

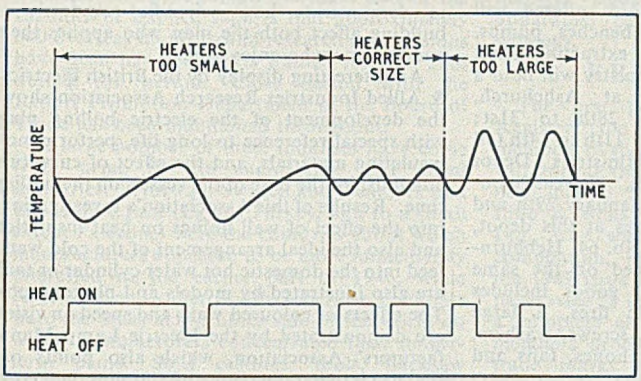


Fig. 3.—Influence of size of heater on performance

Acknowledgments are due to Electro Methods, Ltd., for permission given to the author to publish the above information.

Municipal Reports

Dartford.—The borough electrical engineer (Mr. R. Daw) reports that 23·2 million kWh was sold during 1945-46, as against 22·2 million in 1944-45. Total revenue amounted to £130,018 (against £123,454) and working costs were £113,545 (£102,023), the financial result after payment of all charges being a profit of £2,165 (£2,756). Revenue per kWh sold averaged 1·33d (1·3d). For the year 1947 a further 5 per cent discount is to be given in addition to the present discount for payment of accounts within twenty-eight days; this applies to domestic, business, power and street lighting and institution tariffs.

Ipswich.—Besides the work of constructing the new Cliff Quay station (ultimate site capacity 270,000 kW) the undertaking has in hand a long-term 33-kV transmission scheme. In addition the past year saw a considerable increase in the volume of work confronting the consumers' installation and service department; the chief engineer and manager (Mr. G. A. Vowles) mentions in his report that there were at the end of the year 66 electricians engaged on consumers' service, a standby rota operating to cover 18 hours of every day. The income of this department increased from £17,107 to £28,549 and the net result was a profit of £1,979. Sales of electricity in the undertaking's area —excluding bulk supplies—increased by 4 per cent to 71·5 million kWh, the average price received being 1·13d (against 1·09d). Total income was £488,906 (£442,050), with working expenses at £403,189 (£363,533) and there was a net profit of £10,040 (£11,486). The Department generated 38·9 million kWh (28·5 million).

Bedford. — For the first time for ten years there was a small loss on the year's working of the undertaking (£975); this compares with a net profit of £18,049 in 1944-45. The chief engineer and manager (Mr. P. G. Campling) points out that with the advance of 38 per cent in supply costs since 1939 the existing low charges have become uneconomic, and since the date of the report it has been decided to increase the 10 per cent addition to non-industrial tariffs to 15 per cent.

Revenue last year rose by £17,028 to £429,235, while working expenses, at £354,620, were up by £40,804, resulting in a reduction of £23,776 in the gross surplus. Energy sales totalled 81·5 million kWh against 80·4 million in the previous year, despite a reduction of 3·5 million kWh in power sales. The average price obtained per kWh sold was 1·17d (1·14d).

A total of 35·1 million kWh was generated at the Department's power station (against 32·1 million) and the engineer comments that the availability and performance factors for the year of 89·4 and 94·6 per cent respectively may be considered commendable for a station of its size and age.

Scunthorpe.—With the accounts for 1945-46 we have received from the borough electrical engineer and manager (Mr. H. Peace) comparative figures showing that since 1939 the total sales of the undertaking have risen from 13·6 million kWh to 78·8 million. This large increase has been due to the fact that, in addition to normal domestic development, all the large steel works in the area now take extensive supplies from the Corporation. The local branch of the United Steel Companies (Appleby-Frodingham Steel Co.) commenced taking a 33-kV supply just before the war, followed later by Richard Thomas & Baldwin's (at 6·6 kV) and John Lysaght (at 3·3 and 33 kV). In 1938-39 the undertaking's load factor was 28·81 per cent, while last year it was 57·62 per cent. Revenue in 1945-46 amounted to £289,065, equal to 0·885d. per kWh sold. Total costs, at £260,407, averaged 0·797d. per kWh sold, compared with £64,701 and 11·37d. in the last pre-war year. The net result of the year's working was a profit of £14,496.

Surplus Stores Disposal

VARIOUS engineering stores will be for sale by the Ministry of Supply on January 15th and 16th, at M.O.S. Depot No. 46. Cornholme Mills, Cornholme, Nr. Todmorden, Yorks. On January 22nd and 23nd a sale will be held at M.O.S. Depot No. 111, Gibsons Precast Concrete Ltd., Union Street, Albion, West Bromwich, and the stores offered will include marine engines, work benches, pumps, electric motors, belting, dust extracting plant and vacuum cleaners. The Ministry will hold a further sale at its depot at Ashchurch, Gloucestershire, on January 28th to 31st; February 4th to 7th; February 11th to 14th (all dates inclusive). At the Ministry's Depot No. 118, Rossleighs Garage, Newcastle-on-Tyne, there will be a sale on January 29th and 30th. In addition to the stores at this depot, stores lying at M.O.S. Depot No. 64, Hebburn-on-Tyne will also be auctioned on the same dates. A large quantity of goods includes hotplates (1,500 W), electric fires, a large assortment of nuts and bolts, screws, washers, shackles, etc., desk type telephones, fans and other equipment.

Radio Components

Large quantities of radio components are among the Government surplus stores for which the Ministry of Supply is responsible. Already £500,000 worth of these stocks have been sold, including 12 million fixed condensers, 800,000 variable condensers, 23 million resistances and a million valveholders. In addition, components to the approximate value of £30,000 have been sold to universities, technical schools and other educational establishments. In making this statement, a Ministry of Supply official said that the Ministry's policy was to satisfy public demand. But where the surplus was very heavy in relation to current production and requirements, it might be against the national interest to release the whole of the surplus stocks, especially if they could be sold only at such low prices as would cause serious harm to the industry concerned and lead to unemployment. Unfortunately it was not possible to hold surpluses for any long period, because of shortage of accommodation and, sometimes, the risk of deterioration. For those reasons it was occasionally necessary to scrap goods in serviceable condition, although this seldom happened.

Machine Tool Sale

An auction sale of machine tools will be held at the Ministry of Supply Depot, Queen's Road, Kilmarnock, Ayrshire, on January 28th and 29th. Included among the 600 machine tools to be offered are plain and vertical milling machines, cylindrical grinders, profiling machines, turret and capstan lathes, circular sawing machines, thread millers, centring machines, and many other types.

Building Science Display

THIS week the Incorporated Association of Architects & Surveyors is commemorating the twenty-first anniversary of its foundation by holding a Building Science Exhibition in conjunction with the Department of Scientific and Industrial Research. The object of the exhibition, which is at Caxton Hall, Westminster, is to demonstrate how scientific standards of building affect both the man who applies them and the one who enjoys them.

An interesting display by the British Electrical & Allied Industries Research Association shows the development of the electric boiling plate with special reference to long life, performance, insulating materials, and the effect of curvature and finish of the base of the vessels on the boiling time. Results of this Association's investigations into the effect of wall linings on heat insulation and also the ideal arrangement of the cold water feed into the domestic hot water cylinder or tank are also illustrated by models and photographs. The effects of coloured walls and speed on vision are demonstrated by the Electric Lamp Manufacturers' Association, which also points out the special characteristics of the different types of lamps and fittings.

In carrying out the investigations into the effect of various materials and methods on building design very large use is made of electrical apparatus and instruments. Actual equipment and models show how these are utilized.

Garcke's Manual

WE welcome the reappearance, after the war years, of the "Manual of Electrical Undertakings and Directory of Officials (Garcke)." Although this is the forty-fourth edition of this standard work of reference, it is really the jubilee year of its publication as the first volume was published in 1896. To mark the occasion there is a special article reviewing the progress made in the electricity supply industry during the past fifty years.

Statistical tables, compiled from Returns published by the Electricity Commissioners, are included, representing a comprehensive and comparative survey of electricity supply in Great Britain, as furnished by all authorized undertakings for the years 1925-26 to 1942-43. The "Manual," also covers undertakings in Ireland and a number of non-statutory concerns.

As in previous years, the list of electricity undertakings, arranged in alphabetical order, contains full information regarding the undertakings. Other familiar information includes an alphabetical list of associations, institutions and societies, and a directory of directors and chief officials connected with the electrical industry, with addresses. The manual is published by the Electrical Press, Ltd., 23, Great Queen Street, London, W.C.2, at £3 3s.

COMMERCE and INDUSTRY

Export Trade Research. Electrical Employment Statistics.

NEXT month the British Export Trade Research Organization completes its first year of active work, and the chairman of the Council, Mr. L. Gamage, president also of the Institute of Export, reports that approximately 600 overseas inquiries and research commissions have been handled by its trained research staff during the period. Close liaison with the Export Promotion Department of the Board of Trade has been maintained throughout.

A large number of these inquiries have come from firms in the engineering and allied industries. Norway, Sweden and Denmark and the Middle East (Egypt, Turkey, and to a small extent Palestine) were the countries about which manufacturers appeared to be more immediately interested in the earlier part of 1946, while Argentina and other South American countries were the areas at the other side of the world on which manufacturers concentrated their longer-term plans. Steel castings, tools, hacksaw blades, tubes, cylinders and bearings, metal wire and rollers—are a few of the numerous products on which advice was sought. Facts about the markets for screws, bolts, nuts, padlocks, domestic appliances, motor-bus chassis and filter pumps, both for Europe and for the Americas, were obtained for " Betro " members.

Employment in October

The latest employment statistics published by the Ministry of Labour and National Service relate to October last. They show that the total number of insured people employed in industry and commerce in Great Britain was 11,923,800, of whom 4,006,900 were women. The figures exclude agriculture, mining, railways, shipping, and national and local government service. At mid-1945 the total was 10,935,600 (4,475,200 women) and at mid-1939, 12,331,200 (3,676,900 women). There were 1,570,000 people in the Forces (92,000 women) and 88,000 (4,000 women) in civil defence, National Fire Service and police.

The numbers employed in the various branches of the electrical industry (excluding electricity supply which is bracketed with gas and water) are shown in the accompanying table.

Figures relating to unemployment include the following:—Electrical engineering 2,399 (723 women); electrical wiring and contracting industry 1,082 (84 women); and electrical apparatus, cable, lamps, etc., 3,422 (1,430 women).

F.B.I. Register Revived

The first post-war issue of the " F.B.I. Register," the official directory of manufacturer members of the Federation of British Industries, will appear this summer. The publication has been placed by the F.B.I. in the hands of Iliffe & Sons, Ltd., and Kelly's Directories, Ltd., who will jointly be responsible for the compilation, production and sale. Plans for the 1947 issue allow for a total of about 1,064 pages, size 9⅛ in. by 7 in., the contents including a complete classified buyers' guide of F.B.I. members' products, registers of trade names and trade marks and a complete directory of members' addresses, telephone numbers and telegraphic addresses; new reference facilities in English, French and Spanish will be included.

With a predominantly overseas circulation, the total print order for the Register will be over 10,000 copies, of which some 5,000 will be distributed by the F.B.I. to Government Departments, Trade Commissioners and buyers overseas, whilst the publishers' own organization will sell copies to importers and buyers throughout the world. Advertisement space is available to all F.B.I. members and inquiries should be sent to Dorset House, Stamford Street, S.E.1.

Tummel-Garry Contract

For the Errochty power station in its Tummel-Garry scheme the North of Scotland Hydro-Electric Board has placed a contract with the General Electric Co., Ltd., for the manufacture and installation of three vertical-shaft water turbo-alternators with turbines of Boving manufacture. Each alternator will have an output of 27,800 kVA (m.c.r.) at 11,000 V, and the Boving turbines, a specified rating of 35,000 H.P. against a 525 ft head of water. As much of the plant as possible will be made in Scotland, where the turbines will be built and all the heavy

EMPLOYMENT DURING OCTOBER (THOUSANDS)

Branch	Males (14-65)			Females (14-60)			Total		
	Mid-1939	Mid-1945	Oct., 1946	Mid-1939	Mid-1945	Oct., 1946	Mid-1939	Mid-1945	Oct., 1946
Electrical engineering ..	105·9	106·1	106·4	28·0	69·7	52·8	133·9	175·8	159·2
Electrical wiring and contracting	38·9	32·0	49·3	2·8	5·5	5·3	41·7	37·5	54·6
Electrical apparatus, cables, lamps, etc.	116·4	112·2	130·7	79·5	167·7	133·1	195·9	279·9	263·8

forgings for the alternators produced. The electrical equipment will be manufactured at the G.E.C. Witton Works. Merz & McLellan are the consultants for this scheme and it is hoped to complete the installation for the winter load of 1948.

Turkish Telephone Contract

To comply with the terms of a £500,000 telephone order received by the G.E.C. from Turkey seven motor vans are urgently required. The order involves laying new lines over a wide area of wild country, and no transport is available. A large section of the contract has to be completed within eighteen months and the whole of the work must be finished within two years. The Humber Co., obtained seven ex-service Humber 4-wheel drive chassis for renovation, bodies for these chassis were obtained for the G.E.C. by the Willenhall Coachwork Co., from a "dump" where they had spent several months in the open air, and G.E.C. volunteers are building the vans, the first of which is now ready for dispatch. Two teams of technicians will be sent to Turkey by air and will spend four to six months making preliminary investigations during which they will use these vehicles. Installation engineers will then go out and will use the same transport.

Proposed International Exhibition

A letter and memorandum, signed by Viscount Bennett as president of the Royal Society of Arts have been sent to 165 organizations throughout the country, inviting their representation at a half-day conference to be held at the Society's House on February 6th. The questions to be discussed will be whether an international exhibition on a large scale should be held in London in the near future; if so, whether Hyde Park should be the site; and whether every effort should be made to hold it in 1951, the centenary year of the first International Exhibition.

If the conference approves the general proposal, a formal approach will be made to the London local authorities and to the Government.

Electricians' Wages Question

Under Defence Regulation 56AB all persons carrying out building and civil engineering work, including electrical installation work, must be registered by the Ministry of Works and one condition of registration is that the applicant agrees to accord to his employees conditions and wages neither more nor less favourable than those fixed for the work and the district by joint agreement between employers and employees.

Having an installation department, the Greenwich Borough Council secured registration and, in agreement with the Electrical Trades Union, instituted a scale of wages for electricians under twenty-one years of age more favourable than the rates agreed upon by the National Joint Industrial Council for the Electrical Contracting Industry. The differences ranged between ½d. and 3d.

The National Federated Electrical Association contended that the N.J.I.C. rates should be paid by the Borough Council, but the Ministry of Works held the view that if there was any difference between the Electrical Trades Union and the N.F.E.A. they should try to find a solution. The matter was referred by the Minister of Labour to the Industrial Court which eventually decided that the terms on which the Borough Council employed electricians' assistants between the ages of 16 and 20 years should be neither more nor less favourable than those provided for in the N.J.I.C. agreement and advised the Minister of Labour accordingly. Subsequently the Borough Council agreed to adopt the N.J.I.C. wages and conditions.

Cost of Living Revision

The Cost of Living Advisory Committee has been reconstituted by the Minister of Labour and National Service. It is to advise the Minister on the basis of the official cost of living index figure and on matters connected therewith. The immediate question on which the Committee has been asked to advise is whether any revision in the basis of the figure is practicable or desirable in present conditions and, if so, to advise as to the revision that might be made. The secretary is Mr. J. G. Cannell, Ministry of Labour and National Service, 8, St. James's Square, London, S.W.1.

Middle East Trade Prospects

Last year a trade mission from this country, which included Mr. J. F. Perry of the Metropolitan-Vickers Electrical Export Co., Ltd., visited Iraq, Syria, the Lebanon and Cyprus. The mission's report has now been published by the Stationery Office. This says that wherever it went the mission found abundant goodwill towards this country and a desire to purchase a wide range of British goods. As regards payment, there appeared to be an ample supply of sterling funds in the hands of private buyers. As is usual in such reports, careful selection of agents is counselled and the appointment of separate agents for each country is recommended.

Copper, Lead and Zinc Prices

With reference to its announcement of new selling prices of copper, lead and zinc on January 1st, 1947, the Ministry of Supply now announces the withdrawal of the notification that holders of outstanding licences (for copper, lead and zinc metal as sold by the Directorate of Non-Ferrous Metals) granted on or before December 31st would only be covered at the new prices. Following discussions with the British Non-Ferrous Metals Federation, the

Ministry is now prepared to consider covering these outstanding licences at the prices ruling on December 31st. Holders of such licences (including those who have, since January 1st, converted their licences into contracts at the new prices) should apply to the Directorate of Non-Ferrous Metals, 20, Albert Street, Rugby, not later than January 21st.

Licences and Contracts for Lead

The Ministry of Supply has made some changes in the contract procedure against licences for lead. In future, contracts against licences for "unwrought lead of guaranteed 99·97 per cent lead content" will only be issued by the Directorate of Non-Ferrous Metals, Rugby, if applications are accompanied by a signed declaration regarding stocks held. The existing procedure of issuing licences to implement the system of quarterly allocations of lead continues unchanged.

British Institute of Management

A number of leaders of industry have agreed, at the request of the President of the Board of Trade, to serve on the first Council of the British Institute of Management under the chairmanship of Mr. C. G. Renold. The list includes the following:—Mr. G. Chelioti (director, General Electric Co., Ltd.), Miss Caroline Haslett (director, Electrical Association for Women), and Sir Archibald McKinstry (deputy chairman, Babcock & Wilcox, Ltd.). Representative members include Sir Norman Kipping (Federation of British Industries).

Acoustics Group

For adopting rules and electing a chairman and officers of the newly formed Acoustics Group of the Physical Society, a meeting is to be held on February 19th in the Jarvis Hall of the Royal Institute of British Architects, 66, Portland Place, London, W.1. Membership will be available to all interested persons and members of other societies with provision for group membership by firms. Mr. H. L. Kirke (head of the B.B.C. research section) will preside and a display of recent acoustical apparatus will be on view.

Navigational Apparatus

In our issue of November 15th last we referred to the formation of Chance-Londex, Ltd., with a capital of £10,000. We are informed that the objects of the new company are the manufacture, marketing and servicing of battery-operated navigational and marine lights, fog signals, loudspeakers, radiolocation apparatus, etc. It will purchase from Chance Brothers, Ltd., optical systems, certain types of lamp-changer, battery-charging equipment, either engine driven or mains operated, and structural work associated with marine lights which comes within the scope of that company's manufacture. It will purchase from Londex flasher mechanisms and photo-electric cell control devices. Buoy bodies, batteries and lamps will be purchased direct from the appropriate makers.

Electricians' Wages

"Failure to agree" has been recorded in respect of an application by the Electrical Trades Union for a substantial increase in the wages of electrical contracting operatives. In view of the fact that the existing wages agreement between the Electrical Trades Union and the National Federated Electrical Association expired on the second pay day in January, 1947, for the pay period covered by that pay day, it has been decided by the N.F.E.A. that for all classes of labour covered by existing agreements the present rates shall remain current until further notice.

Earthing to Cables

It is reported by the *Electrical Contractor* that the borough electrical engineer of Blackburn is permitting the earthing of electrical installations on to the supply cables. The Electricity Department will fix an earthing block at a nominal charge of 5s. Where the standard E.D.A. unit is used the facility for earthing the installation is incorporated. The arrangements apply only to a.c. supplies; in no circumstances is the earthing of installations on the d.c. system permitted.

E.R.A. Annual Meeting

The annual general meeting of the British Electrical and Allied Industries Research Association is to be held on Friday, February 14th, at the Connaught Rooms and will be followed by a luncheon, when the Earl of Mount Edgcumbe will deliver his presidential address.

Submarine Power for Dockyards

As a means of easing the burden on generating plant and saving coal the Admiralty has arranged for submarines to supply power to Devonport, Portsmouth and Sheerness Dockyards. Twenty-six vessels are to be used, fifteen at Portsmouth, nine at Devonport and two at Sheerness. The capacity of each is stated to be of the order of 1,000 kW.

Batti-Wallahs' Luncheon

The next monthly luncheon of the Batti-Wallahs' Society is to be held at the Connaught Rooms, London, W.C.2, on January 30th (12-30 for 12.55 p.m.) Mr. Hugh Quigley, M.A., is to be the guest of honour.

Dismantling of Magnesium Works

The extensive plant of the Magnesium Metal Corporation at Port Tennant Swansea, established just before the war for the production of magnesium powder for war purposes, is

being dismantled and sold. In addition to a very large quantity of general plant, the equipment includes some of the latest types of electric furnaces for the production of magnesium. The whole of the plant and machinery is being offered for disposal by George Cohen, Sons & Co., Ltd., who are preparing a catalogue of the equipment available.

Coal Supplies Reduced

Although coal production has recently risen the demand is still increasing at a greater rate. Consequently, the President of the Board of Trade and the Minister of Fuel and Power have announced that supplies of coal to industrial concerns during the next six weeks will have to be reduced. From January 20th these supplies will amount generally to about half of the previous allocations, although special preference will be given to works of national importance.

It is not proposed to reduce the supply of coal to electric power stations, but it was stated that in view of the continuing shortage of generating plant there would probably still be periodical cuts in power supply.

Air Navigation Aids

The three State-owned air lines are setting up a non-profit-making company—International Aeradio, Ltd.—to install and operate telecommunication and radio aids to navigation and landing wherever they are required and would not otherwise be obtainable. It is hoped that the large orders which will be placed by the new company will stimulate the production of equipment by British manufacturers.

Modern Homes Exhibition

The 1947 Modern Homes Exhibition, organized by the *Daily Herald* will open at the Dorland Hall, Regent Street, London, S.W.1, on March 25th. Features of the exhibition will include full-scale electric kitchens and labour-saving devices.

Trade Publications

Walker Bros., Ltd., Temple Row, Birmingham, have resumed the publication of their "Electrical News." The "Winter 1946" number contains many well-produced pictures of appliances to be seen in the showrooms and of places in which the company has carried out installation work.

Morphy-Richards, Ltd., St. Mary Cray, Kent. —Illustrated and priced leaflet on "Mycalex" wall panel heaters.

Calendars, etc.

The Wellman Smith Owen Engineering Corporation, Ltd., have sent us a handsome wall calendar which has some excellent reproductions of photographs in colour of various sections of the company's works. The monthly sheets show also the preceding and following months.

An appealing young lady in scant attire adorns the calendar of Truvox Engineering Co., Ltd., which has monthly sheets showing also the preceding and following three months.

The calendar received from Metway Electrical Industries, Ltd., has monthly sheets surmounted by illustrations of some of the electrical accessories which the company manufactures.

A handy appointments diary in a neat black limp binding has been received from Transformers & Welders, Ltd.

Mitchell Electric, Ltd., is issuing two types of calendar. An attractive quay-side scene with the inscription "Fill the Ships and Fill the Shops" appears on one, while the other, of more utilitarian design, has monthly sheets with extremely bold figures.

Electricity Capital Issues

Statistics issued by the Midland Bank of new capital issues from 1938 onwards show that in 1938 the total issued by electric light and power companies amounted to £15,032,000. Subsequent figures were:—1939, £7,350,000; 1940-44, £2,684,000; 1945, £1,227,000; and 1946, £1,875,000.

Staff Passenger-Coach Service

A service of passenger coaches has been instituted by Philips Lamps, Ltd., between the company's head office at Century House, Shaftesbury Avenue, and two of its factories, one at Mitcham and one at Waddon in Surrey.

E.W.F. Headquarters

The Electrical Wholesalers' Federation has transferred its offices from Henley-on-Thames to permanent headquarters at Kingsway House, Kingsway, London, W.C.2.

Institute of Physics

The address of the Institute of Physics and of its *Journal of Scientific Instruments* is now 47, Belgrave Square, London, S.W.1 (telephone: Sloane 9806/7).

Trade Announcement

Owing to the expiry of their lease at 34, Broadway, S.W. 1, Pooley & Austin, Ltd., have moved to 77, Great Peter Street, S.W.1.

Trade Marks

Application has been made for the registration of the following trade mark. Objections may be entered within a month of January 8th:—

ITONIA. No. 642,959. Class 9. Electrical apparatus and appliances included in Class 9.—David Sidney Bilantz, 3, Leeds Place, London, N. 4. To be associated with No. 428,556 (2330) ix and another.

Motor Control—II

Maintenance of Protective Devices

By "Rotor"

EACH time a starter is inspected the no-volt trip should be checked. Its function may not merely be to prevent a motor automatically restarting when the supply is resumed after a failure; it is frequently also the means by which the overload releases trip the starter, and remote or emergency switches operate, and may form part of the protective sequence circuit. There are two main types of trip, one in which the energized coil holds an iron plunger suspended over the hold-on catch of the starter, and the other in which the moving contacts are attached to the armature and brought into contact with the fixed contacts when the coil is energized.

The no-volt trip contained in a push-button controlled starter is, of course, tested each time the "stop" button is pressed. Remote or emergency stop buttons, where fitted, should be used occasionally for the same purpose. Where such means of control are not employed the trip can often be tested by using a strip of insulating material to separate overload-trip contacts which are connected in the no-volt circuit. Another possible method is to switch off at the main switch and observe if the starter trips out. These tests should be made while the motor is running unloaded if possible. A partial test of a no-volt trip with a hand-operated starter may be made by isolating the starter, moving the handle to the running position with the no-volt armature or plunger held in the energized position and then smartly releasing the latter.

No-volt trips may fail owing to worn retaining catches, stiff working parts, weak or broken return springs or rough contacts. Dirt or oil on the magnet faces will often cause the armature or plunger to remain in the running position even when the coil is de-energized. The fixed core of a no-volt coil may come adrift and fall on to the plunger, reducing its lift so that when released it has not sufficient momentum to trip the hold-on catch. One type of no-volt trip has a hinged armature which is raised by a spring to trip the starter when the coil is de-energized and may fail due to the spring pressure being weakened by the spring adjusting nuts having slackened off.

D

Chattering and noisy operation of contactors, resulting in burnt contacts, may be due to dirt or rust on the contact faces of the electromagnet, rough contacts, incorrect adjustment of contacts or to the contact guides requiring slight lubrication. Anything which increases the air gap between the magnet faces will reduce the reactance of the coil, causing it to draw an increased current from the a.c. mains, resulting in overheating and possible burn-out of the coil. Another cause of severe chatter is fracture of the copper short-circuiting band encircling part of the magnet face, the function of which is to delay the cycle of magnetism in the encircled portion and thus even out the magnetic pull over the whole a.c. cycle. Frequent tripping of a starter may be due to burnt hold-on contacts, overload trip contacts or "stop" button contacts.

Overload trips can usually be completely tested only by injecting a controlled current through the overload element. This is hardly practicable or essential for any but highly important circuits. However, it is

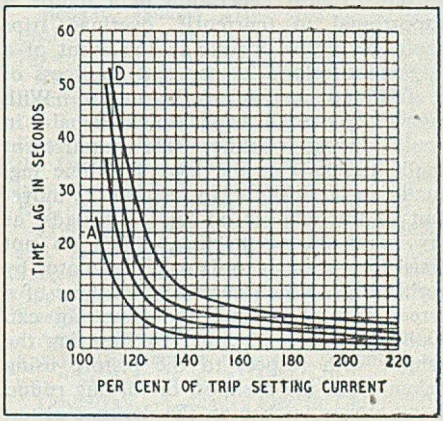


Fig. 2.—Characteristic current-time curves with various time-lag settings of magnetic overload trips. A minimum and D maximum setting

important that the trips should be carefully examined to ensure that they are working freely and that defects will not be revealed by failure to operate under fault conditions. Magnetic trips may fail due to sticking of plungers, strained trip bars and similar

defects. Bi-metal trips may be inoperative due to incorrect adjustment of the strips or stiffness of the tripping mechanism. Directly heated bi-metal strips which are subject to overloads, possibly at starting, may become burnt at the free ends, where the conduction of the fixing points has least effect.

Care should be taken to see that the overload releases are correctly adjusted and correctly rated. Motors, other than totally enclosed machines, built to B.S. 168-1936 and 170-1939, should, under good conditions, be capable of withstanding 25 per cent overload for the following periods :— 2 hr for 10 H.P. and over per 1,000 r.p.m., 30 min for 4 to 10 H.P. per 1,000 r.p.m., 15 min for 1 to 4 H.P. per 1,000 r.p.m. Fractional - horse - power motors, other than those coupled to propeller fans or centrifugal loads, should be able to cope with a similar overload for 5 min. Since the rate of heat generation in a motor is proportional to (current)^2, overload trips should be set to operate in the event of a sustained overload 25 per cent in excess of the full-load current of the motor. With magnetic overload trips which remain in circuit during starting, this requirement usually necessitates the use of a time lag, usually an oil dashpot, to restrain the movement of the plunger on high overloads, as may occur during starting, which do not persist long enough to damage the motor by overheating. When necessary to allow of a correct current setting, the time lag can usually be increased either by lowering the dashpot with respect to the piston, using thicker oil in the dashpot, or turning round the oil escape washer on the dashpot piston to bring into operation a smaller escape hole, thus increasing the time lag. Fig. 2 shows the tripping currents relating to various time-lag settings of one particular overload trip.

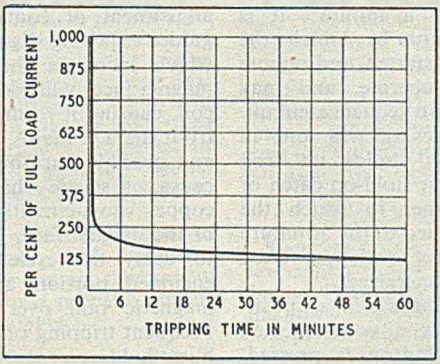


Fig. 3.—Characteristic curve of fusible metal thermal overload trip

The makers' information relative to thermal overload trips should be considered before setting these, as methods of calibration differ. Usually the trips have an inverse-time lag of such a value that the trips require setting at the full-load motor current for correct protection. In order to alter the setting of the fusible metal type of thermal trip a heating element of different rating must be fitted. Fig. 3 shows the characteristic of one such type of trip. Bi-metal trips can usually be adjusted somewhat by varying the amount of strip movement necessary to cause tripping, in accordance with the makers' calibration plate. Settings of bi-metal strips should be checked occasionally; the makers' instructions often specify the correct position of the free end of the strips with respect to some fixed point when the strips are cold. Frequent tripping of thermal-overload releases may be due to bad connections of the elements resulting in increased heating. It is useful to observe the movement of the bi-metal strips when starting a motor. If one moves more than the others this may be due to bad connection of the element or electrical fault on the motor circuit.

On larger switches the magnetic overload trips are often fed by current transformers, the time lag being provided by fuses which are connected across the trip coils. The trip then functions only after the fuse has been melted by overload. The trip coil should then be set at the full-load current, the actual tripping current and time lag depending on the size of fuse fitted. Should the fuses be removed, the trip will then operate practically instantaneously at the coil setting; it may then trip on transient or switching currents, and the burden on the current transformers is increased so that any instruments fed from the same transformers may read incorrectly.

Faulty operation of this type of trip may be found to result from the use of the wrong size of fuse, high resistance fuse contacts or connections, faulty current transformer or incorrect trip setting. Spare time-lag fuses of various sizes should be kept on hand.

Isolating switches and fuse boards require attention in such respects as cleanliness,

correct adjustment and condition of contacts, soundness of connections, and condition and correct fitting of arcing barriers and insulating screens. A single-phase circuit should not be fed from one of the fuses for a three-phase motor circuit, as the melting of the fuse on overload would leave the motor "single phasing." All the fuses of a three-phase set should be renewed if one blows, as the others may have been damaged. Fuses should be correctly labelled and the correct size fitted. Flash-over has occurred in a switch fuse without arcing barriers owing to the melting of wire fuses which had been substituted for cartridge fuses.

In most cases the points mentioned can quickly be checked when treated as a routine matter, the engineer becoming familiar with those which require attention in different types of gear. There is no doubt that attention on the lines suggested can result in a very considerable reduction of avoidable breakdowns and consequent stoppage of production.

Forthcoming Events

Monday, January 20th.—BIRMINGHAM.—Grand Hotel. Birmingham Electric Club. "Brains Trust."

Tuesday, January 21st.—LONDON.—Institution of Electrical Engineers (Radio Section), 5.30 p.m. Discussion meeting.

MANCHESTER.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre (Transmission Group). "Three-Phase Distribution and Electric Welding and Furnace Loads," by A. Langley Morris.

EDINBURGH.—The University. Institute of Physics (Scottish Branch). "Photography of Atomic Tracks," by Prof. P. I. Dee.

Wednesday, January 22nd.—LONDON.—Institution of Electrical Engineers (Transmission and Measurements Sections), 5.30 p.m. Discussion on "Switchgear Alarms and Indications," to be opened by T. S. Andrews and T. R. Reyner.

Faraday Building, Knightrider Street, 5 p.m. Institution of Post Office Electrical Engineers. Informal meeting. "Automatic Exchange Maintenance," by A. Hudson, E. A. Smith and F. S. Hyatt.

John Adam Street, W.C.2, 5 p.m. Royal Society of Arts. "Gas Turbines," by Sir Claude Gibb and Dr. A. T. Bowden.

Thursday, January 23rd.—LONDON.—Institution of Electrical Engineers (Installations Section), 5.30 p.m. "The High Pressure Mercury Vapour Discharge and its Applications," by V. J. Francis and W. R. Stevens.

Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6.15 p.m. Association of Supervising Electrical Engineers. "Delicolor Equipment," by E. E. Faraday.

BRIGHTON.—Joint meeting of I.E.E. Southern Centre with members of the Institution of Mechanical Engineers and Institution of Civil Engineers. "Power Stations of the Future," by G. M. Martin.

NEWCASTLE-ON-TYNE.—Royal Station Hotel, 3.30 p.m. E.I.B.A. (Northern Counties Area). Annual general meeting.

Friday, January 24th.—LONDON.—Institution of Electrical Engineers (Measurements Section), 5.30 p.m. "The Application of Electrical Technique to the Service of some other Industries," by H. Cobden Turner and G. M. Tomlin.

39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. "Engineering Equipment of Flax Mills," by B. C. Oldham.

Storey's Gate, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. Informal meeting. "Materials New to Engineering," by F. T. Barwell and J. C. W. Humphrey.

Saturday, January 25th.—LONDON.—I.E.E. London Students' Section, 2.30 p.m. Visit to the Brookmans Park establishment of the British Broadcasting Corporation.

Waldorf Hotel, Aldwych, W.C.2, 2.30 p.m. Institution of Factory Managers. Annual general meeting.

Monday, January 27th.—SHEFFIELD.—Junior Institution of Engineers (Sheffield Section), 7 p.m. "Light and Colour," by L. H. A. Carr.

Tuesday, January 28th.—LEEDS.—Corporation Electricity Department, Whitehall Road, 6 p.m. I.E.E. North Midland Centre (Installations Group). "Engineering Principles applied to the Design of Domestic Water-Heating Installations of the Solid-Fuel/Electric Type," by R. Grierson and Forbes Jackson.

LONDON.—Royal Society of Tropical Medicine and Hygiene, Portland Place, W.1, 7 p.m. Society of Instrument Technology. "Some Applications of Electronics in the Iron and Steel Industry," by W. C. Fahie.

At the Royal Society, 5.30 p.m. Institute of Physics (Electronics Group). "Semi-Conductors," by Prof. H. S. W. Massey.

COVENTRY.—Coventry Electric Club. "Oils," by R. Gledhill.

Fuel Efficiency Exhibition

Glasgow Corporation Kelvin Hall Special Committee has approved a proposal to hold an exhibition to be known as "The Scottish Fuel Efficiency Exhibition" in conjunction with the conference of Light, Fuel and Power Appliance Manufacturers to be held at Kelvin Hall from March 25th to 27th.

NEW BOOKS

Data on Contacts. A.C. Machinery Textbook.

Electrical Contacts. By Dr. L. B. Hunt with seven collaborators. Pp. 122; figs. 133. Johnson, Matthey & Co., Ltd., 73, Hatton Garden, London, E.C.1. Price 10s. 6d.

This cloth-bound book is printed in bold type on good paper and is illustrated liberally and well. It deals with a subject that is almost as wide as it is complex; so it has been confined to English practice particularly in respect of the very comprehensive range of products of the firms which the authors serve. The information is recorded in a way that renders reference easy, to help the selection of appropriate materials for, and suitable forms of, electrical contact for many diverse purposes in " heavy " as well as " light " current circuits.

The book is broadly divided into three sections, respectively concerned with electrical and mechanical influences on contact life and behaviour, chemical and physical properties of numerous compositions and alloys already available and, finally, different methods of manufacturing contacts.

So many combinations are possible that only the specialist can be conversant with all the limitations of every one. But study of the three sections of this book in conjunction with one another should provide reasonable detail for the designer.

The book concludes with a selected bibliography of 53 references to the subject and a general index.—W.O.F.

Fundamentals of Alternating Current Machines. By A. Pen-Tung Sah. Pp. 466; figs. and illus.; index. McGraw-Hill Publishing Co., Aldwych House, Aldwych, London, W.C.2. Price 25s.

The author is an experienced teacher. In addition to his Chinese experience he has been on the staff of several famous American Universities. He gave a series of lectures at Queen Mary College (University of London) in 1945.

The book is based on a course given to soldier-students in Stanford University (U.S.A.) in 1945. Except for Chapters 24 and 25 the book covers familiar ground in the theory of alternating current machines. All the usual machines are dealt with. In addition there is a chapter on special transformers and their applications and a chapter on parallel running of transformers. A number of fully worked numerical examples are given and also a set of problems (without answers) on each chapter.

Chapters 24 and 25 were not included in the Stanford course and students who find the Stanford material of about the right standard of difficulty will find these two chapters somewhat out of their depth. Chapter 24 concerns the unbalanced operation of alternators and induction motors. It contains an adequate treatment of symmetrical components. Chapter 25 deals with transients in alternating current machines and contains an interesting treatment of the various reactances—synchronous, transient, subtransient—occurring in alternators. Dr. Sah is a master of these subjects, and the better type of student will read these chapters with advantage. They could have been fitted better into the general level of the book if there had been more explanatory matter on such subjects, for example, as the development of equation 1a on page 377.

The author states " the last decade has produced young students fascinated by electronic devices and who approach the theory of dynamo-electric machines with reluctance." He also states " the subject of electrical machines has a heritage of terminology and method of attack of its own which to the novice electronic students appear to be out of gear with their line of thought." In this book the author has developed the theory of machines from the standpoint of circuits and along lines which will use conceptions familiar to the electronics student.

Throughout the book " complexor " is used instead of " vector " for that which can represent a sinusoidal function of time. Considerable use is made of the complexor representation of a.c. power. The proof reading is not above reproach. Errors occur on pages 14, 124 and 238. Figures 24, 6 and 24, 7 are wrongly labelled.

The book can be recommended to students of University and Higher National Certificate standards. It is an excellent exposition of the modern method of presenting the theory of a.c. machines.—W.J.J.

Heaviside's Operational Calculus Made Easy. By T. H. Turney. Pp. 102; figs. 33. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 10s. 6d.

This is the second edition of a book explaining for the benefit of young engineers of average mathematical attainments the methods adopted by Oliver Heaviside in analysing circuit transients, the original of which was reviewed in these columns on August 18th, 1944. New material has been introduced and explanations have in many cases been amplified. Some attention has evidently been paid to reviews of the first edition in regard to textual improvements.—C.O.B.

Books Received

Electric Power Equipment. By J. G. Tarboux. Pp. 493; figs. 373; index. McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C.2. Price 30s.

Practical Mechanics for All. Edited by L. A. Beaufoy. Pp. 448; illus.; index. Odhams Press, Ltd. Price 9s. 6d.

ELECTRICITY SUPPLY

Rebate for Hove Consumers. Hartshead Extensions.

Battersea.—PROFITS RETURNED TO CONSUMERS.—Out of the £20,000 profit which is expected to be made this year the Electricity Department is to return £16,500 to consumers by way of a 5 per cent discount.

Birkenhead.—SUPPLY TO NEW PREMISES.—The Electricity Committee is to provide a supply to the Oaklea housing estate, Pensby, at a cost of £7,429, and to a new factory at Valley Road for Vernons, Ltd. (£3,147).

UNDERGROUND CABLES.—At a cost of £10,012, overhead lines are to be replaced by underground cables.

TRANSMISSION LINE.—The Planning Committee reports that the Central Electricity Board proposes to erect a double line from Prenton substation to Hoylake and Wallasey.

CAMP INSTALLATIONS.—The Housing Committee has arranged for the Electricity Department to install wiring, etc., at camp hutments at Upton at a cost of £2,320.

Chester.—REVISED CHARGES.—The Electricity Department is to put into operation new tariffs which will mean a reduction in the running charges for domestic users in certain rural areas and slightly increased charges in the city. There will be an all-round increase for power. At a Council meeting it was explained that because of increased costs of production and materials the undertaking had been losing money for the last three years and the estimated loss for 1946-47 would be £27,770. With the application of the new tariffs and a substantial reduction in establishment charges a profit of £9,500 was estimated for 1947-48.

Douglas (I.O.M.).—DOMESTIC EQUIPMENT.—Cookers, meters, kettles, service units, etc., costing £3,000 are to be purchased by the Electricity Committee for the Spring Valley housing estate.

APPLICATION FOR GRANT.—The Committee is seeking a grant from Tynwald for supply extensions in and outside the Council's area.

Glasgow.—COMPANIES' CHARGES.—A special sub-committee is to consider the whole matter of the rates of charge of the Clyde Valley Electrical Power Co., Ltd., and its subsidiary distribution company, the Strathclyde Electricity Supply Co., Ltd., to domestic consumers in the city but outside the Corporation's area of supply, with particular reference to the increase of 15 per cent.

Grimsby.—EXTENSION.—The Town Council proposes to arrange for an electricity supply to Welton-le-Wold at a cost of £6,008.

Hove.—REBATE TO CONSUMERS.—The Corporation Electricity Department is to give to consumers a rebate of 30 per cent of the cost of the electricity consumed in the quarter ending March 31st. The estimates showed a profit on the year of £22,625, and it was originally proposed to make a rebate of 20 per cent, costing approximately £14,000 and still leaving a profit of £8,677. The motion to substitute 30 per cent, still leaving a profit of more than £1,000, was made by Alderman A. Nye, who said, after it had been proposed to refer the matter back, that electricity might be nationalized before the Council came to a decision: of the £8,677 profit, the Government would take roughly half in taxes.

Leek (Staffs).—SUPPLY TO ESTATE.—At a cost of £14,000 the Electricity Department is to extend the distribution system to provide a supply to a new housing estate being erected in the Compton area.

Salford.—LOAN FOR METERS.—The Light, Heat and Power Committee is seeking sanction to borrow £15,000 for electricity meters.

Stalybridge.—HARTSHEAD EXTENSIONS.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board has authorized the engineer to proceed with the preparation of plans, etc., required by the Electricity Commissioners in connection with extensions to the Hartshead power station estimated to cost £882,525. The engineer has been empowered to place provisional orders for buildings, turbo-alternator, boiler, cooling tower, etc.

Stockton-on-Tees.—NEW SUBSTATIONS.—In order to cope with the increased demands in Station Road, Norton, the Corporation Electricity Department is to install a new substation and to extend from the 11-kV system. The estimated cost of the scheme is £7,042. A new substation is also required to meet the increased demand in the Britannia Road locality at an estimated cost of £5,764. Application is being made to the Electricity Commissioners for sanction to these schemes.

Stoke Newington.—HOUSING SCHEME.—The Borough Council Electricity Committee is to provide equipment for the Woodberry Down housing estate at a cost of £1,205.

Swansea.—RECORD LOAD. — On December 31st the load at Tir John power station exceeded 100,000 kW for the first time, reaching 108,000 kW at the peak period.

Twickenham. — SCHOOL LIGHTING. — The Middlesex Education Committee is to remodel the electric lighting at the Kneller secondary school at a cost of £2,070.

Wallasey.—HIRE-PURCHASE RESTARTED.—The Electricity Committee is to reintroduce the hire-purchase scheme and has agreed that the following percentages shall be added to the cash

sale price in order to cover interest charges and the additional cost of collection. Two years, 12 per cent; three years, 14 per cent; four years, 16 per cent; and six years, 20 per cent. The cost of fixing appliances is to be charged to the purchasers, and the annual charges for maintenance of appliances, as adjusted to allow for maintenance in the first twelve months after purchase and for the 5 per cent cash discount will be as follows:—Cookers (all types), 9s. 8d.; washing machines, 3s. 11d.; radiators, 2s.; water heaters, 2s. 5d.; wash-boilers, 1s. 2d.; kettles, 1s. 9d. (exclusive of repairs to flex), and vacuum cleaners, 8s. 10d. Sales of kettles on hire-purchase are to be restricted to those bought with a cooker.

Watford.—SUPPLY TO L.C.C. ESTATE.—The Corporation Electricity Committee is to confer with the Northmet Power Co. regarding supplies to the new London County Council estate at Oxhey.

West Bromwich.—MAINS AND SERVICES.—The Electricity Committee is seeking sanction to borrow £20,000 for mains and services.

Wigan.—NEW POWER STATION.—The Town Council has made application to the Electricity Commissioners for consent to establish a generating station on land at Westwood, partly in Ince and partly in Wigan.

Overseas

Germany.—POSITION IN HAMBURG.—We reported last week proposals to remove about half of Hamburg's generating plant for reparations. Protests were made by Mr. Vaughan Berry, the Regional Commissioner, and now the Hamburg correspondent of the *Manchester Guardian* reports that these protests have had the effect of postponing the removal of the plant.

BERLIN POWER SHORTAGE.—In Berlin most of the larger factories have been closed recently through lack of fuel and lengthy stoppages have occurred in the electric power supply. It was stated last week that there was a danger of a total shut-down of electricity supply as during the past few days the power stations received only 800 tons of coal although they had consumed 2,000 tons.

India.—HYDRO-ELECTRIC SCHEME.—The first major post-war reconstruction scheme of the Punjab, the Rasul Hydel power station, is to be completed by the middle of 1948. It will have an installed capacity of 22,000 kW and will provide power for 18,600 tube-wells which are being constructed as an anti-waterlogging measure. With this extra power it is hoped to electrify twenty-eight more towns in the Punjab and also provide power for the irrigation of 712,000 acres of land. It will yield an annual revenue of Rs. 8,630,000. The various hydro-electric construction schemes now in progress in India are expected to provide an extra 4,000,000 kW, out of the estimated water-power potential of 30 to 40 million kW.—*Reuter.*

TRANSPORT

Blackpool.—TRACK RENEWAL.—By 25 votes to 21 the Town Council on January 8th decided to relay Marton tram track at a cost of £60,000, and to continue to use trams on the route.

Glasgow.—TROLLEY-BUS PLANS.—Although the Corporation has not yet started its first experimental trolley-bus service, the Transport Committee is already planning future development. About nine months ago the Corporation decided to experiment with this type of transport on the route between Polmadie and Provanmill. Negotiations for the building of the buses and the provision of a substation and overhead equipment, are still in progress. It is now proposed to provide trolley-bus services along various roads in King's Park area, and in Rutherglen. Other routes which have been agreed upon in principle are in the north and north-east areas of the city. The Committee is recommending the Corporation to include in the next Provisional Order powers to operate trolley-buses over these routes.

Ipswich.—RECORD TRAFFIC.—Both the number of passengers carried and total income last year set up new records. Passenger journeys numbered 26·1 million and the average fare was 1·83d, against 24·0 million passengers and an average fare of 1·81d in 1944-45. The trolley-bus fleet numbers 74 vehicles (57 of them double deck) and 4·4 million kWh was used during the year for traction (2·14 kWh per vehicle mile). Progress was made with the reconstruction and modernization of the overhead system and a new route 0·65 mile in length was constructed. Total income was £201,808 (£182,792), the net result of the year's working being a profit of £15,058 (£22,051).

Sweden. — ELECTRIFICATION HELD UP. — Electrification of the Swedish State Railway lines will be suspended after work now in hand has been completed, according to *Dagens Nyheter.* The reasons given for this decision are lack of materials and shortage of workers.—*Reuter's Trade Service* (Stockholm).

RADIO and TELEPHONY

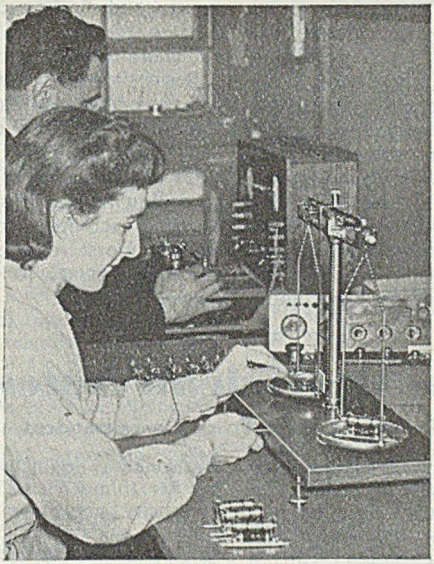
Hull.—TELEPHONE IMPROVEMENTS.—The Corporation Telephones Committee is to enlarge the North Newington exchange to permit of the installation of new Strowger equipment to replace the existing rotary apparatus, and extend cables at a cost of £5,843 for the Newland exchange.

India. — GOVERNMENT ACQUIRES CABLE SERVICE. — The Government of India has exercised its right to purchase the overseas communications service from Indian Radio & Cable Communications, Ltd. The service was taken over on January 1st. It will not be merged with the Indian Posts and Telegraphs Department, but operated directly by the Communications Department.—*Reuter.*

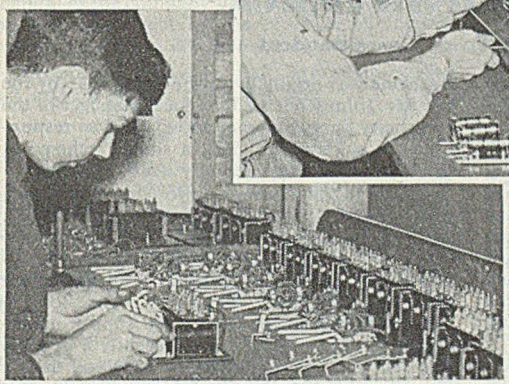
Special-Purpose Relays

Production at a New Slough Factory

THE manufacture of relays for special purposes is now being undertaken by Hendrey Relays, Ltd., at a new factory just opened at Bath Road, Cippenham, near Slough. In these new premises, which replace the company's old factory at Bourne End, the larger space and the up-to-date layout, with all machinery individually driven and controlled, greatly facilitate production and should enable output to be accelerated considerably to meet growing demand for this type of equipment.



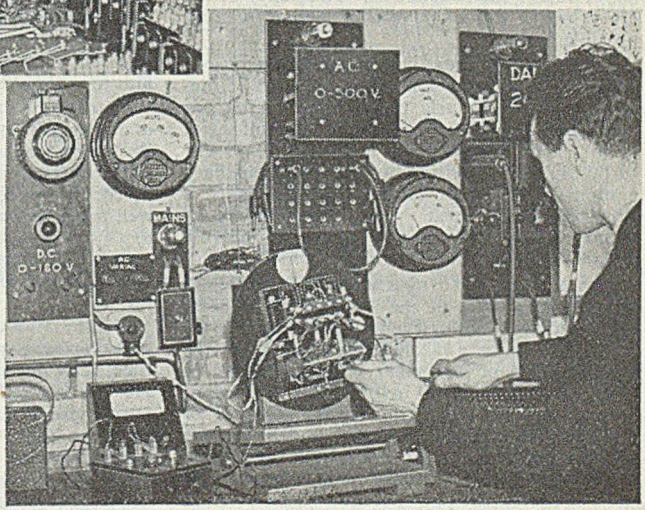
Weighing and level calculation for special level switches



Assembly of relays before testing

In addition to well-equipped machine and assembly shops the company has its own plant for coil winding and impregnating, paint spraying, stove enamelling, copper and nickel plating and welding. Test-room facilities include arrangements for flash-testing at 1,000 V and 2,000 V, insulation testing at 5,000 V and the accurate testing of special mercury switches for angles of tilt down to one minute of arc. All normal facilities for voltage, current and resistance measurement are also available.

A very large range of relays is made, chiefly of the solenoid and iron-cored types. They are made in single-, double- and triple-pole types up to a maximum capacity of 100 A, while time-delay features can be provided either by mercury switches for short-time intervals or by means of a mechanical escapement or synchronous motor for longer periods. Special attention is paid to robustness



Testing current values and angle of tilt for three-phase overload relays on transportable mining equipment

of construction. To avoid contact troubles toughened glass mercury switches are fitted as standard, in some cases on sprung carriages to prevent any transmission of shock. Metal-to-metal contacts are provided when specified, these usually being of precious metal for small currents, although beryllium copper contacts to handle larger a.c. currents are also used.

Both simple spring return and snap action mechanisms are available and among the wide variety of relays seen when we visited the factory recently were models for X-ray work, cigarette manufacture, milk separation, aircraft wind tunnels, railway fog signals, electric trucks, transformer protection, glass annealing furnaces, process timing, etc. There was also a watertight unit for greenhouse use, as well as alternate action relays for such purposes as lighthouse signalling.

In addition to flameproof cases, mercury switches give double protection for mining work, and special units have been developed for main contactors, earth leakage and overload protection. Laboratory apparatus for oil refineries is another speciality. Very critical operating values are obtained as required by the use of counter-balance adjustments. Polarized relays are manufactured to operate upon a current of only 2 mA. For a.c. mains the pole faces are ground and shading rings are fitted to ensure silent operation. Units with flag indicators and hand-reset devices are also available.

Besides relays, limit switches, etc., the company also manufactures a wide range of special-purpose apparatus for laboratories and industrial use. Attractive sheet metal cases of various types are made and finished according to requirements. The company's wartime activities included radar tuning devices, morse repeater keys, safety switches and components for gyroscopes and submarine detectors.

South African Notes

From Our Cape Town Correspondent

THE Minister of Posts and Telegraphs and Public Works said recently that the Minister of Finance had agreed to a five-year telephone development plan costing £18,000,000, as compared with a total of £22,000,000 which had so far been invested in the telephone service. He said that this year £2,500,000 was being spent on telephones. Trunk calls, which reached 10,000,000 a year before the war, now numbered 30,000,000. There was a waiting list of 55,169 for telephones. The policy of the Government was to have a telephone in every possible home.

EXTENSION SCHEMES.—A proposal to raise a loan of £121,000 for extensions to King-williamstown's electric power undertaking has been approved by the ratepayers. Bloemfontein is to spend £200,000 on a second 7,500-kW turbo-alternator, with boiler plant and auxiliary equipment, for its power station. The plant is expected early next year. The Worcester (Cape) Town Council has agreed to borrow £53,000 for electricity extensions in 1947.

SUGAR MILL ELECTRIFICATION.—The recently announced merger of the Tongaat sugar company and the Central Factory is believed to be the first step in a £2,000,000 scheme for the electrification of the sugar industry along the Natal coast. This will involve the provision of a large new power station in the vicinity of Tongaat, to provide electricity and steam for processing purposes in the sugar mills and refineries, in return for supplies of bagasse to be used as fuel in the power station boilers. Such a scheme was originally proposed in 1935 by the late Mr. John Roberts, then local manager of the Electricity Supply Commission. He was responsible for starting, in 1927, a similar scheme at the Rossburgh sugar refinery near Durban.

TRANSFER OF UNDERTAKING OPPOSED.—Two newly-elected councillors at Newcastle, Natal, have given notice of motion to rescind the resolution of the Council of October 1st reaffirming a decision to enter into an agreement with the Electricity Supply Commission to hand over the town's electricity supply undertaking to the Commission. Recently a petition was sent to the Administrator of Natal asking him to withhold consent to this agreement.

ELECTRIC KETTLES.—A considerable number of electric kettles made in Birmingham and other British centres are now on sale in many parts of South Africa, and they are meeting with an excellent response. The kettles are exceptionally well made, and although the price, from £3 15s. to £4 4s., is much higher than that of kettles in pre-war days, they compare more than favourably with those made in South Africa during the war.

VICTORIA FALLS COMPANY. — Speaking in Johannesburg recently the chairman of the Electricity Supply Commission said that when the Victoria Falls Power Company's franchise for the production of electric power expired in 1950, he could see no alternative but for the Government to expropriate the undertaking, as electricity was an essential service out of which nobody should make a profit.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Thomas De La Rue & Co., Ltd., are applying for Treasury consent to issue preference and ordinary shares to the respective classes of shareholders. A meeting is to be held on February 5th to approve alterations in the capital structure, including the conversion of the existing 347,000 issued ordinary £1 shares into stock transferable in 5s. units. Of the £665,016 unissued capital it is proposed to designate £500,000 as 3½ per cent cumulative preference £1 shares and £116,000 as ordinary £1 shares, leaving £49,016 unclassified. The preference and additional ordinary shares will be converted into stock.

A private company, the National Plastics Co., has been formed to amalgamate Moulded Products, Ltd., and De La Rue Plastics, Ltd.

Aeronautical & General Instruments, Ltd., is making an issue to shareholders of £150,000 4½ per cent preference shares of £1 at par. The capital of the company was increased to £400,000 in November last by the creation of 150,000 shares of £1 and 400,000 shares of 5s.

Greenwood & Batley, Ltd., are again paying an interim dividend of 5 per cent.

New Companies

Television Retailers' Development Co., Ltd.—Registered January 3rd. Capital, £10,000. Dealers in, and distributors, wholesalers, retailers, importers and exporters of, all kinds of television, wireless, radiolocation, rediffusion and other apparatus; makers of sound or silent cinematograph films, etc. Directors: R. Bell-Jones, T. R. Taylor, R. H. Squire, F. H. Hardingham and H. A. Curtis. The Radio and Television Retailers' Association, Ltd., may appoint one director, H. A. Curtis being the first nominee. Regd. office: Kent House, Telegraph Street, Moorgate, E.C.2.

Lincoln Electric Holdings, Ltd.—Registered January 2nd. Capital, £11,100. To acquire and hold the whole of the issued share capital of Lincoln Electric Co., Ltd. Directors: G. F. Clipsham, R. E. Clipsham and A. D. Marsh (directors of Lincoln Electric Co., Ltd.). Regd. office: Broadwater Road, Welwyn Garden City, Herts.

Conroy & Owen, Ltd.—Registered January 2nd. Capital, £2,000. Manufacturers of, and dealers in, dynamos, motors, batteries, radio and television sets, neon signs, etc. Directors: P. J. Conroy and M. B. Owen. Regd. office: 76, Portland Street, Cheltenham.

British Astral Co., Ltd.—Registered January 2nd. Capital, £500. Manufacturers of, and dealers in, electrical and mechanical apparatus and accessories, particularly radio and television sets, electrical and mechanical sound and visual reproducing machines, etc. Directors: L. C. Iles and G. W. Luck. Regd. office: 1, The Chase, Bournemouth Park Road, Southend-on-Sea.

Wholesale Distribution, Ltd.—Registered January 1st. Capital, £500. Dealers in, and agents for, the sale of electrical and mechanical apparatus, and in particular domestic electrical equipment and accessories, wireless equipment, etc. Directors: L. R. Wratten and B. E. Thomson. Regd. office, 54a, High Street, Staines, Mdx.

Albany Electrics, Ltd.—Registered January 2nd. Capital, £1,000. Electrical engineers, electrical installation contractors, radio and television engineers, etc. Directors: T. P. B. Clarke, W. Godbold and R. Millwood. Regd. office: 547, Hertford Road, Enfield.

Isola (Birmingham) Electric Co., Ltd.—Registered January 1st. Capital, £1,000. Exporters, importers and manufacturers of, and dealers in, electrical, radio, radar and television goods, cine-projectors, etc. Directors: L. Van Hagen, 167, Court Lane, Brampton, Birmingham, 23, and C. Skacel, Czechoslovakia.

Uni-Tubes, Ltd.—Registered January 3rd. Capital, £23,875. Manufacturers of, and dealers in, tubes, cables, cable armouring and sheeting and conductors, etc. Subscribers: J. C. N. Ward and L. Cooper. Solicitors: Stephenson Harwood & Tatham, 16, Old Broad Street, E.C.2.

Hallams (Electrical Contractors), Ltd.—Registered December 31st. Capital, £5,000. Electrical, radio, general and mechanical engineers, electrical installation contractors, etc. Directors: G. Hallam, Mrs. C. R. Hallam and A. E. Hamlett. Regd. office: 168, Hall Street, Stockport.

Sam Weller, Ltd.—Registered December 31st. Capital, £1,000. To acquire the business of an electrical engineer carried on by C. W. Weller at Newport, Mon. Directors: Victoria N. Weller and C. W. Weller. Regd. office: 29, Mill Street, Newport, Mon.

Dowden Engineering & Electrical Co., Ltd.—Registered December 31st. Capital, £3,500. Electricians, electrical contractors, radio, electrical and general engineers, electro platers, etc. Directors: G. W. Armstrong and V. W. F. Dowden. Regd. office: Central House, Lansdowne, Bournemouth.

Kee Radio & Electrical Equipment Co., Ltd.—Registered December 13th. Capital, £1,000. To acquire the business of an electrical and wireless engineer now carried on by S. R.

Choules as "Kee Radio." Directors: S. R. Choules (permanent chairman and managing director) and Nora M. Choules. Regd. office: King's Road, High Wycombe.

P. Hogg & Sons, Ltd.—Registered January 2nd. Capital, £500. Manufacturers of, dealers in, and agents for, refrigeration and electrical equipment, wireless and television, engineers, welders, etc. Directors: P. T. O'Halloran, J. H. O'Halloran and D. O'Halloran. Regd. office: 32, Head Street, Liverpool, 8.

Tallwatt, Ltd.—Registered December 31st. Capital, £500. Manufacturers, wholesalers and retailers of lampshades and electrical fittings of all kinds, etc. Directors: C. R. Tallon, E. M. Tallon and S. H. Watts. Regd. office: 1, Manor Road, Rugby.

MacCroft, Ltd.—Registered January 1st. Capital, £2,000. Manufacturers and repairers of, and dealers in, motors, dynamos, armatures, batteries, etc. Directors: J. Hall and C. Rumble. Regd. office: 67-8, High Street, Merthyr Tydfil.

C. Stanley Tagg, Ltd.—Registered January 3rd. Capital, £1,000. Electrical and wireless engineers, etc. Directors: C. S. Tagg (permanent) and May C. Tagg. Regd. office: Cromwell House, Borrowash, nr. Derby.

Pontypridd Electrical Installations, Ltd.—Registered December 6th. Capital, £5,000. Directors: W. Plowman, A. L. McKay and Violet M. Thomas. Regd. office: Broadway House, Pontypridd.

Rugby Auto Electric Services, Ltd.—Registered December 16th. Capital, £2,000. Directors: B. J. V. Hooper and R. A. Sheaf, The Café, Willoughby. Regd. office: 49, Church Street, Rugby.

F. J. Wakeford & Co., Ltd.—Registered December 18th. Capital, £1,000. To acquire the business of an electrician carried on by F. J. Wakeford at Guildford. Directors: F. J. Wakeford and C. J. Hampshire. Regd. office: 16, London Road, Guildford.

Fielden (Electronics), Ltd.—Registered December 18th. Capital, £2,000. Directors: J. E. Fielden and R. E. Barrett. Regd. office: Holt Town Works, Manchester, 10.

Phœnix (Electrical Contractors), Ltd.—Registered December 20th. Capital, £2,000. Electrical engineers and contractors, etc. Directors: H. M. James, R. W. Freement and F. J. Ringer. Secretary: R. W. Freement. Regd. office: 60, West Street, Brighton.

Rentevision, Ltd.—Registered December 20th. Capital, £100. Radio and electrical engineers, etc. Directors: J. R. Pullan and V. C. Manelescue. Regd. office: Eagle House, Jermyn Street, S.W.1.

Newcastle & Blyth Radio Services Ltd.—Registered January 6th. Capital £5,000. Directors: J. R. Lovatt, Mrs. Dorothy J. Lovatt, and S. Lovatt. Regd. office: 4a, Leazes Park Road, Newcastle-upon-Tyne.

Bankruptcies

D. W. J. Prentice, electrical engineer, 59, Brecon Road, Fulham, London, S.W.—Application for discharge to be heard on January 21st at Bankruptcy Buildings, Carey Street, London, W.C.2.

R. J. Thurlow, electrical engineer, carrying on business at 27, Fore Street, Ipswich, as Electrical and Radio Repair Service.—Application for discharge to be heard on February 12th at the Shire Hall, Ipswich.

J. Leivers, radio electrical engineer, residing and carrying on business at Victoria Radio Stores, 94, Victoria Road, Kirkby-in-Ashfield, Notts.—Last day for receiving proofs for dividend January 22nd. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

Liquidations

Underwood Radio, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Astles, 56, Mosley Street, Manchester, 2.

Midland Radio Relay Services, Ltd.—Meeting February 7th at 24, Market Place, Rugby, to receive an account of the winding-up by the liquidator, Mr. A. E. Limehouse.

Company's Diamond Jubilee

THIS year Drake & Gorham, Ltd., reach their diamond jubilee and in a letter to members of the staff, Mr. H. Drake, chairman, says that every member has reason to be proud of past achievements, particularly, perhaps, during the last seven years. During the war the company carried out work for nearly every Government Department, including installation and cable work on approximately 100 R.A.F. stations which entailed the laying of 355 miles of e.h.v., h.v. and m.v. underground paper cable, and 1,125 miles of t.r.s. for airfield lighting. The company also put up about 570 miles of overhead conductors for the same purpose.

Among many other interesting items carried out were the complete electrical equipment of numbers of dehydration plants. The manufacturing side included 27,000 tank bogies, special switchgear and searchlight equipment in large quantities for the Ministry of Supply, and aircraft parts for all the well-known fighters and bombers were produced for the Ministry of Aircraft Production.

Referring to the difficulties of the transition period, Mr. Drake says that the spirit which has brought the company to its present enviable position still exists. He expresses confidence that all members of the company will do their utmost to make sure that it plays its full part in assisting the country in its recovery. New capital has been obtained and fresh ventures are planned.

STOCKS AND SHARES

THE Stock Exchange certainly cannot complain of lack of business. The markets ring with a bustle of sustained activity. The floorboards seem to vibrate with the haste of the unceasing traffic over them. Prices are mostly good. Cable ordinary stock has risen 26 points in the last three weeks, and Stock Exchange shares £40 during the same period. These are, of course, exceptional movements. Most of the other variations are much less dramatic, but the general disposition is upward, and this in spite of depression in New York, where prices remain heavy.

The Electricity Bill

Publication of the new Electricity Bill had the effect of slightly reducing the prices of the ordinary shares. The Bill is considered to be confiscatory, imposing a harsh shrinkage of income upon shareholders who have invested their money in what they have rightly regarded as practically gilt-edged shares.

The Bill empowers the Government to take over the companies' assets, lock, stock and barrel, which means that the conservative policy adopted in the past by most of the companies, and their withholding of profits from ordinary shareholders in order that the financial structure might be strengthened, has been waste effort. A day or two before the publication of the Bill, prices in this market had been strong. Electric Finance & Securities rose to 68s., to revert to 65s. Metropolitan were 47s. 6d., reacting to 46s. Earlier falls were mostly regained as the market settled down and, as compared with a week ago the prices show more gains than losses. Central Electricity stocks lost 1 to 2 points.

Central Electricity Board

Stocks of the Central Electricity Board stand at prices below those which might be termed reasonable. Several of the issues would ordinarily be liable to redemption within the next five to ten years. Both of the 5 per cent issues, for instance, could be repaid at 100 by 1955. At present prices, they show running yields well over 4 per cent, but only about 2¾ per cent allowing for loss of capital in the event of normal redemption. This compares with redemption yields of about 2 per cent on British Government securities with comparable repayment dates.

Cable & Wireless Boomlet

Heavy buying of Cable & Wireless ordinary stock sent up the price to 147, and a slight reaction to 144 left a rise of no less than 18½ on the week. The 5½ per cent preference has moved in the contrary direction, being 2 points lower at 125½. Explanation of the reason for the rise in the ordinary stock is awaited, of course, with keen interest. Globe Telegraph ordinary moved up to 47s. 6d. Anglo-American Telegraph preferred advanced to 150, placing the yield on a 4 per cent basis. Anglo-Portuguese advanced to 29s. 6d. Automatic Telephones at 78s. 9d. are a florin to the good, and at 29s. 6d. Henley's are 6d. harder.

Price Changes

Electrical equipment shares have displayed some irregularity, with no decided trend one way or the other. Crompton Parkinsons at 32s. 6d., Ever Ready at 51s. and Johnson & Phillips at 84s. 6d. are on the easier side, but Telegraph Constructions at 57s. 6d. and Chloride Electrical at 5¼ have both gained half-a-crown. Siemens, too, are better at 38s. 6d. British Insulated Callenders remain firm at 48s. 9d. De La Rues have been a feature, rising to £14 on news of developments in connection with the company's plastics interests. Tube Investments have risen to 7$\frac{1}{10}$ since the annual meeting and Hopkinsons are a good market at 5¼. Tillings have strengthened further to 63s. 6d. B.E.T. deferred at 1,240 is 20 points lower.

Radio Activity

Radio shares are amongst the most lively sections of the miscellaneous markets. Movements have been jerky, but have gathered upward momentum. Deccas took a jump from 55s. to 60s. on the announcement that the Ministry of Transport had approved the "Radio Navigator" system for general marine navigation. A world-wide chain, ensuring greater safety for shipping through the fixing of positions by radio, is envisaged by the operating subsidiary. E. K. Coles came to life with a quick improvement from 29s. to 33s. 9d. E.M.I. shares followed the movement with an advance from 26s. 3d. to 28s. 6d. A. C. Cossors at 33s. 3d. have lost ground after the previous week's spurt to 35s.

Newman Industries Capital

Newman Industries stocks have been little affected by the new capital proposals, the ordinary being around 9s. 9d. for the 2s. units. Plant and equipment are being modernized to increase production. The capital expenditure involved has so far been met by temporary borrowing. It is now proposed to raise fresh permanent capital by the issue of a million 2s. shares at 7s. 6d. Under the scheme, ordinary stockholders are to be offered one new share for every 6s. of stock held. Holders of the preference and preferred ordinary are offered two and one shares respectively per £3 of stock. The new shares will rank equally with the existing stock, except that they will not qualify for the final 1946 dividend.

We regret that in the tables published in our issue of December 27th the Electric Construction Co., Ltd., dividends were shown as "Last 12½ per cent. Previous 10 per cent." Actually, as the company points out, a dividend of 12½ per cent has been paid for the past four years.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

H. ALLDAY & Son (1922), Ltd., and R. Bain.—" Mounting of electric switches in wall boxes." 24059. December 1st, 1944. (583769.)

Allmanna Svenska Elektriska Aktiebolaget.—" Overload protection device for three-phase commutator motors." 23102/44. November 24th, 1943. (583714.)

A. Anderson and Anderson, Boyes & Co., Ltd.—" Electric cable junction boxes." 22845. November 17th, 1944. (583690.)

Automatic Telephone & Electric Co., Ltd., and C. Rhodes.—" Inductance coils as used in telecommunication systems." 22510. November 15th, 1944. (583663.)

British Thomson-Houston Co., Ltd.—" Apparatus for coating the inner walls of vitreous bulbs." 22658/44. November 16th, 1943. (583679.) " Brazing alloys." 23439/44. November 25th, 1943. (583737.) " Unit substations." 24220/44. December 3rd, 1943. (583781.)

British Thomson-Houston Co., Ltd., and J. Moir.—" Needle armature pick-ups." 22520. November 15th, 1944. (583665.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" Centrifugal compressors." 22519. November 15th, 1944. (583664.)

Callender's Cable & Construction Co., Ltd., and D. T. Hollingsworth.—" Wave guides for high frequency electric currents." 22920. November 17th, 1944. (583697.)

J. A. Crabtree & Co., Ltd., and F. G. Dodd.—" Treatment of polyvinyl chloride." 23373. November 23rd, 1944. (583730.)

Ericsson Telephones, Ltd., and D. C. Crowe.—" Step - by - step mechanisms." 23109. November 21st, 1944. (583715.)

Ericsson Telephones, Ltd., and L. S. Distin.—" Electro-magnetic switches." 23022. November 20th, 1944. (583706.)

Express Lift Co., Ltd., and S. Kruger.—" Electric switches of the push-button type." 24168. December 4th, 1944. (583776.)

Frigidaire, Ltd., and C. E. Williams.—" Cold storage units." 23709. November 28th, 1944. (583751.)

W. G. D. Gregg.—" Ceiling roses and like electrical fittings." 24204. December 4th, 1944. (583780.)

F. G. Horstmann.—" Mounting, more particularly for inspection lamps." 22826. November 17th, 1944. (583687.)

Linde Air Products Co.—" Electric welding rod guide and contact jaws." 22549/44. December 23rd, 1943. (583671.)

Londex, Ltd., and J. V. Dossett.—" Electrical light buoys or sea beacons." 22992. November 20th, 1944. (583705.)

K. C. Lowe.—" Tubular electric lamp fittings." 23273. Nov. 23rd, 1944. (583724.)

J. McDonald and G. W. B. Electric Furnaces, Ltd. — " Feeding small articles." 23745. November 28th, 1944. (583753.)

Midland Electric Manufacturing Co., Ltd., and A. W. Vicary.—" Snap-action electric switches of the enclosed type." 23225. November 22nd, 1944. (583722.)

M. Mole & Son, Ltd., and P. A. Mole.—" Attachment devices for securing earthing wires in electrical installations." 22847. November 17th, 1944. (583691.)

Oldham & Son, Ltd., and H. Holt, jun.—" Miners' electric cap lamps and the like." 23931. November 30th, 1944. (583764.)

Standard Telephones & Cables, Ltd., and S. G. Foord.—" Process for bonding polythene to metal surfaces." 22856. November 17th, 1944. (583694.)

Standard Telephones & Cables, Ltd., and A. Mortlock.—" Electric frequency counting arrangements." 23732. November 28th, 1944. (583752.)

Standard Telephones & Cables, Ltd., E. C. Lee and S. G. Stevens.—" Terminations for electric power cables." 22861. November 17th, 1944. (583695.)

Stirling Boiler Co., Ltd., and E. E. Noble.—" Tubulous vapour generators." 22829. November 17th, 1944. (583688.)

Superheater Co., Ltd., and L. C. Southcott.—" Steam superheaters for water tube boilers." 23692. November 28th, 1944. (583749.)

F. Tench (Automatic Electric Laboratories, Inc.).—" Motor-driven cam-actuated electric switches." 23893. November 30th, 1944. (583758.)

J. W. Tills.—" Switches, for controlling electrical circuits, actuated by electro-magnetic means." 22531. November 15th, 1944. (583669.)

A. West & Co., Ltd., and F. J. Pavitt.—" Relays for protecting electric circuits." 23133. November 21st, 1944. (583716.)

Westinghouse Brake & Signal Co., Ltd., L. H. Peter and S. A. Stevens.—" Electric welding apparatus." 23038. November 20th, 1944. (583708.)

H. D. Wheeler and P. A. H. Mossay.—" Direct current dynamo-electric machines for use as electrical governors, and electrical governing systems." 23323. November 23rd, 1944. (583728.)

F. Whyman and Metropolitan-Vickers Electrical Co., Ltd.—" Braking equipment for electric traction systems." 23064. November 20th, 1944. (583713.)

RECENT INTRODUCTIONS

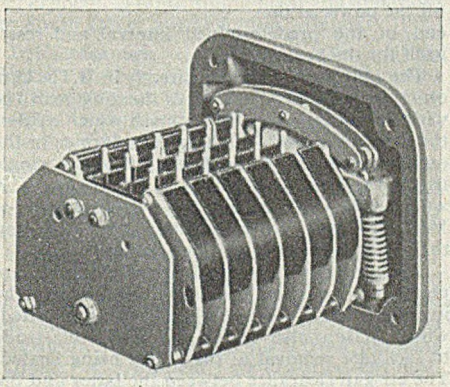
Notes on New Electrical and Allied Products

Suds-proof Starter

THE push-button starter for 0·5 H.P. motors made by BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester, is now available in an enclosure that is made proof against suds and oil by the use of gaskets; various front plates are obtainable for flush cavity mounting as well as dust-protected boxes for surface mounting. The starter itself, which is attached to the lid of the cast-iron box, has been redesigned to incorporate moulded and die-cast components. The mechanism is of the over-centre toggle type, double quick break, with triple-pole indirectly heated thermal overload trips. The box is 6·75 in. high by 3 in. wide and 5 in. deep, weighing 7 lb, with 0·75 in. screwed conduit entries at the top and bottom.

Reversing Switch

A modified version of the type 754 dual-handle switch, cam-operated for motor reversing and four speed selection, is announced by BROOKHIRST SWITCHGEAR, LTD. It has a single handle for reversing duty only and is particularly suitable for machine-tool motors. It is designed for two or three positions, forward-reverse or forward-off-reverse; and in two forms, three-pole for 3 H.P. or six-pole for 7·5 H.P.

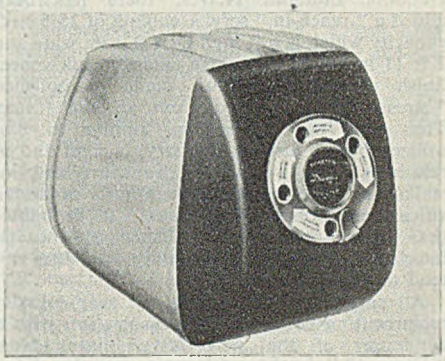


Motor reversing switch

at up to 550 V. It is mounted flush within a small cavity space; arc chutes and separators are provided between poles while the butt contacts with a rolling action are easily replaceable.

Novel Toaster

A toaster which is claimed to toast bread to four degrees of crispness by the simple presetting of a dial has been "styled" by the Design Group, Ltd., and is being produced by BRITISH DIAMIX, LTD., Meltrum Works, Beatty Street, Camden Town, N.W.1. The body is a maroon coloured plastic moulding, with a chromium-plated dial. The dial does not affect the heating element; it is clockwork



Dial-set bread toaster

operated for pre-setting the chosen time interval after which a spring is released which ejects the toast. Two slices can be accommodated at the same time. The device is almost a cube on a stable base to permit rotation of the dial without upsetting the toaster.

Mains Clocks

A range of synchronous "B.E.M." clocks is being made by BRITISH ELECTRIC METERS, LTD., Brynllwyd Works, Bangor, North Wales, and distributed by Modern Electric Power Products, Ltd., Morden Road, Mitcham, Surrey. There are several fancy styles, rectangular, disc and semi-circular, designed with a heavy base, polished and lacquered, supporting a mirror coloured peach, green, or smoke, on which is mounted a polished dial with a domed centre glass protecting the hands. The smallest is 7·75 in. by 7·75 in. and the largest 11 by 6·25 in. respectively high and wide.

Unit Industrial Heaters

Industrial heaters of the unit type, named "Aircon," have been introduced by AIR CONDITIONING & ENGINEERING, LTD., 3, Bayley Street, Tottenham Court Road, London, W.C.1. Two models are available of 2 and 4 kW at 220/240 V single phase. An electric fan attached to the rear of the metal cabinet propels air over the heating elements and outward through the front grille, which is lowered to direct the warmed air downward.

The cabinet is a 12 in. cube, enamelled green and designed to hang on a wall or from the

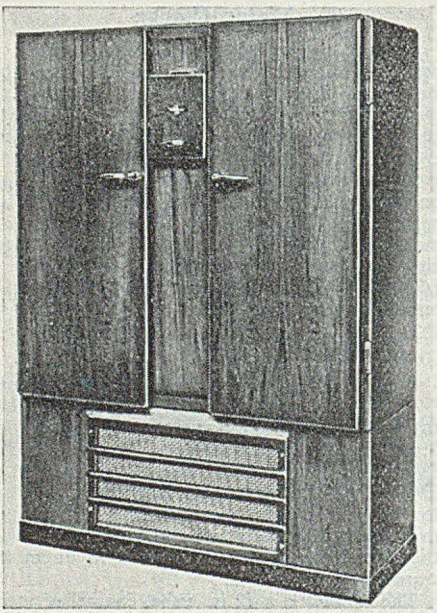
ceiling. It operates at " black heat " and the 1,300 r.p.m. fan is so arranged that it can, if desired, be made to draw fresh air from outside and warm it before dispersal inside. Individual switching or thermostatic control singly or in banks can be provided. The net weight is 13·5 lb.

Large Refrigerator

To the existing range of refrigerators made by FRIGIDAIRE, LTD., Edgware Road, The Hyde, Hendon, London, N.W.9, there has been added a " reach-in " service cabinet of 25·5 cu ft capacity which is 6 ft high by 4 ft 3 in. wide and 1 ft 11 in. deep. It has an exterior teak veneer finish of natural colour, made of polished " stressed skin " plywood on an oak frame. This form of construction, similar to that utilized by the aircraft industry, is rigid and of relatively light weight for transport and installation. The insulating medium is expanded vulcanized rubber, which is said to be lighter than cork, while the polished sheet-metal interior is made of a light alloy that does not tend to flake or corrode.

A small motor drives a twin-cylinder reciprocating compressor in association with a condenser of the air-cooled radiator type. " Freon-12 " is the refrigerant and the direct expansion evaporator has been redesigned; it is available with or without ice-making facilities.

The cabinet has two doors mounted on concealed hinges and fitted with locks. The interior shelves, six plain and one with hanger bars, are adjustable at 5 in. centres and removable for cleaning, providing a storage area of 22 sq ft.



Refrigerator cabinet for caterers and large houses

The height of the cabinet can be reduced by supporting it on a recessed plinth instead of the ventilated base that encloses the condenser.

Dielectric Heaters

Thermionic generators for the high-frequency heating of dielectric substances are produced under the trade name of " Radyne " by RADIO HEATERS, Toutley Works, Wokingham, Berks (proprietors: Static Condenser Co., Ltd.). They are rated at 400 and 800 W as well as 1·75, 4 and 6 kW at 20 Mc/s.

" Radyne " dielectric heating cabinet

Closure of the protective cage at the top, enclosing the specimen to be heated, switches on the radio-frequency power while a built-in process timer indicates the progress of the heating cycle on a dial on the front control panel, then switches off the power at the end of the predetermined interval and resets itself for the next operation.

The output is indicated directly in B.Th. U/m on a meter and the rate of heating can be varied smoothly by a single knob which adjusts the ratio of a load-matching transformer in the oscillator circuit. The latter utilizes a single triode valve needing d.c. of a little over 0·5 A with 4,000 V on its anode. The valve is of Mullard make, with a silica envelope and the tungsten filament can be renewed.

The protective cage and upper electrode are perforated to allow steam to escape and the live electrode is earthed when the cage is lifted, which action also raises the upper electrode to facilitate removal of the object being heated. The air-gap clearance between the latter and the upper " live " electrode is adjustable by means of a knob on top of the heating chamber. All models are gloss-enamelled in cream and black with chromium plated fittings.

E.I.B.A. Northern Counties Area

THE annual general meeting of the Northern Counties Area of the Electrical Industries Benevolent Association will be held at 3.30 p.m. on January 23rd, at the Royal Station Hotel, Neville Street, Newcastle-upon-Tyne, Mr. J. Clement, presiding.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Birmingham.—January 31st. Electric Supply Department. Electric motors and starters. (See this issue.)

Bootle.—January 25th. Borough Council. Electric lamps, flexes, and cables, for six or twelve months ending March 31st, 1948. W. A. Harrison, borough enginyer, Town Hall.

Brighouse.—January 31st. Electricity Department. Two 11-kV switchboards and two transformers, one 300 and one 600 kVA. (January 3rd.)

Bury.—January 31st. Electricity Department. Two 1,500-kVA, 6,500/400/230-V, three-phase transformers. (See this issue.)

Cardiff. — January 29th. Rural District Council. Electric lighting and heating circuits in ten existing Council houses at Taff Terrace. H. Jackson, electrical engineer, 20, Park Place.

Dumfries.—January 28th. Electricity Department. 3,300/415-V transformers. (See this issue.)

Great Yarmouth.—January 31st. Electricity Department. Transforming plant and apparatus for South Denes power station. (January 10th.)

Irthlingborough. — February 1st. Urban District Council. Electrical water boosting plant, comprising duplicate centrifugal pumps, motors, automatic starters, etc. E. Turnbull, surveyor, Council Offices, Station Road.

Manchester.—February 10th. Waterworks Committee. Five electrically driven pumps together with main switch and motor starting gear, etc. (January 10th.)

Oldham.—February 3rd. Town Council. Electrically driven automatically controlled submersible pumping unit (capacity 700 gallons per minute), complete with time operated switchgear, for the Butterworth Hall pumping station. C. Busfield, waterworks engineer, Greaves Street.

Plympton St. Mary.—January 23rd. Electricity Undertaking. Paper-insulated and rubber insulated cables, cable accessories, house service meters and l.v. distribution switchboards. (January 10th.)

February 14th. Overhead line materials, street lighting equipment, e.h.v. switchgear, house wiring materials and tools. (See this issue.)

Portsmouth.—February 12th. Electricity Department. Two 230-V, 200-Ah, stationary lead-acid accumulator batteries each fitted with charging equipment. (January 10th.)

Reigate.—January 25th. Borough Council. Wiring of large garage. (January 10th.)

Salford.—January 23rd. Public Health Department. Thirty electrically heated food conveyors. Secretary, Hope Hospital, Eccles Old Road.

Southend-on-Sea.—March 13th. Corporation. Electrically operated rolling stock for the pier electric railway. (See this issue.)

Southwark.—January 30th. Electricity Department. Wiring of domestic premises. (See this issue.)

Surrey.—January 31st. County Council. Applications are invited from contractors and manufacturers who wish to be included in the list of suppliers of electrical installations, lifts, refrigeration, and X-ray apparatus and hospital equipment. (January 3rd and 10th.)

Tottenham.—February 7th. Borough Council. Electric lamps (Schedule No. 20). F. Hill, acting town clerk, Town Hall, N.15.

Windsor.—January 27th. Town Council. Domestic electrical equipment, including refrigerators, wash-boilers and water heaters. G. S. Baker, borough engineer, 16, Alma Road.

Orders Placed

Birkenhead.—Electricity Committee. Accepted. Assisted wiring installations.—S. & F. George ; J. & J. Peters.

Glasgow.—Health Committee. Accepted. Five electric vehicles for the internal transport of food in hospitals (£3,672).—Victor Electric Vehicles.

Hertfordshire.—Health Committee. Accepted. Five electrically heated food containers for Barnet Hospital (£157).—A. Browne & Co.

Norwich.—Watch Committee. Recommended. Traffic signals (£4,509).—Siemens & General Electric Railway Signal Co.

Sheffield.—Transport Committee. Accepted. Fifteen pairs of tramcar motors (£586 per pair). —Metropolitan-Vickers.

Southwark.—Electricity Committee. Accepted. Cables for a further twelve months.—Scottish Cables. Battery (£364).—Britannia Batteries. Control boards (£1,062).—W. Lucy & Co. Meters.—Measurement, Ltd. Ring main equipment.—Cooke & Ferguson. Transformers.—Electric Construction Co.

Watford.—Electricity Committee. Accepted. Meters.—Landis & Gyr; Met.-Vick.; Aron Electricity Meter; Ferranti. Cables.—Telegraph Construction & Maintenance Co.

York.—Electricity Committee. Accepted. 5-cwt electric van (£633).—Crompton Parkinson.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alloa.—Additional classrooms at Technical and Commercial School; superintendent.

Ashington.—Fourteen houses for aged people, with communal reading room and laundry; W. Leech, builder, 2, Clayton Street, Newcastle-on-Tyne.

Barnsley.—Factory for Johnson & Barnes, Ltd., Rutland Street, Leicester.

Birkenhead.—Factory, Corporation Road; British American Tobacco Co., Ltd.

Birmingham.—New schools (£250,000); city engineer.

Carluke.—New works at Braidwood for Coltness Iron Co., Ltd.

Coventry.—Houses (152), Canley estate (£167,674); city architect.

Croydon.—New factory for Brooklands Plating Co., Ltd., The Waldrons.

Dunston-on-Tyne.—Offices for De La Rue Plastics, Ltd., North Eastern Trading Estate; T. Clements & Sons, Selborne Gardens, Newcastle-on-Tyne.

Durham.—Houses (56), Sunderland Road, for the City Council; J. W. White (Contractors), Ltd., Sunderland.

Glanford Brigg.—Houses (38) at Winterton for R.D.C.; Buttrick & Buttrick, architects, 43, Oswald Road, Scunthorpe.

Glasgow.—Reconstruction and modernizing of Queen's Dock (cargo handling gear, etc.), to cost £6,275,000; chief engineer, Clyde Navigation Trust.

Hampstead.—Working-class dwellings (64), at Well Walk; James & Bywaters & Rowland Pierce, 5, Bloomsbury Street, London, W.C.1.

Hawick.—Extension and completion of sewage purification works for Town Council; J. & A. Leslie & Reid, 72A, George Street, Edinburgh.

Hexham.—Additions to premises for Co-operative Laundries, Ltd.; C.W.S. Building Department, West Blandford Street, Newcastle-on-Tyne.

Jarrow.—Factory, Bede Estate, for Beck & Co. (Fashions), Ltd.; J. W. Hanson & Son, architects, 123, Northumberland Street, Newcastle-on-Tyne.

Factory for disabled persons; C. S. Errington, 46, Grainger Street, Newcastle-on-Tyne.

Kilmarnock.—New engineering shop, stores and assembly block, in East Shaw Street, for Glenfield & Kennedy (part of reconstruction scheme to cost £120,000); master of works.

Lambeth.—Dwellings, Murphy Street area, for L.C.C.; Unit Construction Co., Ltd., 38, Millbank, S.W.1.

Lanarkshire.—Factory at Airdrie for Scottish Industrial Estates, Ltd.; secretary of company, 3, Woodside Place, Charing Cross, Glasgow.

Manchester.—Shops and flats (77), and civic centre, Wythenshawe (£249,159); city architect.

Completion of Northenden depot (£35,000); city architect.

Middlesbrough.—Additions for the Lionweld Steel Flooring & Stairway Co., Ltd.

Two schools on the Thorntree estate; education architect, Woodlands Road.

Morpeth.—Coachbuilding works for Halliwell & Wellway, Ltd.; J. Dodds, Wansbeck Street.

Newcastle-on-Tyne.—Mineral water factory; C.W.S. Architects' Department, 90, Westmorland Road.

Houses (400), Blackett-Ord estate; city architect, 18, Cloth Market.

Houses (192), for the City Council; M. Harrison & Co., Ltd., builders, Leeds.

Dental school and dental hospital at the Medical School; J. R. Rutherford & Sons, Jesmond Road.

Bakery on the Coast Road for Embleton & Sons; Stephen Fenwick, 46, Dunn Street.

North Shields.—Factory for the Albert Edward Docks Sawmills Co.; J. Walton Taylor & Son, Norwich Union Buildings, Westgate Road, Newcastle.

Perth.—New offices for General Accident, Fire & Life Assurance Corporation, Ltd.

Peterhead.—New buildings and plant at canning factory (£50,000), for Crosse & Blackwell; manager.

Shilbottle.—Factory for the Board of Trade; W. Moss & Son, St. Mary's Place, Newcastle-on-Tyne.

South Shields.—Houses (48), Marsden Road; G. Bailey, Ltd., builders, King Street.

Factory, Adelaide Street, for Prices, The Tailors, Ltd., Leeds.

Electrical installations in 120 Corporation houses; borough engineer, Town Hall.

Southwark.—Flats (76), St. Agnes Place (£123,329); Harry Neal, Ltd., 117, Baker Street, W.1.

Stepney.—Dwellings, Chicksand Estate Extension for the L.C.C.; Pitchers, Ltd., 57, Ashburton Grove, N.7.

Dwellings, Shadwell Gardens estate, for L.C.C.; A. E. Symes, Ltd., 51, Coleman Street, E.C.2.

Stocksbridge.—Extensions to works for S. Fox & Co., Ltd.

Sunderland.—Houses (2,000), at South Hylton and Grindon; borough engineer.

Factory, West Chirton, for Levine & Co., Ltd., Pudding Chare, Newcastle-on-Tyne; Arthur & Kirkup, architects, 13, Swinburne Street, Newcastle-on-Tyne.

Factory at West Chirton for Torday & Co., Ltd.; Gray & Kinghorn, architects, Camden Street, North Shields.

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First Post on Monday,** and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

THE CHARGE for advertisements in this section is 2/6 per line (approx. 7 words) per insertion; ***ONLY OFFICIAL AND GOVERNMENT ANNOUNCEMENTS CAN NOW BE DISPLAYED:***— 35/- per inch. Where the advertisement includes a Box Number this counts as six words and there is an additional charge of 6d. for postage of replies.

SITUATIONS WANTED. — Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed.

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPT.

Electric Motors and Starters

THE Electric Supply Committee invites tenders for the supply of A.C. Electric Motors and Starters to be delivered as required. The general conditions of contract (which includes the Corporation's Fair Wages and Conditions of Labour Clause), Specification No. APP. 39 and forms of tender, may be obtained on application to the undersigned.

Sealed tenders, enclosed in the official envelope provided and endorsed for the purpose, must be delivered to the undersigned not later than 10 a.m. on Friday, 31st January, 1947, when they will be opened. Tenders not complying with the foregoing will be rejected.

F. W. LAWTON,
Chief Engineer and Manager.

14, Dale End,
Birmingham, 4. 4397

PLYMPTON ST. MARY RURAL DISTRICT COUNCIL ELECTRICITY UNDERTAKING

THE above Council invite tenders for the supply and delivery of the following materials:—

(a) Overhead Line Materials.
(b) Street Lighting Equipment.
(c) E.H.T. Switchgear.
(d) House Wiring Materials.
(e) Tools.

Specifications, conditions and forms of tender can be obtained from the undersigned.

Tenders to be delivered to the undersigned not later than 14th February, 1947. The Council do not bind themselves to accept the lowest or any tender.

PERCY T. LOOSEMORE,
Clerk to the Council.

Council Offices, Plympton.
9th January, 1947. 4432

ROYAL BURGH OF DUMFRIES ELECTRICITY DEPT.

TENDERS are invited for the supply and delivery of Spec. T.12: 3,300/415-v. Transformers. Specification and form of tender may be obtained from the Burgh Electrical Engineer and Manager, Leafield Road, Dumfries. (Extra copies of the specification and form of tender, 5s. each.)

Tenders, enclosed in plain sealed envelope, endorsed "Tender for Transformers," to be delivered to the undersigned not later than the first post on 28th January, 1947. The Council does not bind itself to accept the lowest or any tender.

J. HUTCHEON,
Town Clerk.

Municipal Chambers, Dumfries.
10th January, 1947. 4420

METROPOLITAN BOROUGH OF SOUTHWARK ELECTRICITY DEPARTMENT

TENDERS are invited for wiring domestic premises under the Council's Rental Wiring Scheme to a specification obtainable from C. S. Brookes, Electrical Engineer and Manager, Penrose Street, S.E.17.

W.B.A. priority certificates will not be available for this work.

Tenders must be returned not later than first post on 30th January, 1947.

D. T. GRIFFITHS,
Town Clerk.

7th January, 1947. 4433

COUNTY BOROUGH OF SOUTHEND-ON-SEA

New Rolling Stock, Pier Electric Railway

TENDERS are invited for the supply of new Electrically Operated Rolling Stock, composed of Four 7-Coach Train Sets complete, suitable for use on Southend Pier Electric Railway, which operates from a 550-volt D.C. traction supply.

Copies of the general conditions, specification and form of tender may be obtained on application to the Pier-master and Foreshore Manager, Pier Hill Buildings, Southend-on-Sea, accompanied by a fee of 2 guineas, which will be refunded on receipt of a bona fide tender (not subsequently withdrawn) and the return of all documents supplied.

Tenders, which must be enclosed in a plain sealed envelope not bearing any name or mark indicating the sender, and endorsed "Tender for Rolling Stock: Southend Pier Electric Railway," must be delivered to me before 10 a.m. on March 13th, 1947. The Corporation do not bind themselves to accept the lowest or any tender.

ARCHIBALD GLEN,
Town Clerk.

Municipal Offices,
Clarence Rd., Southend-on-Sea. 4426

COUNTY BOROUGH OF BURY ELECTRICITY DEPT.

THE Corporation invite tenders for the supply and delivery of 2 1,500-kVA. 6,500/400/230-volts, 3-phase Transformers. Forms of specification, etc., may be obtained from the Engineer and Manager, Electricity Department, Market Street, Bury.

Tenders, endorsed "Transformers," are to be delivered to me not later than Friday, the 31st January, 1947.

EDWARD S. SMITH,
Town Clerk.

Municipal Offices,
Bank Street, Bury.
10th January, 1947. 4441

SITUATIONS VACANT

COUNTY BOROUGH OF CROYDON ELECTRICITY DEPARTMENT

Electrical Cooking Demonstrators

APPLICATIONS are invited from suitably qualified women for the following permanent appointments:

(a) SENIOR DEMONSTRATOR (to hold a recognised diploma in domestic science and the E.A.W. Electrical Housecraft Diploma).
(b) DEMONSTRATOR (to hold a recognised diploma in domestic science and/or the E.A.W. Electrical Housecraft Diploma).

Salary scales will be in accordance with the National Scheme as follows: (a) A.P.T.II, £380 × £15 to £425 per annum, plus cost-of-living bonus (at present £48 2s. per annum); (b) A.P.T.I, £350 × £15 to £395 per annum, plus cost-of-living bonus (at present £48 2s. p.a.).

The appointments will be subject to the provisions of the Local Government Superannuation Act, 1937, and the satisfactory passing of a medical examination.

Application forms and conditions of appointment may be obtained from the Chief Engineer and General Manager, Electric House, Wellesley Road, Croydon, and should be returned to him not later than the 30th January, 1947. Canvassing will disqualify.

E. TABERNER,
Town Clerk.

Town Hall, Croydon.
January, 1947. 4438

CITY OF COVENTRY ELECTRICITY DEPT.

APPLICATIONS are invited for the following appointments:—

(1) ONE JUNIOR SHIFT ENGINEER, at a salary in accordance with Class J, Grade 8a, of the National Joint Board Schedule, at present £487 per annum, rising to £510 per annum.

Candidates should have a sound technical and practical training in electrical and mechanical engineering and experience in a modern generating station.

(2) THREE COMMERCIAL ASSISTANTS in the Commercial, Installations and Development Sections, at a salary in accordance with Class J, Grade 9a, of the National Joint Board Schedule, at present £389 per annum, rising to £408 per annum.

Candidates should have had a sound technical training and possess the Higher National Certificate in Electrical Engineering or an equivalent qualification. A good knowledge of installation and contract work, preparation of specifications, and installation and maintenance of hired and other electrical apparatus is essential. Experience in supervision of stores and personnel and general organizing ability will be considered as an additional qualification.

(3) ONE CONSTRUCTIONAL ASSISTANT, at a salary in accordance with Class J, Grade 8, of the National Joint Board Schedule, at present £521 per annum, rising to £544 per annum.

Candidates should have had a sound engineering training and possess the Higher National Certificate in Mechanical Engineering or an equivalent qualification.

Experience in steam pipe-work and plant layout, together with structional steelwork and building work in connection with generating station extensions is essential.

The selected candidate will be required to take complete control of the Constructional Drawing Office, and experience in the control of direct labour would be an advantage.

(4) ONE GENERAL BUILDING FOREMAN AND CLERK OF WORKS, at a salary in accordance with Class J, Grade 9, of the National Joint Board Schedule, at present £425 per annum, rising to £445 per annum.

Candidates must have served an apprenticeship and have had practical experience in the control of direct labour and be capable of supervising alterations and additions to the undertaking's property, including buildings, roadways, sewers, etc. Experience in the setting out and supervision of erection of structural steelwork would be an advantage, and experience in the use of a dumpy level is desirable.

The selected candidate will be required to take control under the Constructional Engineer, of the undertaking's building operatives, and must be able to drive a motor vehicle which will be provided by the undertaking.

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

The persons appointed will be required to contribute to the Coventry Municipal Officers' Widows and Orphans' Pension Fund.

Applications, stating particulars of age, training, qualifications, experience, etc., and accompanied by copies of recent testimonials, should be forwarded to the undersigned not later than first post on Monday, 27th January, 1947. Envelopes should be endorsed with the designation of the post for which application is being made.

F. W. GODDEN, M.I.E.E.,
Electrical Engineer and Manager.

The Council House,
Coventry.
4th January, 1947. 4309

LONDON COUNTY COUNCIL

REQUIRED at the South-East London Technical Institute, Lewisham Way, S.E.4, a full-time Lecturer in the Electrical Engineering Department. Candidates must be graduates, or hold equivalent qualifications, and have had good industrial experience either in the generation and distribution of electrical energy or in the design and manufacture of electrical machinery. The work includes Ordinary and Higher National Certificate courses for day and evening students, and may include some teaching in the Secondary (Technical) School.

Salary, Burnham Scale, £300 × £15 to £525 (men), plus London allowance (minimum £36) a year, and additions for training and qualifications as applicable. Payment of a special responsibility allowance will be considered. Commencing salary according to teaching and industrial experience. Other things being equal, preference will be given to registered disabled persons.

Application forms from the Education Officer (T.1), County Hall, S.E.1 (stamped addressed foolscap envelope necessary), returnable by 8th February, 1947. H.M. Forces personnel abroad should apply by letter. (77) 4387

IRELAND: DEPARTMENT OF INDUSTRY AND COMMERCE

Vacancy for Electrical Engineer

THE Minister for Industry and Commerce invites applications for a post of Electrical Engineer for the design and construction of Airport Lighting systems. Applicants should have a University Degree in Electrical Engineering or equivalent qualifications, and should have extensive experience in the preparation of plans and specifications for electrical installations, including experience of lighting technique and supervisory switching control. Experience in the design of airport lighting systems is desirable.

The appointment will be temporary and non-pensionable and will be terminable at one month's notice. It is expected that the appointment will be for a period of about twelve months.

Applicants should be not less than 30 years of age on 31st January, 1947. In the selection of a candidate for appointment regard will be had to service in the Defence Forces or in an Auxiliary Defence Organisation, and applicants should furnish evidence of their service (if any) with these bodies.

Salary will be fixed in accordance with the experience and qualifications of the successful candidate, but will be at a rate not less than £1,000 inclusive a year. Applicants should state the lowest salary they would be prepared to accept.

Applications, giving name in full, present address, date of birth, qualifications and experience, should be addressed to the Secretary, Department of Industry and Commerce, Room 314, Kildare Street, Dublin, so as to arrive not later than 31st January, 1947. Applications should be accompanied by two recent testimonials or the names of two persons to whom reference may be made.

JOHN LEYDON,
Secretary.

Department of Industry and Commerce, Dublin.
3rd January, 1947. 4395

CROWN AGENTS FOR THE COLONIES

APPLICATIONS from qualified candidates are invited for the following posts: Engineering Assistants required by the Directorate of Municipalities, Government of Iraq, for two years in the first instance.

Salary I.D. 90 a month, plus cost-of-living allowance of I.D. 24 a month (Iraqi dinar = £1). Free passages. Posts not pensionable, but there is a provident fund. The central offices are in Baghdad, but the appointments involve considerable travelling in Iraq. Candidates must be either (M/N/17531) A.M.I.E.E. and have had considerable experience in the installation, maintenance and operation of Diesel-driven A.C. and D.C. generating plant and the layout and construction of H.T. and L.T. overhead lines (a working knowledge of small water pumping plants an advantage); or (M/N/17532) A.M.I.Mech.E. and have had considerable experience in installation, maintenance and operation of Diesel engines and generating plant and of engine-driven and motor-driven pumps (a working knowledge of water supply schemes an advantage).

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting appropriate reference number against the appointment for which application is made on both letter and envelope. 4341

BOROUGH OF REIGATE ELECTRICITY DEPT.

Assistant Consumers' Engineer

APPLICATIONS are invited for the position of Assistant Consumers' Engineer. Candidates must have the Higher National Certificate in Electrical Engineering (or equivalent qualification) and possess experience in installation and maintenance of domestic electrical apparatus.

Salary in accordance with Class E, Grade 8a, N.J.B. Schedule, No. 9 Area, at present £387 rising to £404, plus an allowance of £50 per annum for use of car. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the person appointed will be required to pass a medical examination.

Forms of application and conditions of appointment may be obtained from the Electrical Engineer and Manager, Electric House, Linkfield Corner, Redhill. These must be completed, endorsed "Assistant Consumers' Engineer," and delivered to me not later than 31st January, 1947. Canvassing, directly or indirectly, will disqualify.

HEBER DAVIES,
Town Clerk.

Town Hall, Reigate, Surrey.
6th January, 1947. 4339

COUNTY BOROUGH OF GREAT YARMOUTH ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the following positions:—

(a) DISTRICT MANAGER AND ENGINEER. Applicants must be capable of taking charge of supply to a rural area of 80 square miles containing 3,000 consumers. L.T. and 11 kV networks are mixed o/h and u/g. A district office and showroom is being opened in Martham, Norfolk, and a flat containing 7 rooms, above the office, will be available, rent and rates free, to the successful applicant.

The applicant will be directly responsible to the Engineer and Manager for the commercial success of the area, for servicing, meter reading and collecting, and small contracting work; but mains extensions, billing and certain other work will be carried out from head office. Commercial initiative is essential, together with distribution and general supply experience. Applicants should be graduate members of the Institution of Electrical Engineers or possess equivalent qualifications, and have had a sound practical and theoretical training.

Salary and conditions of service in accordance with the National Joint Board Schedule, Class B, Grade 6, at present £402/410/417 per annum.

(b) ASSISTANT DRAUGHTSMAN. Applicants must be qualified draughtsmen and have had a good general technical education and training, and preferably with experience in mains records, building and structural engineering as applied to substations, etc. Salary and conditions of service in accordance with the National Joint Board Schedule, Class G, Grade 10a, at present £300/305/311 per annum.

(c) PREPAYMENT CLERK. Applicants must be over 21 and have had a good general experience in ledger work, particularly in the quarterly and prepayment accounts department of an electricity undertaking. Each applicant must submit particulars of his general education and subsequent qualifications.

Salary and conditions of service in accordance with the General Division of the National Scale, £300 per annum at 30 years of age, plus cost of living bonus, which is at present £59 10s. per annum.

(d) JUNIOR COOKERY DEMONSTRATOR. Applicants must have had a good general education and training at a domestic science college. The work consists of demonstration on domestic and heavy duty cooking equipment, together with general showroom duties.

Salary and conditions of service in accordance with the General Division of the National Scale with cost of living bonus according to age.

(e) ASSISTANT COSTS CLERK. A vacancy exists for a temporary Assistant Costs Clerk, and applicants must have had experience in ledger work in connection with goods received, invoices, requisitions, etc. Each applicant must submit particulars of school certificates gained and subsequent qualifications.

Salary and conditions of service in accordance with the General Division of the National Scale, £300 per annum at 30 years of age, plus cost of living bonus which is at present £59 10s. per annum.

The successful applicant in each case (except (e)) will be required to pass a medical examination, and the appointment is subject to the Local Government Superannuation Act, 1937. Applications, stating age, particulars of qualifications and experience, accompanied by copies of recent testimonials, should be addressed to the undersigned not later than the 27th January, 1947, and appropriately endorsed.

Canvassing, directly or indirectly, will be deemed a disqualification, and candidates must disclose in writing whether, to their knowledge, they are related to any member or holder of any senior office under the Council. A candidate who fails to do so will be disqualified or, if appointed, will be liable to dismissal without notice.

FARRA CONWAY,
Town Clerk.

Town Hall, Great Yarmouth.
9th January, 1947. 4429

WOLVERHAMPTON AND STAFFORDSHIRE TECHNICAL COLLEGE

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

APPLICATIONS invited for appointment as Senior Assistant in Electrical Engineering. Salary £600 to £750 per annum, with additions for recognised training. Applicants should be graduates with appropriate teaching and industrial experience. Research experience an advantage. Further particulars obtainable on application within 10 days of this advertisement from F. Lonsdale Mills, Clerk to the Governors, Education Offices, North Street, Wolverhampton. 4274

HIS MAJESTY'S COLONIAL SERVICE

The Colonial Postal Service

ASSISTANT Controllers of Telecommunications (Wireless) are required in the Telecommunication Dept. of the Malayan Union. Officers selected will normally be required to take executive control of a group of wireless stations and will be responsible to the Controller of Telecommunications of the region in which the stations are situated for all technical traffic and staff matters connected with these stations. Alternatively they may be required to perform specialist wireless duties in any part of the Malayan Union at the discretion of the Director of Telecommunications.

Qualifications normally entitling candidates to consideration are Associate Membership of the Institution of Electrical Engineers or degrees or diplomas giving exemption from the qualifying examinations of that Institution. They should have had at least 2 years' practical experience in a responsible technical position in a radio operating or manufacturing undertaking. Under present conditions, however, consideration will be given to applications from candidates with longer experience who lack the full examination qualifications but expect to be able to secure these during the first 3 years of their service in Malaya. Candidates must be between 25 and 35 years of age.

Salary scale from £560 by annual increments of £35 to £1,120 per annum, starting salary depending on age, qualifications and experience. Appointments are on probation for permanent pensionable employment. Free quarters are not provided, but Government quarters, partially furnished, are usually available at low rates. Free passages for the officer and, if married, for his wife on first appointment and on leave. Home leave on full pay is normally granted after 3 years of resident service at the rate of 4 days for each month of resident service. Allowances in respect of children under 18 are payable at the rate of £98 for the first child and £70 for the second child. Outfit allowance on first appointment.

Applications, stating age, experience and qualifications, should be addressed to the Director of Recruitment Colonial Office, 15, Victoria Street, London, S.W.1. Employees of the British Post Office or the British Broadcasting Corporation should apply through their Establishment Officer. 4409

HIS MAJESTY'S COLONIAL SERVICE

The Colonial Postal Service

ASSISTANT Controllers of Telecommunications (Engineering) are required in the Telecommunications Department of the Malayan Union. Selected officers will normally be required to take executive control of a district within a telecommunications region, and will be responsible to the Controller of Telecommunications of that region for all technical traffic and staff matters within the district. Alternatively they may be required to perform specialist engineering duties in any part of the Malayan Union at the discretion of the Director of Telecommunications.

Qualifications normally entitling candidates to consideration are Associate Membership of the Institution of Electrical Engineers, or degrees or diplomas giving exemption from the qualifying examinations of that Institution. In addition candidates should have had not less than 2 years' practical experience with the British Post Office or with a manufacturer of telephone and telegraph apparatus. Under present conditions, however, consideration will be given to applications from candidates with longer experience who lack the full examination qualifications but expect to be able to secure these during the first 3 years of their service in Malaya. Candidates must be between 25 and 35 years of age.

Salary scale from £560 by annual increments of £35 to £1,120 per annum, starting salary depending on age, qualifications and experience. Appointments are on probation for permanent pensionable employment. Free quarters are not provided, but Government quarters, partly furnished, are usually available at low rates. Free passages for the officer and, if married, for his wife on first appointment and on leave. Home leave on full pay is normally granted after 3 years of resident service at the rate of 4 days for each month of resident service. Allowances for children under 18 are payable at the rate of £98 per annum for the first child and £70 for the second child. Outfit allowance on first appointment.

Applications should be addressed to the Director of Recruitment Colonial Office, 15, Victoria Street, London, S.W.1, stating age, qualifications and experience. Employees of the British Post Office should apply through their Establishment Officer. 4408

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Appointment of Technical Staff: Ocker Hill Generating Station, Tipton, Staffordshire

THE above-named Authority invite applications for appointment to the following positions in connection with the commissioning of new plant at their generating station at Ocker Hill, Tipton.

(1) ONE CHARGE ENGINEER, Class H, Grade 8, salary £481 per annum. Candidates must have had a thorough practical engineering training and be experienced in the operation of large steam turbo-alternators, switchgear, high-pressure boilers and auxiliary plant in a modern generating station. Corporate membership of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers will be an advantage.

(2) ONE ELECTRICAL AND SWITCHGEAR MAINTENANCE SUPERINTENDENT, Class H, Grade 8, salary £181 per annum. Candidates must have had a wide experience in the erection and maintenance of alternators, 33,000-volt switchgear and associated protective apparatus, 3,300 and 400-volt works auxiliary motors, including switch and control gear, with protective devices as installed in a modern generating station. An electrical manufacturing works training is essential, and Corporate Membership of the Institution of Electrical Engineers will be an advantage.

(3) FIVE COMBUSTION ENGINEERS, Class H, Grade 8a, salary £455 per annum. Candidates must be well versed in fuel technology and have had a thorough practical engineering training and a wide experience in the efficient operation of high-pressure boilers of large capacity, modern boiler-house equipment and instruments in major generating stations. Corporate Membership of the Institution of Mechanical Engineers and/or the Institution of Electrical Engineers will be an advantage.

Each appointment will be governed by the National Joint Board conditions of service and will be subject to the Authority's Superannuation Scheme under the Local Government Superannuation Act, 1937. The selected candidates will be required to pass a medical examination.

Applications, stating age, full particulars of training and experience, accompanied by copies of three recent testimonials, should reach the undersigned not later than the 3rd February, 1947. Canvassing, either directly or indirectly, will disqualify.

H. F. CARPENTER,
Clerk and Manager.

Phœnix Buildings,
Dudley Rd., Wolverhampton.
8th January, 1947. 4417

BOROUGH OF STOCKTON-ON-TEES ELECTRICITY DEPARTMENT

Chief Assistant Engineer

APPLICATIONS are invited for the above appointment at a salary in accordance with N.J.B. Schedule, Class F, Grade 2, at present £714-£729-£743 (inclusive) per annum, plus car allowance.

Candidates must be fully qualified electrical engineers and experienced in the control and operation of an electricity supply undertaking. Corporate membership of the I.E.E. is essential. The appointment is an established post under the Corporation's Superannuation Scheme, and the successful candidate must pass a medical examination.

Application forms and conditions of appointment can be obtained from the undersigned, and must be returned not later than Monday, 3rd February, 1947, endorsed "Chief Assistant Electrical Engineer."

N. HUNTER, M.I.E.E.,
General Manager and Engineer.

Electricity Offices,
Bishopton Lane,
Stockton-on-Tees. 4463

FOLKESTONE ELECTRICITY SUPPLY COMPANY LIMITED

Draughtsman

APPLICATIONS are invited for the above appointment for Draughtsman with experience in a distribution drawing office who is conversant with mains records and the design and layout of distribution networks.

Salary and conditions of employment will be in accordance with N.J.B. Schedule, Class E, Grade 9, viz., £335-£351 per annum.

Applications should be addressed to the Regional Manager, Folkestone Electricity Supply Co. Ltd., York House, Cheriton Gardens, Folkestone, giving full details of experience, age, training and qualifications, and accompanied by copies of two testimonials. 4431

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Appointment of Additional Operating and Maintenance Staff: Ocker Hill Generating Station, Tipton, Staffordshire

THE above-named Authority invite applications for the following appointments in connection with the commissioning of new plant at their generating station at Ocker Hill, Tipton:—

Operating Staff:
- 4 Shift Turbine Drivers.
- 9 Shift Turbine Auxiliary Plant Attendants.
- 4 Shift Evaporator, Softener and Circulating Water Plant Attendants.
- 3 Shift Chargehand Stokers.
- 15 Shift Stokers.
- 5 Shift Boiler House Auxiliary Plant Attendants.
- 1 Locomotive Driver.
- 1 Shunter.
- 1 Platelayer.
- 2 Crane Drivers.
- 2 Shift Weigher and Capstan Attendants.
- 4 Shift Coal Conveyor Attendants.
- 2 Shift Coal Plant Labourers.
- 4 Shift Boiler House Ash Plant Attendants.
- 2 Shift Ash Conveyor Attendants.
- 2 Ash Wheelers.

Maintenance Staff:
- 4 Mechanical Fitters and Turners.
- 4 Mechanical Fitters' Mates.
- 1 Instrument and Laboratory Engineer's Assistant.

The rates of pay and conditions of service are in accordance with the Schedule of the District Industrial Council for the Electricity Supply Industry (No. 5, West Midlands Area, Zone A). The Authority have in operation a Pension and Life Assurance Scheme, and employees will become eligible for membership after a period of satisfactory service.

Applications, stating age and full particulars of experience, should be addressed to the undersigned.

H. F. CARPENTER,
Clerk and Manager.

Phœnix Buildings,
Dudley Rd., Wolverhampton.
8th January, 1947. 4416

METROPOLITAN BOROUGH OF FULHAM ELECTRICITY DEPARTMENT

Second Architectural Assistant

APPLICATIONS are invited for the position of Second Architectural Assistant. Candidates must be not more than 35 years of age and must be either a registered architect or preferably an Associate of the R.I.B.A. Applicants must have had training and experience in the preparation of plans and specifications, bills of quantity, etc., for all types of buildings, including electricity substations, showrooms, etc.

The salary will be in accordance with the A.P.T. Division IV of the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services, commencing at £440 per annum, and rising by annual increments of £15 to maximum of £485, including London weighting. Salaries are at present subject to an addition of cost-of-living bonus amounting to £59 16s. per annum.

Completed applications must be despatched to reach me not later than 12 noon on Monday, 17th February, 1947. Forms of application and general conditions of the appointment may be obtained on sending stamped addressed envelope to me, envelope enclosing request to be endorsed "Second Architectural Assistant."

CYRIL F. THATCHER,
Town Clerk.

Town Hall,
Fulham, S.W.6. 4412

CITY OF PLYMOUTH EDUCATION COMMITTEE

Plymouth and Devonport Technical College
(Principal: A. R. Boeree, M.A., B.Sc.(Oxon), F.I.C.)

APPLICATIONS are invited for (a) the post of Lecturer in Chemistry: (b) the post of Lecturer to teach Electrical and/or Civil and Mechanical Engineering. A good honours degree of a British university and teaching and industrial experience are desirable. Salary will be paid according to the Burnham Technical Report. Further particulars and application form (which should be returned within two weeks of the appearance of this advertisement) may be had from Andrew Scotland, Director of Education, Cobourg Street, Plymouth. 4282

ASHFORD (KENT) U.D.C. ELECTRICITY UNDERTAKING

Appointment of Consumers' Engineer

APPLICATIONS are invited from suitably qualified engineers over 30 years of age for the post of Consumers' Engineer. The salary will be in accordance with the N.J.B. Schedule, being fixed at Grade 4, present classification Class E, present value £559 p.a. rising to £571. The post will be regraded to Grade 3 as and when new showrooms are opened.

Candidates must be corporate members of the Institution of Electrical Engineers or possess equivalent technical qualifications. They must have had considerable experience in the development of load for domestic, commercial and industrial purposes, including the preparation of specifications and estimates for all types of electrical installations, and the supervision of installation and maintenance work. They must also have had experience in hire and hire-purchase schemes, development of sales and showroom organisation and control.

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

Applications, endorsed "Consumers' Engineer," giving particulars of age, training and experience, accompanied by copies of not more than three recent testimonials, must be received by the undersigned not later than Monday, February 3rd, 1947.

RAMSDEN MELLOR, A.M.I.E.E.,
Electricity Offices, Engineer and Manager.
Ashford, Kent.
11th January, 1947. 4446

COUNTY BOROUGH OF SOUTHAMPTON ELECTRICITY DEPARTMENT

Substation Engineer

APPLICATIONS are invited for the above-named position at a salary for Class H, Grade 8b, of the N.J.B. Schedule (now at £429 per annum), subject to increments and cost-of-living adjustments, and a deduction for superannuation. The successful applicant must pass a medical examination.

Applicants should each possess an engineering degree and/or be a Corporate Member of the Institution of Electrical Engineers, and must be experienced in the operation and maintenance of static substations, transformer kiosks, the erection and connection of switchgear and new equipments, the testing, setting and calibration of all protective apparatus, the testing and filtering of switch and transformer oil, the calculation of fault currents, the records applicable to the duties, the control of the work of the substation electrical fitters, and must be prepared to undertake stand-by duties.

Applications, on forms to be obtained from Mr. W. G. Turner, Borough Electrical Engineer, Civic Centre, Southampton, and accompanied by not more than three testimonials, must be returned in envelope marked "Substation Engineer" to the undersigned not later than 31st January, 1947. Canvassing, directly or indirectly, will disqualify.

R. RONALD H. MEGGESON,
Civic Centre, Town Clerk.
Southampton. 4389

BOROUGH OF BARKING ELECTRICITY DEPT.

Appointment of Third Mains Assistant

APPLICATIONS are invited for the position of Third Mains Assistant at a salary in accordance with the N.J.B. Schedule, Class F, Grade 9, commencing at £376 per annum.

Candidates should hold the Higher National Certificate in Electrical Engineering or its equivalent, and also have had sound technical and practical experience in the installation and maintenance of H.V. and M.V. distribution systems.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications must be submitted on the appropriate form, which may be obtained from the Borough Electrical Engineer, Electricity House, Ripple Road, Barking, and should be returned to me, together with three recent testimonials, by Monday, 3rd February, 1947, endorsed "Third Mains Assistant."

E. R. FARR,
Town Hall, Barking, Essex. Town Clerk.
6th January, 1947. 4383

CITY AND COUNTY BOROUGH OF BELFAST ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the position of Assistant Power Station Superintendent. Applicants must have a sound engineering training, have a University Degree in Electrical Engineering and/or be Corporate Members of the Institution of Electrical Engineers, and have had at least five years' experience of power station practice. They must not be more than 40 years of age on the 1st February, 1947.

The salary for the position is in accordance with Grade 5, Class J, of the National Joint Board Schedule of Salaries for Technical Engineers on the staff of Authorised Undertakers. The scale is £651 for the first two years, £666 for the third and fourth years, and £682 after the fourth year. Preference will be given to ex-Service candidates possessing the required qualifications.

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

Applications must be made on official forms, which can be obtained from the City Electrical Engineer and General Manager, Electricity Department, East Bridge Street, Belfast, and, with copies of not more than three recent testimonials, should reach the Town Clerk, City Hall, Belfast, not later than 4 p.m. on Friday, 24th January, 1947. Canvassing, oral or written, if proved to the satisfaction of the appointing authority, will disqualify.

JOHN DUNLOP,
City Hall, Belfast. Town Clerk.
3rd January, 1947. 4360

LONDON AND HOME COUNTIES JOINT ELECTRICITY AUTHORITY

APPLICATIONS are invited for the appointment of Consumers' Engineer, Twickenham district. Candidates must be Corporate Members of the Institution of Electrical Engineers, or possess equivalent qualifications. They must have had experience in sales and development of an electricity supply undertaker operating a wiring department and hire and hire-purchase schemes, and be capable of taking charge of consumers' department.

Conditions of service and salary in accordance with N.J.B. Schedule, Grade 5, Class G, at present £573-£604 per annum, plus 5% for London area. The Authority's regulations provide for a car allowance of £80-£125 per annum, according to mileage, to be made to employees using their own cars in the Authority's service.

The person appointed will be required to pass a medical examination by the Authority's medical adviser, and to become subject to the Authority's Superannuation Scheme, which applies generally the provisions of the Local Government Superannuation Act, 1937, including the provisions of that statute relating to transfer values.

Applications, stating age, qualifications and experience, and endorsed "Consumers' Engineer," giving names and addresses of not more than three persons to whom reference may be made, must be sent to the District Manager, 42, York Street, Twickenham, so as to reach him by not later than Thursday, the 30th January, 1947. Canvassing, directly or indirectly, will be a disqualification.

A. L. BURNELL,
5-6, Lancaster Place, Clerk to the Authority.
Strand, W.C.2.
January, 1947. 4369

CROYDON (COUNTY BOROUGH OF) EDUCATION COMMITTEE

Croydon Polytechnic

Principal: Hugh A. Warren, M.Sc.(Eng.), A.M.I.C.E., M.I.Struct.E.

APPLICATIONS are invited for an appointment in the Electrical Engineering Department of a full-time Lecturer in Telecommunications with specialist knowledge in Radio Engineering. Applicants should hold a degree in electrical engineering or an equivalent qualification, and have had satisfactory industrial experience in light-current and radio engineering. Previous teaching experience would be an added qualification.

Salary will be Burnham Technical Scale (London area). Duties to commence as soon as possible.

Further particulars and form of application may be obtained on receipt of a stamped addressed envelope from the undersigned, to whom completed forms must be returned within two weeks of the date of this advertisement.

HERBERT ROBERTS,
Education Office, Education Officer.
Katharine St., Croydon. 4437

CITY OF BRADFORD

Foreman (Electrical Contracting)

APPLICATIONS are invited for the position of Foreman (Electrical Contracting) in the Consumers' Engineer's Section of the Electricity Department from persons who have had a sound training and considerable practical experience in the electrical contracting industry.

The person appointed will be directly responsible to the Consumers' Engineer for the preparation of estimates and specifications for all classes of electrical installation work undertaken by the department, the supervision of the carrying out of such work, and the control of the staff engaged thereon.

The normal working hours will be 47 per week, and the wage paid will be the rate applicable to an electrician in the contracting section, which is at present 2s. 6d. per hour, plus £1 10s. per week, i.e., a total amount of £7 7s. 6d. per week. This wage will be subject to review when a Scheme of Grading of Foremen, etc., now under consideration by the Corporation, is put into operation.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications, stating age, qualifications, experience and appointment at present held, accompanied by copies of recent testimonials, and endorsed "Foreman (Electrical Contracting)," should be sent to the Electrical Engineer and Manager, 45-53, Sunbridge Road, Bradford, so as to reach him not later than 4th February, 1947.

W. H. LEATHEM.
Town Hall, Bradford. Town Clerk.
January, 1947. 4430

THE YORKSHIRE ELECTRIC POWER COMPANY

Charge Engineer

APPLICATIONS are invited for the position of Charge Engineer and Assistant Charge Engineer at Ferrybridge Generating Station (125 MW and scheduled for extension).

Applications will be considered from persons who (a) have had a sound technical education and training; (b) have had operating experience with E.H.T. switchgear; (c) are members of the Institution of Electrical Engineers or Institution of Mechanical Engineers.

Switchboard Attendants

Applications are invited for the position of Switchboard Attendant at Mexborough General Station (60 MW) and Ferrybridge Generating Station (125 MW).

Candidates should have had a regular training and experience in similar duties.

Apply, stating age, training, experience and present position, to GM/GH, The Yorkshire Electric Power Company, Bramhope, near Leeds. 4465

NORTH-WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Assistant Meter Engineer

APPLICATIONS are invited for the above position in a Class A Meter Testing Station. Applicants should be under 40 years of age and be graduates of the I.E.E. or possess equivalent technical qualifications, and should preferably have had experience in the testing, repair and adjustment of D.C. single and polyphase metering equipments.

The salary will be in accordance with Class J, Grade 9a, of the National Joint Board's Schedule, commencing at £389 per annum.

List of duties and forms of application may be obtained from the undersigned. Applications to be received not later than Monday, 3rd February, 1947.

F. FAVELL, M.I.E.E., M.I.Mech.E.,
York Chambers. Chief Engineer and Manager.
Kingsway, Stoke-on-Trent. 4439

SCOTTISH SOUTHERN ELECTRIC SUPPLY CO. LTD.

Consumers' Department: Senior Assistant

APPLICATIONS are invited for the above position. The person appointed will be required to handle correspondence with industrial, farm and other consumers. Commencing salary, £300 per annum.

Applications, stating age, qualifications, particulars of training and experience, and accompanied by one copy of recent testimonials, should be addressed to the undersigned.

G. H. SANKEY.
Galashiels. Manager.
10th January, 1947. 4445

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Civil Engineering and Ferro-Concrete Designers

THE above-named Authority desire to appoint Civil Engineering Designers and Ferro-Concrete Designers in connection with the design and layout of important generating station extensions. The qualifications for these appointments are as detailed below:—

CIVIL ENGINEERING DESIGNERS. Applicants must have a wide experience in civil engineering, including the design of structures in steel and brick, the installation of heavy machinery, and the foundation works associated therewith. Applicants must also be Corporate Members of the Institution of Civil Engineers or possess an equivalent qualification.

FERRO-CONCRETE DESIGNERS. Applicants must be good draughtsmen, have had a wide experience in the design of large ferro-concrete structures, and be Corporate Members of the Institution of Civil Engineers and/or the Institution of Structural Engineers.

The appointments will be for the duration of the work, which it is estimated will be about three years.

The salary in each case will be £684 per annum, subject to adjustments for future variations in the cost of living.

Applications must be made on the prescribed form, which may be obtained from the address below, and should reach me not later than the 3rd February, 1947.

H. F. CARPENTER,
Phœnix Buildings. Clerk and Manager.
Dudley Rd., Wolverhampton.
8th January, 1947. 4418

METROPOLITAN BOROUGH OF FULHAM ELECTRICITY DEPARTMENT

Publicity Assistant

APPLICATIONS are invited for the position of Publicity Assistant, male or female, to act as Assistant to the Publicity Officer, from candidates not over 35 years of age who have had training and experience in commercial art, poster work, lettering, preparation of brochures and pamphlets, showroom layout and window displays, mailing campaigns, and special demonstrations incorporating proprietary articles. Knowledge of Multilith and Multigraph printing machines and Adrema addressing systems desirable.

Salary and conditions in accordance with the National Joint Council for Local Authorities' Administrative, Professional, Technical and Clerical Services, General Division. Salary according to age and ability, maximum (male) £389 16s., (female) £312 2s. per annum, including appropriate London weighting and cost-of-living bonus.

Forms of application and general conditions of the appointment may be obtained on sending stamped addressed envelope to me, envelope enclosing request to be endorsed "Publicity Assistant." Completed applications must be despatched to reach me not later than 12 noon on Monday, 17th February, 1947.

CYRIL F. THATCHER,
Town Hall. Town Clerk.
Fulham, S.W.6. 4411

BOROUGH OF GRAVESEND

Distribution Superintendent

APPLICATIONS are invited for the above position from Corporate Members of the I.E.E. The position is Class F, Grade 3, with a salary of £640-£667 per annum, and the successful applicant will require to undergo a medical examination and participate in the Corporation's Superannuation Scheme.

Applicants should preferably be under 45 years of age and must have had experience on E.H.V. and L.V.A.C. and D.C. mains, on rotary and rectifier plant, and on the construction and operation of substations, overhead lines and underground networks.

The Gravesend system handles about 50 million units per annum and has 44 substations, with another 12 under construction. The present maximum demand is approximately 14,000 kW's and industrial loads comprise about half the consumption of electricity to the 16,000 consumers.

Applications, giving details of training and past work and present position, together with copies of any testimonials, should be sent to the undersigned before Friday, 31st January, 1947.

G. V. HARRAP, A.M.I.E.E., M.Am.I.E.E., M.I.B.A.E., General Manager
17, Harmer Street. and Engineer.
Gravesend, Kent. 4264

BOROUGH OF GRAVESEND

Generation Superintendent

APPLICATIONS are invited from Corporate Members of the I.E.E. and/or Corporate Members of the I.Mech.E. for the above position. Membership of the Institute of Fuel will be a recommendation. The position is Class F, Grade 3, carrying a salary of £640-£667 per annum, and the successful applicant will be required to contribute to the Council's Superannuation Scheme.

Applicants should preferably be under 45 years of age and have had a thorough training and a varied experience in the operation of steam-raising and electrical generating plant in a Selected Power station.

The Gravesend Selected Power Station has a capacity of 13,500 kW's with steam at 200 lb./sq. in. and generation at 6,600 v. A programme of modernisation is in hand and 2-shift running is usual.

Applications, giving details of training and past work and present position, together with copies of any testimonials, should be sent to the undersigned before Friday, 31st January, 1947.

G. V. HARRAP, A.M.I.E.E., A.I.Mech.E., M.Inst.F.,
General Manager
17, Harmer Street, and Engineer.
Gravesend, Kent. 4263

METROPOLITAN BOROUGH OF FULHAM ELECTRICITY DEPARTMENT

Boiler House Inspector (Mechanical)

APPLICATIONS are invited for the position of Boiler House Inspector (Mechanical), male. Applicants must be not more than 40 years of age and must have educational qualifications equal to Inter. B.Sc. They must also have served at least a 3-years recognised apprenticeship, and have full practical knowledge of fitting and alignment to close limits. Candidates must also have had at least 5 years in a position of responsibility as a mechanical engineer, preferably on maintenance of heavy plant.

Salary and conditions will be in accordance with N.J.B., Class M, Grade 9a, at present £501 18s. per annum.

Forms of application and general conditions of the appointment may be obtained on sending stamped addressed envelope to me, envelope enclosing request to be endorsed "Boiler House Inspector (Mechanical)." Completed applications must be despatched to reach me not later than 12 noon on Monday, 17th February, 1947.

CYRIL F. THATCHER,
Town Hall, Town Clerk.
Fulham, S.W.6. 4410

CROWN AGENTS FOR THE COLONIES

APPLICATIONS from qualified candidates are invited for the following post: Power Station and Waterworks Engineer required for the Basrah Port Directorate, Iraq, for one year in the first instance.

Salary I.D.50 a month rising to I.D.70, plus high cost-of-living allowance of I.D.12 a month for single men and I.D.13 or I.D.15 for married men according to number of dependants (Iraqi dinar = £1). Free passages. Provident fund. Candidates, preferably not over 40 years of age, must have had thorough practical experience of the running and maintenance of large Diesel engines, alternating current generators, switchgear and general power station work. They should be capable of taking charge of a station of approximately 4,000 kW capacity and of a water purification plant of 3,000,000 gallons a day capacity (including electrically driven pumps, clarifier and settling basins, Paterson pressure filters and chlorine injection apparatus).

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/14428 on both letter and envelope. 4340

THE UNIVERSITY OF LIVERPOOL

APPLICATIONS are invited for a Senior Lectureship (Grade I) in the Department of Electrical Engineering (Electronics), at a salary scale of £850/£50/£1,050 per annum.

Applications, stating age, academic qualifications, teaching and research experience, together with the names of three referees, should be received not later than 28th February, 1947, by the undersigned, from whom further particulars of the conditions of appointment may be obtained.

STANLEY DUMBELL, Registrar.
January, 1947. 4371

CROWN AGENTS FOR THE COLONIES

APPLICATIONS from qualified candidates are invited for the following post: Accountant required by the Government of Malaya for the Electrical Department for one tour of three years in the first instance, with prospect of permanency.

Salary $400 a month rising to $800 a month (dollar = 2s. 4d.). Initial salary according to age and war service. Cost-of-living allowance for married men $130 and for single men $90 a month on salary of $400. Children's allowance $70 a month for the first child and $50 for second child. Outfit allowance £60. Free passages and liberal leave on full salary. Candidates, between 25 and 35 years of age, must be Associates of the Institute of Chartered Accountants or of the Society of Incorporated Accountants and Auditors, or possess similar professional qualifications, and should have had experience in accountancy in a municipal electricity department or other electricity undertaking.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/16829 on both letter and envelope. 4342

WEST GLOUCESTERSHIRE POWER CO. LTD.

APPLICATIONS are invited for the positions of:—(a) ASSISTANT DISTRICT MAINS ENGINEER, for operation, maintenance and construction of a section of the company's mains system, at a salary in accordance with the N.J.B. Salary Schedule, Class F, Grade 6. Applicants must have a sound technical and practical training and experience in construction and maintenance of overhead lines. Member of the Institution of Electrical Engineers preferred.

(b) SHIFT ENGINEER for the company's power station at Lydney, Glos. Salary in accordance with the N.J.B. Salary Schedule, Class F, Grade 8.

The appointments are subject to the company's conditions of service, which includes membership of a superannuation scheme. Application must be made on the prescribed form, which can be obtained from 126, London Road, Gloucester, and envelopes endorsed according to the position applied for. 4356

CITY OF LONDON ELECTRIC LIGHTING CO. LTD.

Telephone and Meter Assistant

A vacancy occurs in the Meter Room (Class A) for an Assistant who is prepared to combine the work of maintaining a relay automatic telephone system with that of testing and repairing meters, protective relays and instruments. A good opportunity occurs for anyone with the necessary qualifications for taking up the light current side of electricity supply. Salary according to experience and qualifications.

Apply to the undermentioned, giving full particulars of training, experience, age and present position, not later than 25th January, 1947: Distribution Superintendent, The C.L.E.L. Co. Ltd., Falcon House, Aldersgate Street, London, E.C.1. 4327

WEST GLOUCESTERSHIRE POWER CO. LTD.

APPLICATIONS are invited for the position of Assistant in the Company's Meter Testing Department at Gloucester. Applicants must be experienced in the repairing and testing of all types of A.C. single-phase meters. Salary, dependent upon age and experience, according to the company's grading scheme, will be from £221 to £260 per annum, plus cost-of-living bonus.

Appointment is subject to the company's conditions of service, which includes membership of a superannuation scheme. Full particulars of experience, age, education and technical training should be addressed to the Meter Engineer, West Gloucestershire Power Company Limited, 126, London Road, Gloucester. 4357

ST. AUSTELL & DISTRICT ELECTRIC LIGHTING & POWER COMPANY LTD.

Overhead Linesmen

POWER Linesmen required. Wages and conditions of employment will be in accordance with N.J.I.C. rates for No. 12 Area. Applications should be sent to the undersigned, giving full particulars of experience and enclosing copies of references.

J. E. FLOWER, A.M.I.E.E.,
Chief Engineer and Manager.
4348

CORPORATION OF KIRKCALDY

Appointment of Mains Assistant

APPLICATIONS are invited for the position of Mains Assistant in the Department of the Burgh Electrical Engineer. Salary Class E, Grade 8, N.J.B. Schedule, presently £413 per annum. Applicants must be Graduates of the Institution of Electrical Engineers and have had experience with an Electricity Supply Authority in construction, commissioning, operation and maintenance of 6.6-kV and 400/230-volts distribution systems. The appointment will be subject to the provisions of the Town Council Conditions of Service and the Local Government Superannuation (Scotland) Act, 1937, and the selected candidate will be required to pass a medical examination.

Form of application may be had from the Burgh Electrical Engineer, Electricity Department, Victoria Road, Kirkcaldy, with whom applications, along with copies of three recent testimonials, must be lodged not later than 29th January, 1947. 4394

STRETFORD & DISTRICT ELECTRICITY BOARD

Draughtsman

DRAUGHTSMAN required, age 25/40 years, with experience in mains recording, substation layouts and general work in drawing office of electricity undertaking. Salary in accordance with National Scale A.P.T. Division, Grade 1, commencing at £330 per annum, plus cost-of-living bonus, at present £59 10s. per annum. The appointment will be subject to the provisions of the Local Government Superannuation Act and a medical examination. Applications, stating age, qualifications and experience should be received not later than 20th January, 1947.

HUGH G. BELL,
Chief Engineer and Manager.

Trafford Power Station,
Trafford Park,
Manchester, 17. 4305

BIRKENHEAD CORPORATION ELECTRICITY DEPT.

Meter Testers and Repairers

APPLICATIONS are invited for two Meter Testers and Repairers experienced in the repair and testing of all types of meters, both A.C. and D.C., single-phase and polyphase, and of time switches.

Conditions of service and rates of pay will be in accordance with the D.J.I.C. Schedule (No. 3 Area), at present 2s. 3.61d. per hour.

Applications, stating age, training and experience, together with copies of two testimonials, should be addressed to the Borough Electrical Engineer, Craven Street, Birkenhead, not later than 1st February, 1947.

E. W. TAME,
Town Clerk.

Town Hall, Birkenhead.
3rd January, 1947. 4404

ENGINEERING APPRENTICESHIPS IN MINISTRY OF SUPPLY ESTABLISHMENTS

AN Open Competitive Examination for Engineering Apprentices in the Royal Ordnance Factories in various parts of the country and in the Royal Aircraft Establishment, Farnborough, will be held at local centres in March, 1947.

Engineering apprentices are expected to reach Higher National Certificate or equivalent standard by the end of their apprenticeship. Candidates must be not less than sixteen and not more than eighteen years of age on 1st March, 1947.

Copies of the regulations and forms of application may be obtained from the Secretary, Ministry of Supply, Room 268 (Exam.), Shell-Mex House, Strand, London, W.C.2. The latest date for the receipt of applications is 31st January, 1947. 4013

ACCOUNTANT required by The Seaton & District Electric Light Company Limited. Capable of taking charge of local accounts. Preference given to one with experience of similar organisation. Appointment will be permanent and pensionable. Applications in writing, giving details of age, experience, etc., and salary required, to Electricity Offices, Seaton, Devon. 4312

ALBRIGHT & Wilson Ltd. invite applications for their Technical Sales Staff in the South-Eastern area and Yorkshire in connection with development of the uses of Dow Corning Silicone products. Applicants should preferably hold a science degree or its equivalent and be between the ages of 23 and 33. Details of experience and qualifications should be sent to 49, Park Lane, London, W.1. 4213

BOROUGH OF WHITEHAVEN

APPLICATIONS are invited from Corporate Members of the Institution of Electrical Engineers for the post of Electrical Engineer at a salary in accordance with the agreement of the 9th July, 1941, made by the National Joint Committee of Local Authorities and Chief Electrical Engineers, viz., 1st year £726, 2nd year £791, 3rd year £855, plus war bonus.

Applicants must have had control of E.H.T. transmission and L.T. 3-phase, 4-wire overhead distribution systems, and of D.C. generation and distribution.

Applications, stating age, experience and qualifications, together with the names of two persons to whom reference can be made, should reach me not later than 30th January, 1947.

A. D. VICKERMAN,
Town Clerk.

Town Hall,
Whitehaven. 4400

APPLICATIONS are invited for the position of Chief Designer for A.C. motors up to 250 h.p. Applicants should have good commercial experience and be capable of taking complete charge of design at works of a large manufacturer in the North of England. Should be between 30 and 45 years of age and possess sound knowledge of all types of induction motors, both single and polyphase. Excellent prospects and permanency for the right man. Please state age, details of education, training and experience to—Box 4280, c/o The Electrical Review.

APPLICATIONS are invited for the position of Paper Cable Manufacturing Department Manager. Applicants must have received a sound technical training and have had experience of modern methods of paper cable manufacture, up to and including 33 kV. The position offers good prospects and a superannuation scheme is available. All applications will be treated in the strictest confidence. Reply, giving full details of experience, age and education, to the Chief Personnel Officer, Crompton Parkinson Ltd., Electra House, Victoria Embankment, W.C.2, marked "P.M." 4185

APPLICATIONS are invited for positions of Sales Representatives (part time). Vacancies occurring in following territory: London and South East England, South West England, including South Wales, Lancashire and Yorkshire. Applicants must have selling experience on battery chargers, rectifiers, and transformers up to 10 kVA. These appointments provide remunerative propositions to successful applicants. Apply, in writing, with full particulars to—Legg (Industries) Limited, Williamson Street, Wolverhampton. 4306

APPLICATIONS are invited from graduates with industrial experience of design and manufacture of electronic servo control system for post of Development Engineer with South-West Lancashire organisation. State full particulars of qualifications, experience and salary required to—Box 4421, c/o The Electrical Review.

ARMATURE Winders and Improvers required. A.C. and D.C., top rates, good working conditions.—Electrical Power Repairs (Gillingham) Ltd., Strover Street, Gillingham, Kent. 5005

ARMATURE Winders and Improvers urgently required. Top rates and good conditions.—Box 113, c/o The Electrical Review.

ARMATURE Winders and Improvers urgently required. Top rates and good conditions.—Collins Electrical Ltd., 22, St. Alban's Place, London, N.1. 85

ASSEMBLY Shop Superintendent required for light electrical manufacturers west of London. Qualifications required are good technical background, experience of modern assembly methods, and ability to control production shop of 200 men and women. Commencing salary £650 p.a.—Box 4413, c/o The Electrical Review.

ASSISTANT Engineer, 25 to 35, required for overhead transmission line work in consultants' office in Newcastle. Must be thoroughly conversant with design and checking of steel towers; electrical experience desirable but not essential. Applications, stating age, qualifications, experience and salary required, to—Merz & McLellan, Carliol House, Newcastle-upon-Tyne, 1. 4401

ASSISTANT Mechanical Engineer for consulting engineers' office, age 28-40 years. Must be well educated, technically trained as a mechanical engineer, including drawing office, with some experience in an electric power station. Location London. Salary according to training and experience.—Box 4388, c/o The Electrical Review.

CLERKS (junior and senior) required for accounts and costing departments. Write first, giving full particulars and salary required to—The Secretary, Troughton & Young Ltd., Imperial Court, Basil Street, Knightsbridge, S.W.3. 5214

CHARGEHAND required for Assembly Department of electrical manufacturing company. Previous experience of line assembly and component parts essential. Good disciplinarian used to control of male and female labour. Permanent staff position.—Box 4390, c/o The Electrical Review.

CHIEF Draughtsman-Designer required by progressive North London company. Applicant must have creative ideas, wide experience, manufacturing technique, progressive record in design and development of domestic electrical appliances, including fractional h.p. universal motors. Scope for initiative and liberal salary.—Box 4384, c/o The Electrical Review.

DESIGNER-Draughtsman required with good experience small electro-mechanical control devices, West London area. State age, experience and salary required to—Box 4358, c/o The Electrical Review.

DISTRIBUTION Engineers. Wanted for large public utility undertaking abroad, thoroughly experienced and fully qualified Engineer who has been in full charge of large distribution network employing nominally 13-kV and 4-kV overhead and underground distribution systems, also 20-kV underground sub-transmission. Experience with installation of 80,000-volt underground cable desirable. Age between 30 and 35. Minimum qualifications, corporate member of I.E.E. or equivalent degree. Also Junior Engineer with similar qualifications, although not necessarily as experienced. Age 25-30. Salaries offered, £1,500 and £1,200 respectively. Write—Box B.745, c/o Streets, 110, Old Broad Street, E.C.2. 4288

DRAUGHTSMAN and Estimator required. Experienced in layout of lighting and power installation West London area.—Box 4453, c/o The Electrical Review.

DRAUGHTSMAN required, with experience of contract work on H.T. and L.T. switchgear, wiring diagrams, etc. Apply, giving full details of age, experience and qualifications, to—South Wales Switchgear Ltd., Blackwood, Mon. 4285

DRAUGHTSMEN required by switchgear engineers. Experienced in contract work, protective gear diagrams or design. Applications in writing, with full particulars, to—Ferguson, Pailin Ltd., Manchester, 11. 86

ELECTRICAL Contracting. Wanted, an Engineer used to supervising and estimating in London. Salary in accordance with A.S.E.E. scale. Apply in writing, giving full details of experience, to—Newman & Watson Ltd., 45, Nottingham Place, London, W.1. 4422

ELECTRICAL Inspector for instrument and light electrical assembly. Knowledge of electronics essential. London area. State age, education, experience and salary required.—Box 4425, c/o The Electrical Review.

ELECTRICAL wholesalers offer progressive post to young man who has received training in accountancy. Knowledge of electrical trade desirable but not essential. Applicants should reside in Portsmouth district. Commencing salary £400 p.a. Reply, giving details of age and experience, to—Box 4391, c/o The Electrical Review.

ELECTRICAL Wholesalers require Assistant for buying department. Must have first-class knowledge of electrical material and markets therefor.—London Electrical Company Ltd., 92, Blackfriars Road, S.E.1. 104

ELECTRICIAN—must be used to power and screwed conduit and thermostatic control.—187 Goswell Road, E.C.1. 4455

ELECTRICIANS wanted for large factory in Essex, under good conditions, including a 5-day week, good wages paid, in agreement with trade unions. Experienced in factory maintenance, wiring and plant installation. A.C. and D.C.—Box 4012, c/o The Electrical Review.

ELECTRICIANS wanted for London, must have thorough knowledge of trade. Good prospects for live men. Telephone for appointment—Cunningham 2401. 4456

ENGINEER, experienced in cable laying and overhead line work, required to take charge of contractors' office in Midlands. Age limit 35.—Box 4249, c/o The Electrical Review.

ENGINEER required to assist in organisation and preproduction of complex electro-medical and other electronic equipment. Good general engineering training with experience of small quantity production is essential, with some basic knowledge and experience of electronic equipment. Write for details to—Personnel Manager, The Edison Swan Electric Co. Ltd., Ponders End, Enfield, Middlesex. 4414

ENGINEERS and Draughtsmen are invited to apply to a large electrical engineering firm in the Midlands which has vacancies in the switchgear department for Technical Sales, Contract, Costing and Design Engineers; also experienced Technical Engineers capable of handling large projects for generation, transmission and distribution. Vacancies also exist for Draughtsmen for circuit diagram and general work.—Box 69, c/o The Electrical Review.

ENGINEER for high tension distribution contracts, state wages required and experience.—Box 4458, c/o The Electrical Review.

ENGLISH Steel Corporation Limited, Vickers Works, Sheffield, require Draughtsman for electrical installation work. Experience desirable in plant substation and distribution layouts. State age, experience and salary required. 4407

F.H.P. Motor Manufacturer requires in London Technical Sales Engineer. Previous experience essential. Write, with full details of qualifications, salary required, age, etc., to—Box 4322, c/o The Electrical Review.

FOREMAN. Company engaged in the production of scientific instruments requires an experienced Foreman to take charge of small shop engaged on electrical and mechanical assembly; some experience of electronic instruments desirable.—Box 4373, c/o The Electrical Review.

FOREMAN Electrician to take control of medium-sized installation contracts in the London area. Must have London experience of first-class work, car owner preferred. Good salary, car expenses and future advancement offered in a large, rapidly expanding organisation. Apply to—Thompson Ritchie & Co. Ltd., 39 Victoria St. S.W.1. 4346

FOREMAN, experienced in layout, estimating and staff control on electrical installation work. State experience and wages required.—Meta Ltd., Electrical Contractors, 60, Cornbrook Park Road, Manchester, 15. 4405

FOREMAN for Electrical Testing Dept. electric motor manufacturers, etc., ranging from fractional to 500 h.p.—Higgs Motors, Witton, Birmingham, 6. 41

FOREMEN (Working), heavy electrical power, for factory installations in Huntingdon, Preston, Northallerton, Aylesbury and Eastbourne. Experienced, capable of taking complete charge for augmented supplies, 250 kVA and upwards.—Box 5132, c/o The Electrical Review.

FULLY qualified Electricians required at N.F.E.A. rate of 2s. 6d. an hour. Apply to—The East Anglian Electric Supply Co. Ltd. (L.R.S.), Finborough Hall, Stowmarket, Suffolk. 4449

GENERAL Fitter required, with experience of erection and maintenance of modern switchgear; 2s. 8d. per hour (No. 10 D.J.I.C.). Apply to—Chief Electrical Engineer, 154 Uxbridge Rd. Shepherd's Bush, W.12. 4361

JIG and Tool Draughtsmen required with experience to cover high-class precision tools, automatic machine tools, cams, etc. Men with experience of this type of work should reply, stating full details of experience, age, salary required, to—Box 4344, c/o The Electrical Review.

JOINTERS required for work in Persia. Suitable applicants would be placed on a year's contract with good salary and accommodation found.—Box 4277, c/o The Electrical Review.

JOURNEYMAN Maintenance Electricians familiar with all types of electric lifts, motors, etc., for London area. Regular work, good pay for right man. Write, stating experience, age, etc., to—Box 4323, c/o The Electrical Review.

JUNIOR Draughtsman required for small electrical apparatus and wiring diagrams. Write, stating age, experience, and salary required to Messrs. Clifford & Snell Ltd., Carshalton Road West, Sutton, Surrey. 5210

LARGE iron and steel group operating blast furnaces, coke ovens, rolling mills, steel plant, etc., invite applications for the position of Electrical Engineer. Applicants should preferably have had an extensive experience in the design, layout and installation of H.T. and L.T. gear, A.C. and D.C. distribution systems, rolling mill drives, and auxiliary electrical equipment associated with a large iron and steel works. The selected applicant will be required to take charge under the Chief Engineer of the general design, layout and installation of all the electrical gear included in a large modernisation scheme which the company is carrying through. Applicants should submit full details of education, experience, appointments held, age, salaries earned, etc. The salary range will be dependent on experience and qualifications, but will be in the order of £750/£900. The position is permanent and subject to the conditions of the Company's Pension Scheme. Applications, which will be treated as confidential, should be submitted to—Box 4231, c/o The Electrical Review.

MAINTENANCE Engineer required by manufacturers of electrical equipment in South Lancashire. Ex-Serviceman preferred. Write details, salary, training, experience to—Box 4355, c/o The Electrical Review.

MANAGERESS of good appearance and personality required for high-class electrical and radio retail and art goods business, 30 miles from London. Must be thoroughly capable and able to take full control. Write with particulars, stating age, experience and salary required.—Box 115, c/o The Electrical Review.

MAINTENANCE Fitter or Electrical Fitter wanted for varied mechanical and electrical work.—Arlington Plastics Development Ltd., 15/27, Gee Street, London, E.C.1. 4347

MECHANICAL Draughtsman required, accustomed to modern production technique on I.C. engines or gas turbine designs. Reply, stating details of qualifications, experience, age and salary required, to—Box 4343, c/o The Electrical Review.

MECHANICAL Designer/Draughtsman required for manufacturer of electro-mechanical speciality equipment. Some electrical knowledge an advantage. Candidate must possess ideas and personality, also ability to handle outside contacts. Excellent prospects for right type. Apply, stating age, experience and salary required —Box 5191, c/o The Electrical Review.

OLD-established firm of electrical contractors desire to contact young, energetic, qualified Electrical Engineer to take charge of branch, with view to directorship. Investment of £2,000 required.—Box 5189, c/o The Electrical Review.

POWER Station Instrument Mechanic required for power station with modern instruments, including automatic boiler control. Candidates should have training and experience in routine maintenance of flow, temperature and pressure instruments normally associated with modern boiler plant. Wages in accordance with No. 3 Area D.J.I.C. Schedule, present rate 28.6½d. per hour for 47-hour week. Write, stating age, full details of experience and qualifications, to—The City Electrical Engineer, Electricity House, Carlisle. 4464

PRODUCTION Engineer required by large firm of radio and telephone equipment manufacturers in the London area. Comprehensive knowledge of theoretical and practical methods of production of electro-mechanical mechanisms essential. Reply, stating full details of qualifications, age, experience, salary required, to—Box 4365, c/o The Electrical Review.

PROGRESSIVE North London company requires a Departmental Manager to control the manufacture of small universal electric motors and associate sub-assemblies. Liberal salary to suitable applicant with energy and determination.—Box 4350, c/o The Electrical Review.

PURCHASING Agent. Firm of instrument Manufacturers in the London area requires a Purchasing Agent to take complete charge of purchasing department: must have intimate knowledge of electrical industry. Salary according to qualifications.—Box 4372, c/o The Electrical Review.

REPRESENTATIVE required to call on electrical wholesalers in London area, with car. A permanent and progressive position with growing firm offered to energetic young man with some knowledge of domestic electrical appliances. No existing connection necessary. A reliable and trustworthy young man wishing to start a new career preferred. Write fully to—Genwind's, Bentley Heath, Knowle, Birmingham. 4427

REPRESENTATIVES required for London and several districts in U.K. by manufacturers of high-class electric light fittings. Only those with first-class connections and knowledge of the trade will be considered.—Box 4392, c/o The Electrical Review.

REQUIRED, Assistant Electrical Maintenance Engineer for London brewery, must be conversant with A.C. and D.C. industrial installation and all round mechanical experience. Under 35 years of age. Experience and salary required.—Box 4440, c/o The Electrical Review.

ROYAL Air Force. There are still several hundred vacancies for Short Service Officers in the recently formed Education Branch. Candidates should be between 23 and 31 and should have a university degree in Mathematics, physics or engineering. A man age 25 may draw pay at £310, £347 or £420 a year on entry, according to qualifications and experience. In addition to pay, single men receive free furnished accommodation and married men receive married allowance of £228; in both cases rations are provided in kind or a ration allowance of £57 a year paid in lieu. A gratuity is payable on completion of 5 years' service. This will ultimately be £500, but for officers appointed until further notice it will be £562 10s. Gratuity will be reduced for men in contributory service for civil teacher's superannuation by the amount of the superannuation contributions, which will be paid by the Air Ministry. Opportunities will arise for appointment to permanent commissions. Full details and application forms from Air Ministry (A.R.1), Kingsway, London, W.C.2. 3995

SENIOR Engineer required for laboratory development work on line transmission equipment. Honours degree and experience with carrier current telephone equipment essential. Salary in accordance with qualifications and experience. Apply to—Telecommunications Dept., Ref. 235, Siemens Brothers & Co. Ltd., Woolwich, S.E.18. 4450

SIX first-class Electricians required immediately by South Lancs. firm. Must be fully conversant with all classes of industrial electrical maintenance, including contactors, motors, generators, etc., both A.C. and D.C. Substantial premium will be paid to capable men. Electrical wiremen are not required.—Box 4399, c/o The Electrical Review.

STOREKEEPER required by London firm of electrical contractors. Must be capable of taking charge. Write, stating age, previous experience in detail and salary expected.—Box 4424, c/o The Electrical Review.

SUPERVISOR for Installations. Able to control men, set out and progress installation works, prepare estimates occasionally. Starting salary £350.—Box 5106, c/o The Electrical Review.

SWITCHMAN, physically fit, used to operation and maintenance of various types of E.H.T. and M.T. switchgear, protection gear and transformers. Must be capable of performing switching operations in substations, including isolating and earthing, and general power plant maintenance on switchgear and motors. Shift work on 4-cycle rota, with average wage over £7 per week, with prospect of bonus. Knowledge of switchgear essential. The job is permanent for the selected applicant, who would be expected to make own domestic arrangements. Write, stating age and qualifications, to—Labour Department, I.C.I. Ltd., Metals Division, Witton, Birmingham 6. 4370

TECHNICAL Assistant. Company engaged in the production of scientific instruments requires a Technical Assistant in Sales Department; must have first-class technical qualifications and knowledge of sales office routine. Knowledge of temperature control instruments and electronic technique desirable. Salary according to qualifications.—Box 4374, c/o The Electrical Review.

TELEPHONE Installers and skilled Electricians required covering the West and South-Western counties, operating from Bristol and Plymouth. Full rates of pay, plus travelling expenses and out-of-town allowances, etc., including voluntary pension scheme. Permanency for right type of man. Apply direct to—Divisional Manager, Dictograph Telephones Ltd., 28 Park St., Bristol 1. 5176

TRANSFORMER Technical Sales Engineer, internal appointment, tendering and correspondence, static transformers and allied apparatus; conversant association requirements. Single man (25-30) suggested due housing difficulty; 5-day week, pension scheme. Particulars and salary required to HTC, please.—British Electric Transformer Co. Ltd., Hayes, Middx (Phone, Hayes 1954): 4366

WELL-known London manufacturer has vacancy for a Senior Development Engineer in his domestic appliances division. Candidates preferred with a degree in engineering, experience in appliances, and proved administrative ability. Applications treated in strict confidence. —Box 4362, c/o The Electrical Review.

WORKS Manager, having held similar position for many years and experienced radio or light electrical engineering (mass production), is offered an excellent opportunity with view to ultimate directorship. Bucks area.—Box 4269, c/o The Electrical Review.

WORKS Manager required for manufacturers of electrical illuminating fittings (electroliers, pendants, brackets, etc.). Only those who have had experience in this class of manufacture and are capable designers will be given consideration. Permanent progressive career for applicant with initiative and the necessary experience. Full particulars of past experience and salary required to—Box 4359, c/o The Electrical Review.

YOUNG Assistant required immediately by London firm manufacturing electric control gear. Duties are partly technical, and electrical knowledge to Ordinary National Certificate standard desirable but not essential. Replies, stating age, experience and salary required, to—Box 4251, c/o The Electrical Review.

YOUNG Electrical Engineer, B.Sc. honours, required for development laboratory of large electrical concern, S.W. London area. Some experience electronics essential. Apply in writing, stating age, experience and salary required, to—Personnel Manager, 45, Nightingale Lane, S.W.12. 4184

APPOINTMENTS FILLED

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

BOX 3226—Senior Assistant; Galloway Water Power Co.—Shift Charge Engineer; Neale & Partners Ltd. —Supervisors (2), Foreman Jointer and Electricians; Portland U.D.C.—Electrical Engineer. All applicants are thanked.

SITUATIONS WANTED

ADVERTISER seeks position as Representative; 26 yrs.' experience electrical contracting materials. South Coast preferred.—Box 5138, c/o The Electrical Review.

AN administrative post required London area by Electrical Engineer, wide experience in various industries. Present technical manager old-established co. Age 37. B.Sc., A.M.I.E.E.—Box 5177, c/o The Electrical Review.

B.Sc., Grad. I.E.E., experience nil, seeks opening. State terms.—Box 5211, c/o The Electrical Review.

BUYER, age 24½ yrs., single, A.M.P.O.A., desires change. Several years' exp. elec. and radio eng. firm. At present with elec. light fittings manufacturer.—Box 5207, c/o The Electrical Review.

CHARTERED Electrical Engr. requires post, instrument design, sales or production. Would consider part-time consultant work.—Box 5185, c/o The Electrical Review.

CHARTERED Electrical and Mechanical Engineer (33), wide experience in manufacture of cables, motors and transformers, seeks post as plant or production executive.—Box 5137, c/o The Electrical Review.

CHIEF Designer, leading cooker manufacturers, desires change; 20 years' experience design and development all forms cooking and heating equipment, domestic and industrial.—Box 5141, c/o The Electrical Review.

CHIEF Engineer, recently returned from overseas, desires similar post at home or abroad or partnership with firm of consulting engineers. Has held sole charge for ten years of an ultra-modern cotton mill containing over one hundred thousand spindles and over two thousand looms, both group and individually driven. Power transmission, electrical distribution, maintenance and reorganisation of drives a speciality. Excellent references. For fuller details apply—Box 5193, c/o The Electrical Review.

DESIGN Engineer (25), Grad. I.E.E., seeks responsible position. Sound training and experience A.C., D.C. machines.—Box 5203, c/o The Electrical Review.

ELECTRICAL Engineer, A.M.I.E.E. Diploma Faraday House, with 6 years' experience transformer and alternator testing and construction. 14 years' experience electrical maintenance, seeks progressive executive post.—Box 5169, c/o The Electrical Review.

ELECTRICAL Engineer, B.Sc.(University), M.I.E.E., age 39, technical and commercial, 20 years with large manufacturing organisations on power stations, substations and industrial plants, transmission, distribution and switchgear expert, able to tackle any electrical scheme, desires change, preferably with consultants (small capital available), but other alternatives considered at 4-figure salary.—Box 5182, c/o The Electrical Review.

ELECTRICAL Engineer, D.F.H.(Hons.), A.M.I.E.E. (31), married, disengaged after 6½ years' service in Indian Army as elec. and mech. engineer, seeks responsible post with reputable firm. Experience covers cables, transformers, condensers, E.H.T. and L.T. overhead and underground schemes and supervision; contracts estimating; well experienced in handling labour and working on own initiative.—Box 5174, c/o The Electrical Review.

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STEAM Generating Set, Belliss & Morcom twin-cylinder engine, speed 448/495 r.p.m., complete with condenser, coupled to Siemens generator, 150 kW, 220 volt D.C., 660 amps., No. 30921; also Steam Generating Set, Allen twin-cylinder engine, speed 400 r.p.m., complete with condenser, coupled to E.C.C. generator, 100 kW, 220 volt D.C.—Edgar G. Rees, Great Western Dock, Llanelly. 4271

STEAM Generating Set comprising British Electric Plant Co. Generators, 26.25 kW, 105 v. (has been running at 110 v.), speed 400 r.p.m., and 120-lb. Steam Compound Engine, with forced lubrication, by James Lowden & Co., Glasgow. Tachometer fitted to engine. Switchboard complete with instruments and 8 outgoing circuits. Spare armature (unused).—Charles V. Hill Ltd., Electrical Engineers, 5/7, Queen Street, Belfast. 4385

SUPERIOR Type Builders' Ladders now in production; also Steps, Trestles and Extension Ladders. Phone—Shaftesbury Ladders Ltd., 453, Katherine Road, E.7. Grangewood 3363/4. 15

SWITCH Blocks, round I.W. & W. E. Well finished in best quality hardwood. 3½" & ¾" 48/- gross, 3" x ¾" 45/- gross. 2½% discount. Carriage paid.—Elf Mfg. Co., Sansome Place, Worcester. 5155

THE Genwind quality Electric Suction Cleaner. Powerful & silent, with unique features. Sold only through genuine wholesalers. Write for further details from—Genwind's, Bentley Heath, Knowle, Birmingham. Manufacturing Mechanical and Electrical Engineers. 130

TUBULAR Heaters, space wanted. 100, 2 ft., £80; 100, 3 ft., £90. Prices nett, ex. premises.—Moss Bros., 53, Goodge Street, W.1. Mus. 5385. 4398

THE following Reels are surplus to requirements, and bids are invited: 12,000 Wooden, overall length 3½", barrel dia. 1¼", flange dia. 2", bore ¾"; 5,000 Pressed Steel, overall length 3¾", barrel dia. 1¾", flange dia. 3", bore ¾"; 4,500 Wooden, overall length 4¼", barrel dia. 1½", flange dia. 3", bore 5/16"; 1,200 Wooden, overall length 3¼", barrel dia. 1½", flange dia. 2¼", bore ¾"; 2,000 Fibre Board Centres, Pressed Steel Flanges, overall length 3¼", barrel dia. 1½", flange dia. 2¼", bore 5/16".—Industrial Processes Ltd., Lomeshaye Mill, Nelson, Lancs. 4353

TRANSFORMER "Welders" to BSS/171/1936 4 kVA, 1-phase, 50, type AN, 400/230-0-90 volts, excellent condition, £50, carriage paid. Apply—J. Thorn & Sons Ltd., Brampton Road, Bexleyheath, Kent (Bexleyheath 305). 122

TRIPPING Battery, consisting of 55 HTN5 cells, made by the Hart Accumulator Co. Ltd. Capacity of the cells at a 10-hr. discharge rate is 54 a.h. This battery is in good order and can be seen at the Power Station, Trading Estate, Slough. Offers and enquiries in connection with same should be sent to—The Chief Engineer, Slough Estates Ltd., Trading Estate, Slough. 4265

TURBO-Alternator Sets. (1) 5,000-kW Adamson/G.E.C. Set, new 1924, 200 lb. pressure, 3,000 r.p.m., voltage 6,600/3/50, complete with surface condenser and all auxiliaries; (2) 3,750-kW Adamson/G.E.C. Set, new 1922, 200 lb. pressure, 3,000 r.p.m., voltage 6,600/3/50, complete with surface condenser and all auxiliaries; (3) 3,000-kW Howden/Siemens Set, new 1920, 200 lb. pressure, 3,000 r.p.m., voltage 6,600/3/50, complete with surface condensers and all auxiliaries; (4) 1,500-kW B.T.H. Set, new 1918, 200 lb. pressure, 3,000 r.p.m., voltage 6,600/3/50, complete with surface condenser and all auxiliaries; (5) 1,500-kW Adamson/Bruce Peebles geared pass-out Turbo Alternator Set, new 1940, 265 lb. working pressure, pass-out 35/40 lb. pressure, speed 6,000 r.p.m., coupled through David Brown reduction gear to 1,500-kW Alternator, 11,000/3/50, 1,500 r.p.m., complete with switchboards, surface condenser and auxiliaries (2 sets available). Further details can be obtained from—B.C.S. (Engineers & Contractors) Ltd., Taffs Well, nr. Cardiff. Tel. Taffs Well 296/7. 4428

UNUSED Flat Top Bogie Trolleys, 5' × 3' × 16" high, oak tops and bearers, iron wheels 11" dia. × 2" wide, front wheels swivel with 36" "T" type draw-bar, £7 10s. each; with 12" dia. solid rubber-tyred wheels, £10 each. Unused Samson Type Trucks, 22" × 17" × 5" high, of 2½" square oak, four iron wheels, 3" dia. × 1¾" face, one central wheel 3½" dia. × 2½" face, £3 10s. each, delivered, cash with order.—Reed Brothers (Engineering) Ltd., Cuba Street, London, E.14. 4283

VACUUM Cleaner Parts. Hoses, braided, all diameters. Commutators, bearings, fans, carbon brushes, driving belts, brushes, attachments and fittings for all makes. Wholesale only. Send for price list.—Vacuum Cleaner & Electrical Supplies Ltd., 543, Moseley Rd., B'ham, 12. 80

VACUUM Cleaner Spares and Accessories. Bags, bearings, belts, brushes, fans, switches, etc. Repairs, rewinding, rebristling. Send for price list.—Reliance Vacuum Cleaner Service, 152-154, Broadway, Bexleyheath, Kent. 93

VOLTMETERS, total quantity available 200. New, 6", 50 cy., 0-300 v., even scale. Govt. surplus. Offered subject to remng. unsold, 30s. each.—113, Southwark Street, S.E.1 (TEM. 3866). 4158

WEE Meggers, 500 v., in case, £12 5s. 6d.: Record 500-v. Test Set, £11, C.O.D. (new).—Robins, 222, West End Lane, N.W.6 (HAM. 0879). 82

2 Cummins Industrial Diesel Engines, rating 75 h.p., new and in original cases.—John Blackwood Hodge & Co. Ltd., Hunsbury Hill Works, Northampton (Phone, Northampton 4425). 4293

2, 4 and 6 cyl. Diesel Engines rated at 6, 13 and 20 h.p. respectively, complete with radiator, fuel tank, electric starter and mounted on steel base, enclosed by steel canopy with hinged side panels. All these engines are new. Approx. 100 available.—John Blackwood Hodge & Co. Ltd., Hunsbury Hill Works, Northampton (Phone, Northampton 4425). 4294

3-kW, 8-gal. Copper-lined Boilers, 230 or 110 v., 3-heat control. £5 ea.; ¼-h.p., 230/1/50 Cap. Start Ind. Motors.—Pearce, 66 Gt. Percy St., Ldn. W.C.1 (Nr. Angel). 5181

5-h.p. Motors, secondhand, totally enclosed, half-hour rated, 3,000 r.p.m., 400 v., 3-ph., 50 cycles, A.C.; also 3-h.p. Motors, reconditioned by makers, as above but protected type and continuously rated. Immediate delivery.—Carter & Co. (Nelson) Ltd., Engineers, Nelson, Lancs. 4295

6-kW, 110-volt D.C. Diesel Engine-driven Lighting Set, fully automatic, unused, £552. Battery extra.—Box 4380, c/o The Electrical Review.

5-kW and 2½-kW, 230/250-volt D.C. Generating Sets, complete with 4-cylinder, 10-h.p. Austin Engines, with petrol tanks, radiators, fans and switchboards. Large number available.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 103

7/064 P.V.C., Henley, original 250-yard coils, £25 per 1,000 yards, carriage paid.—Electrical Agencies Ltd., 32, College Street, Belfast. 4375

10-kW Unit Heaters, three-phase, 400 volts. Immediate delivery.—Carter & Co. (Nelson) Ltd., Engineers, Nelson, Lancs. 4296

19/064 T.R.S. Cable, Geipel make, original maker's packings: 4,000 yds. available at £60 per 1,000 yds.—Electrical Agencies Ltd., 32, College Street, Belfast. 4378

40-kW Set, Armstrong-Whitworth Compound Engine and Generator, 230 v. D.C. compound wind. Can be inspected under running conditions. Offers to—H. & J. C. Hird, Yarm, Yorks (Tel. Eaglescliffe 2142). 4393

67.5-kVA Alternator Set; 100-h.p., 6-cylinder Petrol Engine and direct coupled to 67.5-kVA, 3-phase, 50-cycles, 400/230-volt Alternator. Mounted on combination baseplate and complete with switchgear (two sets available).—Newman Industries Ltd., Yate, Bristol. 4448

75-h.p. Diesel Engine Generator Sets, G.E.C. or Westinghouse, 31 kVA, 115/230 volt A.C., single-phase, control and meter panel, 12-volt electric starter, mounted on pneumatic wheels, new and in original cases, 38 available.—John Blackwood Hodge & Co. Ltd., Hunsbury Hill Works, Northampton (Phone, Northampton 4425). 4292

100-v. Verity D.C. Motors in good running order. 2 h.p., 1,450 r.p.m., Brookhirst starter, £15; 1.5 h.p., 1,400 r.p.m., Verity starter, £12; 5 h.p., 1,200 r.p.m., Verity starter, £20; 7 h.p., 1,200/1,800 r.p.m., auto-starter, £25. Can be seen in Lincs.—A. E. Co. Ltd., 2, Henrietta Street, W.C.2. Tem. 2708. 4308

250-kW Rotary Converters (2), with transformers and switchgear, input 6,600 volts, 3-phase, 50 cycles, output 420/210 volts; also A.C. and D.C. Motors, Switchgear, Generating Sets, Welders, etc.—Midland Counties Electrical Engineering Co. Ltd., Grice Street, Spon Lane, West Bromwich. 36

260 Ceramic Boiling Rings, 6½" dia., complete assembled with elements, together with pattern for casting stand. Also large studs unplated. Offers to—Ampli-Hire, 32, High St., Thornton Heath, Surrey. 5186

500 Electric Motors, Dynamos, Transformers, Converters, etc., etc., at low prices.—S. C. Bilsby, A.M.I.C.E., A.M.I.E.E., Crosswells Road, Langley, near Birmingham. Phone, Broadwell 1359. 21

4,000 yards 610/018 V.I.R. Cotton Braided, equivalent to 39/083, packed in 5 unopened original drums; offered £10 per 100 yards or £250 the lot.—Electrical Agencies Ltd., 32, College Street, Belfast. 4376

5,000 good strong Crates, inside measurements 29" × 9½" × 9½", ½" thick, battened all round, at 1s. 9d. each, ex works.—K. Goldser & Sons, 14a, Rectory Square, London, E.1 (Tel. Stepney Green 2550). 75

ARTICLES WANTED

A.C. and D.C. Motors and Transformers urgently wanted. Burnt-out machines acceptable.—Max Electric Co. Ltd., 190, Thornton Rd., Croydon. 12

A.C. Motors wanted urgently, all sizes and voltages. Best prices offered.—John Phillips & Co. Electrics, 31, Fortune Green Road, W. Hampstead (Hampstead 8132). 127

ACETATE and other thermoplastic scrap; polythene and P.V.C. in any form; also scrap cable and insulated wire; urgently wanted.—Elton Levy & Co. Ltd., 18, St. Thomas Street, S.E.1. 30

ALTERNATOR, 100 to 150 kW, 400 volts, 3-phase, 50 cycles, suitable for belt drive and complete with control gear.—J. G. Sneath Ltd., 5, Wallwood Street, Limehouse, E.14. 4423

AN unlimited number of Modern A.C. Motors urgently wanted for essential work. Highest cash prices paid for suitable units. We also want all types of motors for conversion and rewinding. Send details to—Sales Dept., A. P. Watson, 104, Upper Brook St., Manchester, 13. 132

BI-Pin Holders, for 4' fluorescent units, required in small or large quantities.—Moss Bros., 53, Goodge Street, London, W.1 (MUS. 5385). 4275

CONVERTOR from D.C. to A.C., 210-250 volts output, 1,250 watts, 3-400 watt. Mercury Discharge Chokes for 200-volt circuit.—Drawing Materials Co. Ltd., 87, Edmund Street, Birmingham, 3. Central 5223. 5216

D.C. Motors, 220 v., 1,800 r.p.m., 1 h.p., new or secondhand.—J. W., C. S. Ltd., Staffa Works, Staffa Road, E.10. 4367

DIESEL A.C. Generating Set from 10 to 15 kW, 220/440 v., 50 cycles, 3-phase. Quotation F.O.B. Air Mail. Baluchistan Fruit Products Ltd., Quetta, India. 5123

ENGINEERING Technical Books (new or secondhand) wanted in any quantity. Attractive cash offers. Call—Third floor, 356, Oxford Street, W.1, or "Stoneleigh," St. George's Avenue, Weybridge. 62

FLUORESCENT Lamps, 5 ft., urgently required, any quantity, best prices paid. Collected London area.—Box 111, c/o The Electrical Review.

FLUORESCENT Lamps (tubes), 5 ft. 12 urgently required. Good prices paid.—Box 4235, c/o The Electrical Review.

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LARGE quantities Miniature Motors, 200-250 volt.—Box 5192, c/o The Electrical Review.

MERCURY (Quicksilver) wanted. Write for packing instructions. Gold, Silver and Platinum also purchased.—Collingridge & Co. Ltd., Riverside Works, Riverside Road, Watford (Tel. 5963). 20

POWER Guillotine up to 14 gauge, a Deep-Back Fly Press, 7 to 10 cwt., and Angle Bender, 16/14 gauge.—T. R. & T. Ltd., 28, Newton Road, Kingskerswell, Newton Abbot. 4349

POWER Sockets and Plugs, interlocked or otherwise, 3-pole and earth, 40 to 60 amp., for 400 v., 3-phase supply. Offers of new or secondhand stocks would receive immediate attention.—Cox & Danks Ltd., Plant & Machinery Department, Faggs Road, Feltham, Middx. Phone: Feltham 3471/3. 4314

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REDUCTION Gear for 1-h.p. Motor, 940 r.p.m. down to approximately 60 r.p.m.—Box 4459, c/o The Electrical Review.

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WANTED, D.C. and A.C. ball-bearing Motors. Full details to—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 29

WANTED for Export: All types of Electric Fans, Irons, Fires, Heaters and Household Equipment. Also Switches, Lampholders, Insulators, Wire, etc., etc., in fairly large quantities. We have 1,700 buying agents.—Quilliam Products, 22 High St., Kingston-on-Thames. 4258

WANTED, Rotary Converters, any size.—Universal, 221, City Road, London, E.C.1. 22

1-h.p., 230-v. A.C. or D.C. Motor.—Universal Electrical, 221, City Road, London, E.C.1. 25

1 Rotary Convertor, 400 kW, 6-phase, 230 volts D.C., to transformer, preferably transformer at 400 volts with star point brought out; 1 Rotary Convertor, D.C. 220 v., A.C. 400 v., 50 cycle, 3-phase.—William Tatton & Co. Ltd., Upperhulme, nr. Leek, Staffs. 124

200 Metal Cases for making car battery chargers. Offers to—Box 5208, c/o The Electrical Review.

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A Progress System can be put into your factory to increase and stabilise production. Details—S. Green, 42, Hertslet Road, London, N.7. 5082

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BRISCOE Plating Co. Ltd. now have available capacity for Silver and Nickel Plating and quantity production of Electrical and Household Products, in which we are specialists. Enquiries invited to—3-5, Maddox Street, London, W.1. 123

CAPACITY available for coil winding, impregnating, engraving and light machine work.—Castlenau Instruments Ltd., 50, Glentham Road, S.W.13. 37

CAPACITY available for light assembly, February, March. Some machining, London area.—Box 91, c/o The Electrical Review.

CONTRACT work wanted, cables, ducts, etc., experienced engineers, estimates free.—Abrax Contractors, 15, Merifield Road, Eltham, S.E.9. 5200

ENGINEERS, Precision, South England, seek manufacture of electrical, mechanical or domestic assemblies or components. Press tools, gauges, small stampings, capstan turning, also Internal and External Grinding. Write—Box 74, c/o The Electrical Review.

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GENERAL machining work undertaken, suitable for 9" and 6" centre lathes or Ward 3A and 2A capstans. Milling, shaping or horizontal boring. Good class work to close limits. Prompt deliveries.—Nibbs & Scott, Manufacturing Electrical and Mechanical Engineers, St. Margaret's Lane, Titchfield, Hants. Tel. Titchfield 126. 4415

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MACHINING Work, for Centre Lathes up to 6½ in. centres and medium-sized milling (good grade work preferred).—The London Electric Firm, Croydon. Uplands 4871. 56

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AGENTS required for Manchester, Leeds, Newcastle, Birmingham, Leicester, Glasgow, Bristol areas. Remuneration, contribution to expenses and commission. Apply, giving technical qualifications, age, experience, establishment, connections and references, to—Small Electric Motors Ltd., Eagle Works, Beckenham, Kent. 4345

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NORWAY requires Electrical Instruments: Ammeters, Voltmeters, Wattmeters, etc. Norwegian wholesaler desires sole representation for high-class products. Please write—A/S Rowal, 4 Klingenberg Gate, Oslo, Norway. 4250

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PREMISES suitable for Workshop and Office, N.W. area, wanted, or in exchange for similar premises at Holland Park. Write—5, Tudor Mansions, Gondar Gardens, N.W.6; or 'phone Hampstead 8132. 4363

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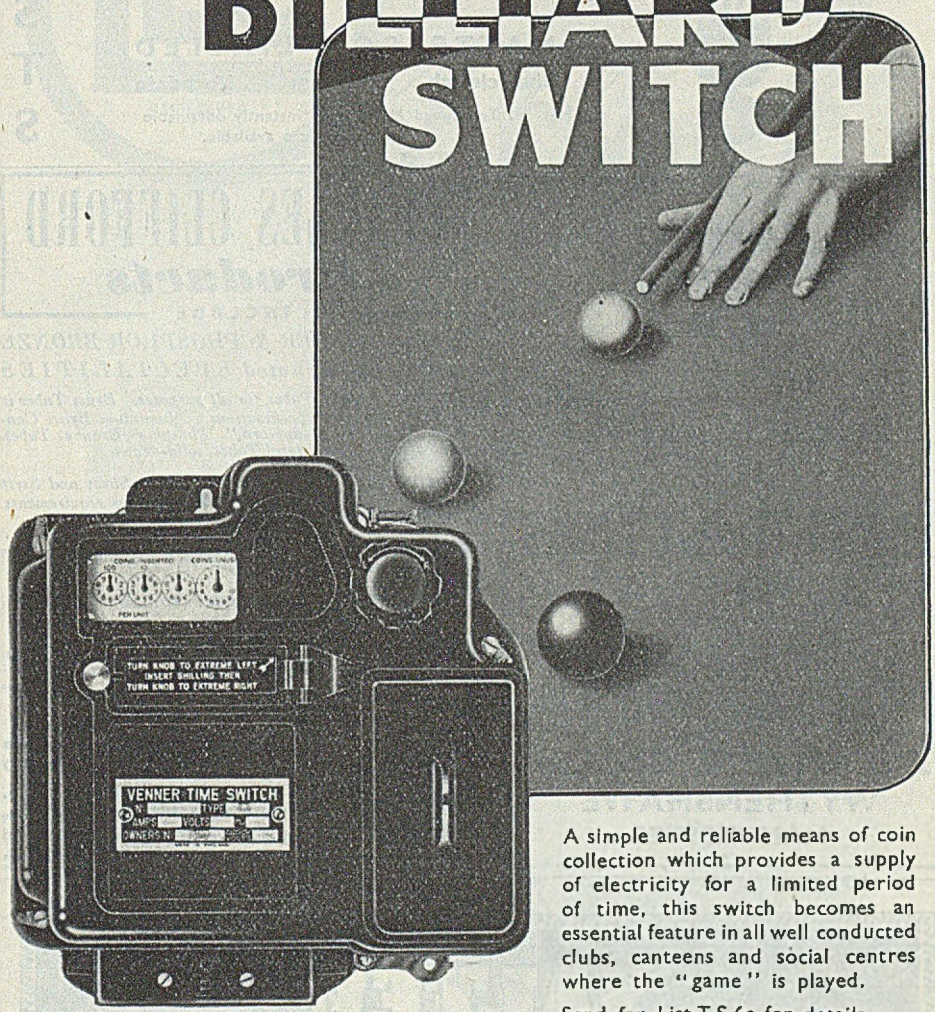

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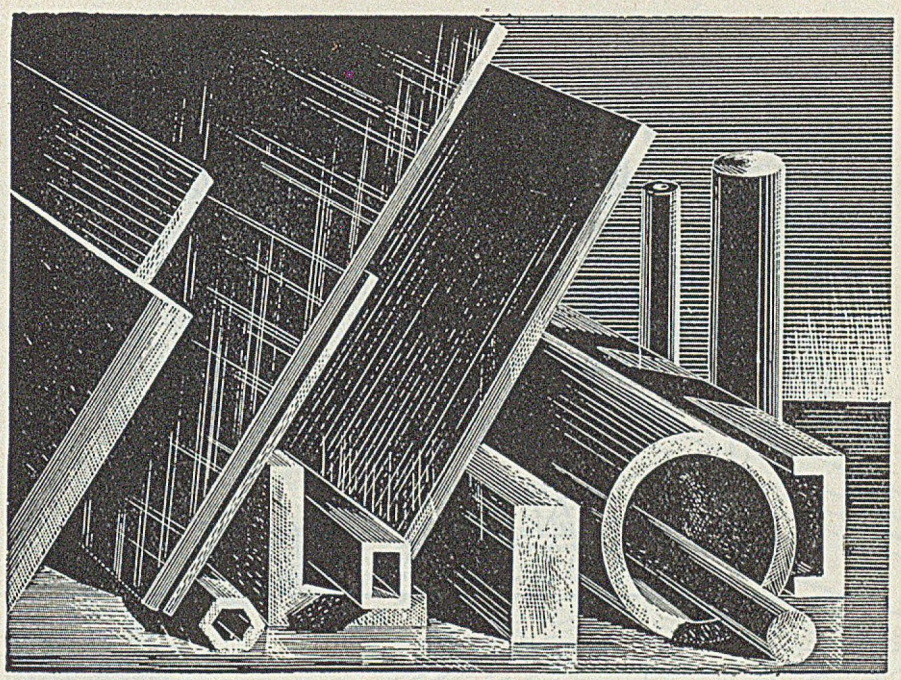

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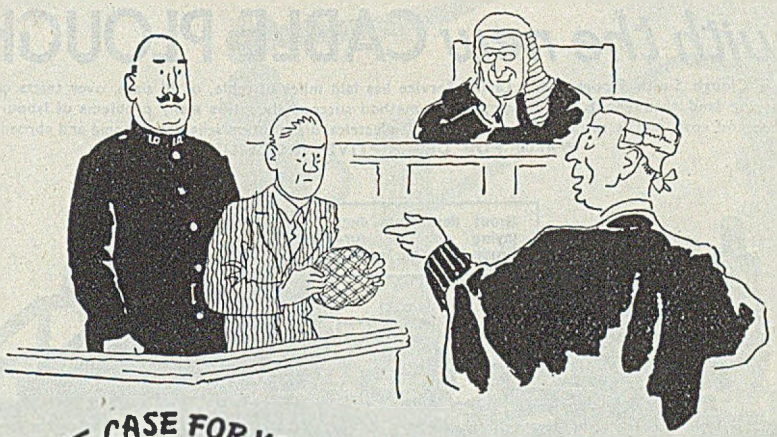

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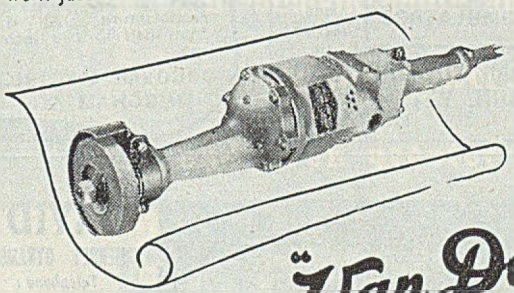

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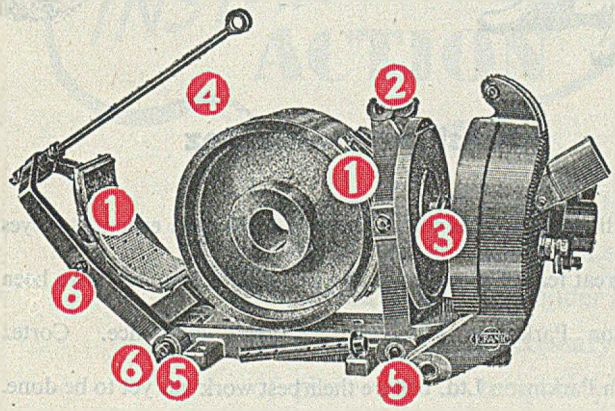

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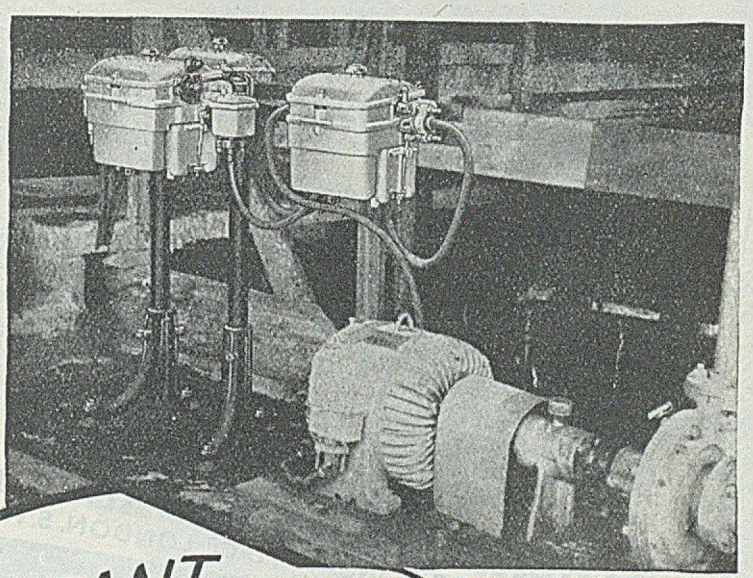

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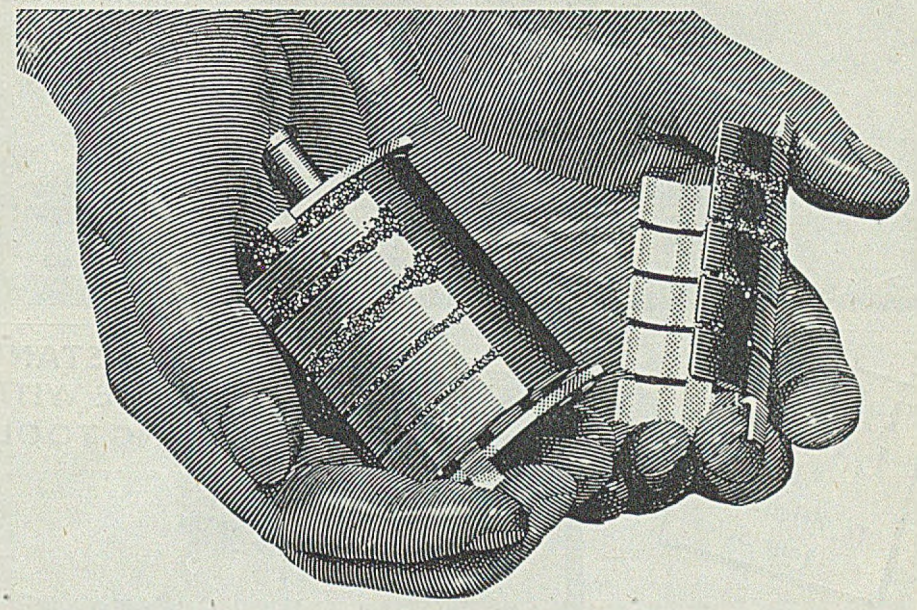

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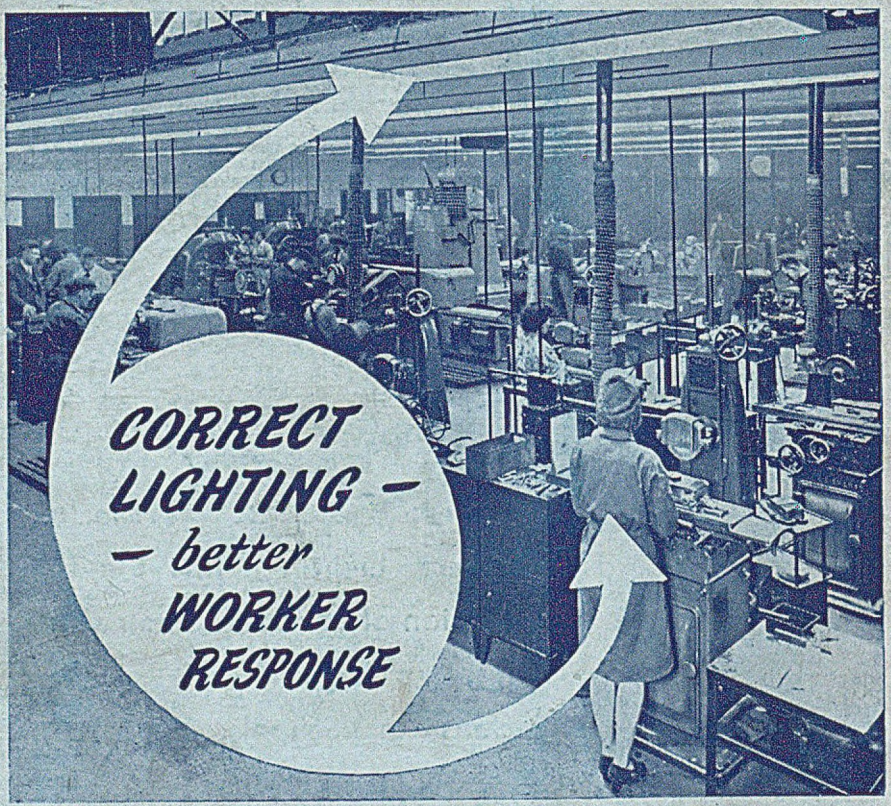

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