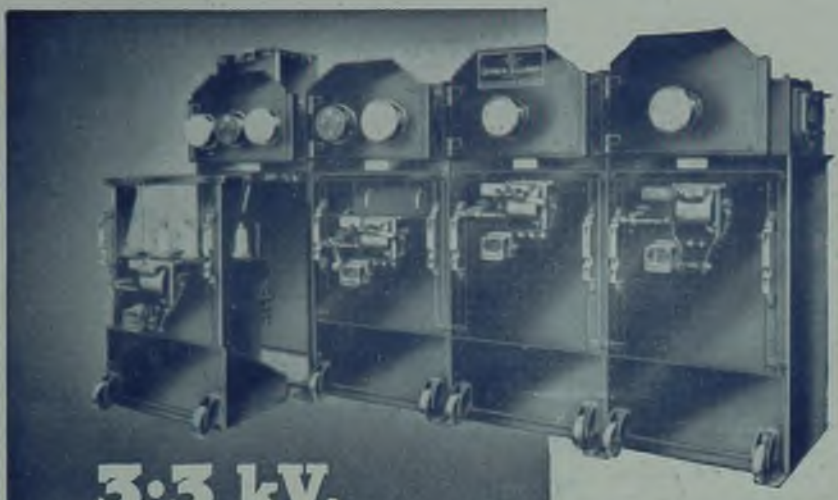
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXVI. No. 3510 MARCH 2, 1945 9d. WEEKLY

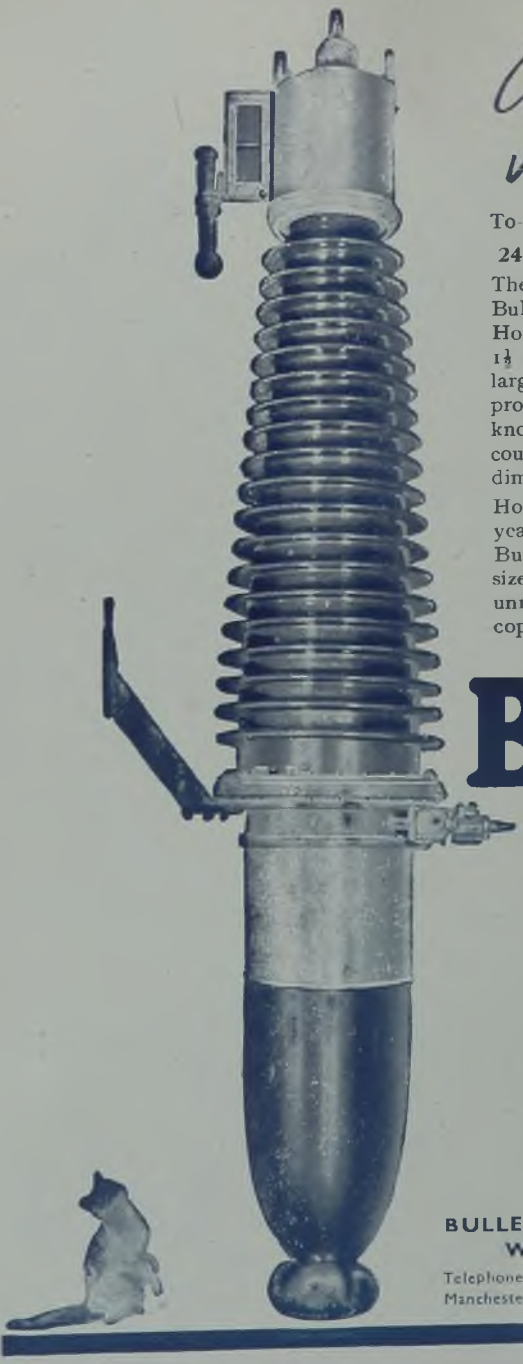


BIBLIOTEKA POLITECHNIKI SLĄSKIEJ

3·3 kV. 6·6 kV. AND 11 kV. TRUCK GEAR

Ellison Truck Switchgear is made in various types and sizes with single or duplicate busbars, on or off load selectors and current ratings of up to 1200 amps.

502



IN 1924 Bullers made the first big bushing of 66 kV capacity. To-day we are able to show this massive

242 kV OIL FILLED BUSHING.

The porcelain parts were made in Bullers' works for the British Thomson-Houston Co. Ltd. It measures 15 ft. 1⅛ inches overall and is one of the largest bushings of this kind yet produced. Only the skill and knowledge acquired by long experience could produce insulators of such dimensions free from flaws.

How much larger will be called for in years to come, only the future can say. But one thing is certain, whatever the size, Bullers will be ready with their unrivalled resources and experience to cope with the problem.

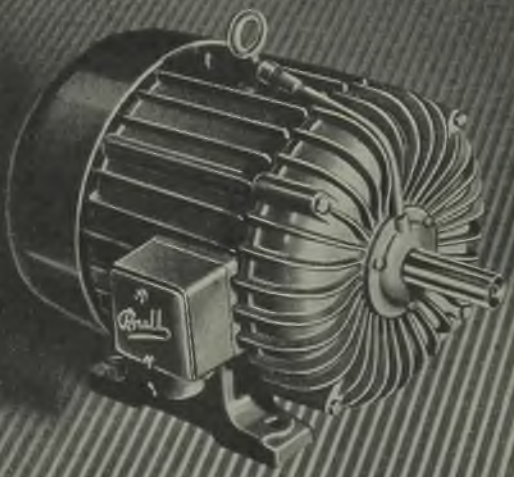
Bullers

INSULATORS

AND IRONWORK

BULLERS, LTD. THE HALL, OATLANDS DRIVE
WEYBRIDGE, SURREY
Telephone : Walton-on-Thames 2451
Manchester Office : 196 Deansgate, Manchester

FAN COOLED

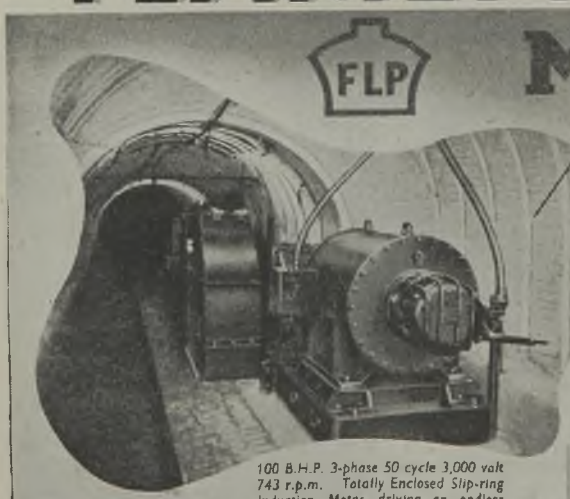


BULL MOTORS (E.R.&F.TURNER LTD)
IPSWICH

ALSO LONDON, MANCHESTER, BIRMINGHAM, SHEFFIELD, NEWCASTLE AND GLASGOW

A

FLAMEPROOF



MOTORS for HAZARDOUS SITUATIONS

The specially robust construction of PEEBLES FLAMEPROOF MOTORS ensures long years of satisfactory performance in addition to safeguarding life and property while operating under hazardous conditions.

100 B.H.P. 3-phase 50 cycle 3,000 volt 743 r.p.m. Totally Enclosed Slip-ring Induction Motor driving an endless rope haulage in a Scottish Coal Mine

PEEBLES

BRUCE PEEBLES & CO. LTD., ENGINEERS EDINBURGH.

THE MOTOR WITH THE HIGH STRENGTH/WEIGHT RATIO

3622

MAIN CONTROL SWITCHES
for all factories

BILL

BILL "H.R.C." Fuse Switches fitted with "English Electric" H.R.C." Cartridges.

Made for 30, 60, 100, 160, 200, 300 & 500 Amps., 600 Volts; Double, triple and four pole and with neutral links.
Fitted for Conduit, busbar chamber flange or cable glands.

Easy Wiring, minimum Maintenance

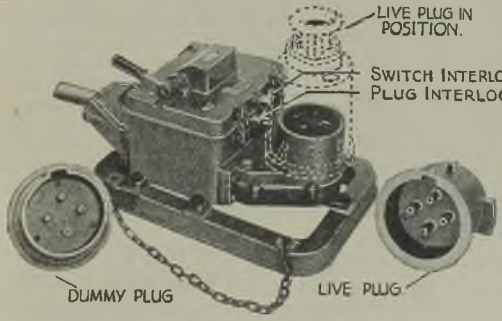
LONDON: A W ZELLEY
73, GREAT PETER ST.
WESTMINSTER, S.W.1

BIRCHFIELDS · 5011 (4 LINES)

BILL SWITCHGEAR LTD
BIRMINGHAM·20

MANCHESTER·GLASGOW·
BELFAST·BURTON-ON-TRENT
EXETER·SOUTHAMPTON

"AICHO" BIRMINGHAM



Weekes' Watertight Plugs and Sockets stand up to the hardest conditions of use. They are available with, or without, watertight interlocked switch-fuse.

Plug pins mechanically guarded, contact sockets shrouded and contact pins and sockets are easily renewed.

Enquiries also invited for Cartridge Fuses, Switchgear and Switchboards

L. WEEKES (LUTON) LIMITED

WATERTIGHT PLUGS AND SOCKETS

RATINGS : Up to 300 amps., 500 volts, D.C. or A.C. Cable entries as required.

Full details on request

L. WEEKES (LUTON) LIMITED
LUTON, BEDS.

London Office : 36-38 KINGSWAY, W.C.2
Telephone : Holborn 1091 ; Luton 278
Branches at BIRMINGHAM, GLASGOW, NEWCASTLE

RAWLPLUG FIXING DEVICES

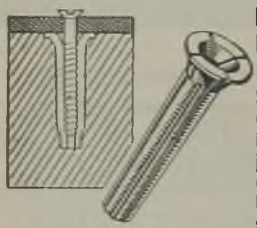
Solve all your Fixing Problems

RAWLPLUGS

There is a RAWLPLUG for every size of screw and coach screw, from the tiny No. 3 for light wiring to the large No. 28 which will withstand a direct pull of over 4 tons. Rawlplug fixing is safer, quicker and neater than any other method.

RAWLBOLTS

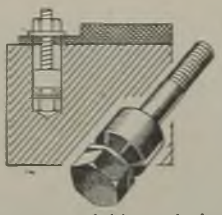
The use of RAWLBOLTS requires the minimum of time, labour and tools. No grouting is needed. No time-lag waiting for cement to dry. Made in two types—bolt projecting and loose bolt type—they solve every bolt-fixing problem. Available with pipe clips, round and square hooks and eye bolts. Size $\frac{1}{4}$ in. to $\frac{3}{4}$in. diameter. Standard Whitworth thread.



RAWLPLUG METAL PLUGS

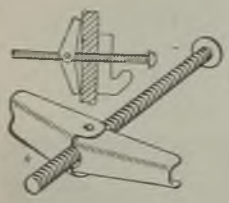
(Screw Anchors)

Specially suited for use where the plug is likely to be subjected to extreme climatic conditions. Made in sizes to take screws from No. 8 to No. 14 and lengths from 1 in. to 2 in. Designed with flange for hollow brick work and to stop plug being inserted too far in hole.



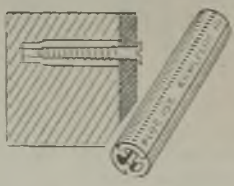
BOLT ANCHORS

The RAWLPLUG BOLT ANCHOR is especially designed for fixings of a specialised nature. Unaffected by atmospheric conditions it can be fixed below water if necessary. Full range of sizes available and the anchors will take bolts from $\frac{1}{4}$ in. to $1\frac{1}{4}$ in. diameter.



TOGGLE BOLTS

Toggle Bolts provide an ideal means of making secure fixings to hollow partition walls or ceilings, i.e. lath and plaster, asbestos board, etc., as they distribute the strain over a wide area.



WHITE BRONZE PLUGS

Specially designed for outdoor jobs where a metal plug is specified or preferred. One end of the plug is " coned " to facilitate the entrance of the screw when it is first inserted.

B311

WRITE FOR TECHNICAL LITERATURE TO:

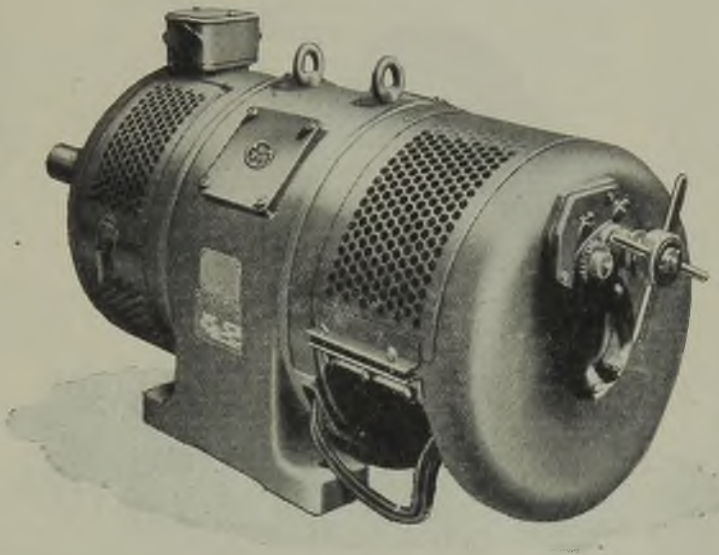
THE RAWLPLUG CO., LTD., LONDON, S.W.7

B T-H

VARIABLE-SPEED A.C. MOTORS

FROM 3 HORSEPOWER UPWARDS

High efficiency at all speeds.
Simple starting—by direct switching. No rheostat required.
Hand, remote, or automatic speed control.
Absolutely smooth speed change and stable operation over widest speed range.
Speed variation by self-contained means—no external regulator or resistances.



No other manufacturer has had a wider experience in the design and manufacture of variable-speed drives of ANY POWER.

BTH products include all kinds of electric plant and equipment; Mazda lamps and Mazdalux lighting equipment.

BTH RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND

A3337

AEI

STRONG SUPPORT

Crompton stockists have the support of a strong publicity campaign. The advertisement shown here is one of a series which appear in the National newspapers, weekly periodicals, and an effective list of Provincial newspapers. The campaign is reinforced, also, by posters, painted signs, and arterial road signs.

EQUIPMENT for ALL INDUSTRIES

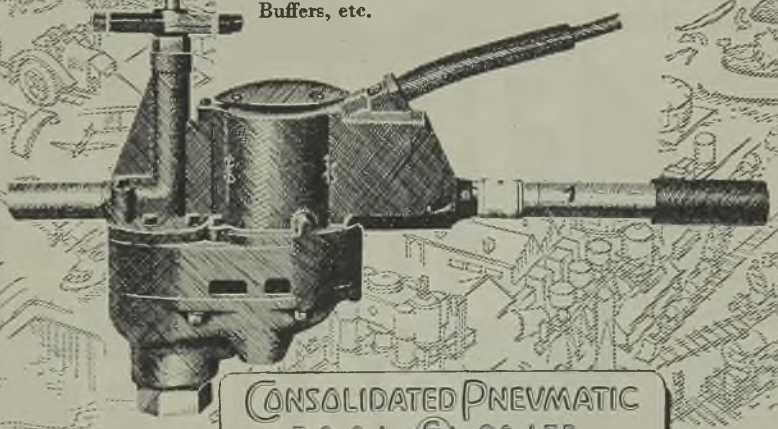
THROUGHOUT THE WORLD

Hicycle DRILLS

Hicycle Drills and Reamers with their simplicity of design combine power with light weight, freedom from breakdown and exceptionally low operating costs. Greater production is obtained at a fraction of the power costs of compressed air tools.

The machine illustrated is the "505" Hicycle Drill and Reamer—capacity drilling 1½", reaming 1".

The Hicycle range of machines also includes drilling machines from $\frac{3}{16}$" capacity, Tappers, Screwdrivers, Nutrunners, Grinders, Sanders and Buffers, etc.



CONSOLIDATED PNEUMATIC TOOL CO. LTD.
FRASERBURGH ABERDEENSHIRE

AIR COMPRESSORS · PNEUMATIC TOOLS · ELECTRIC TOOLS · DIESEL ENGINES · VACUUM PUMPS
CONTRACTORS' EQUIPMENT · ROCK DRILLS · DIAMOND DRILLS · OIL WELL TOOLS

Robert Sharp & Partners

C 34

FRY'S METAL FOUNDRIES LTD.
Tandem Works, Merton Abbey, London, S.W.19. Telephone : Mitcham 4023
and at Manchester, Glasgow, Birmingham and Dublin

ELECTRONIC
DEVICES for SCIENCE and INDUSTRY

The G.E.C. is foremost in the design and supply of radio valves and electronic devices as being essential links in the national effort to secure a speedy victory.

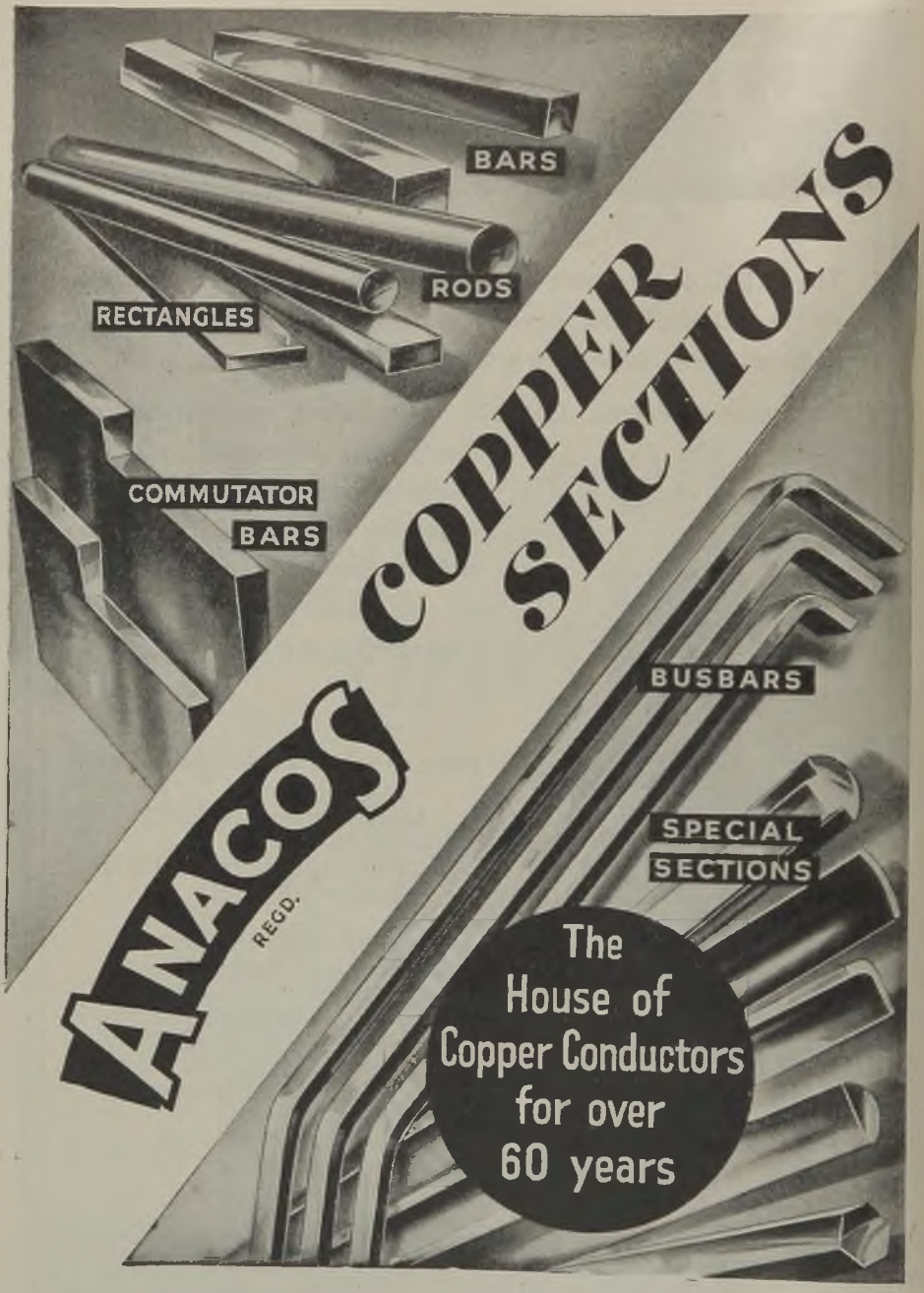
Thermionic Valves, Cathode Ray Tubes and associated Electronic Devices will inevitably become increasingly necessary in post-war application to scientific development in all spheres of electrical engineering and industry.

Here are just a few examples:—

- Navigation Aids
- Oscilloscopes for Industrial and Scientific Research
- Valve Control Devices and Electronic Switches
- Public Address and Alarm Systems
- High Frequency Heating
- Instruments of all kinds

Osram PHOTO-CELLS G.E.C. CATHODE RAY TUBES Osram Valves

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



TELEPHONE BLACKFRIARS 8701 (8 lines)
FREDERICK SMITH & COMPANY
INCORPORATED IN THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED
ANACONDA WORKS, SALFORD 3, LANCS
TELEGRAMS "ANACONDA MANCHESTER"

Still available for essential purposes

FOR D.C.

F.1.52

FOR A.C.

FERRANTI

Multi-range

TESTING SETS

FERRANTI LTD., Hollinwood, Lancs. *London Office: Kern House, Kingsway, W.C.2.*

THE EMPIRE STORY OF MOFFATS LIMITED

Awarded Highest Honours

This **GOLD MEDAL** *and* **DIPLOMA** *are treasured possessions of Moffats Limited*

At the great New Zealand and South Seas Exhibition of 1925-26, Moffat cookers won the Gold Medal award of Merit for the finest electric cookers.

Throughout the years Moffat cookers have retained that distinction in the face of international competition—not only in New Zealand, but in all parts of the world, the intrinsic value of Moffat cookers is recognised and acknowledged.

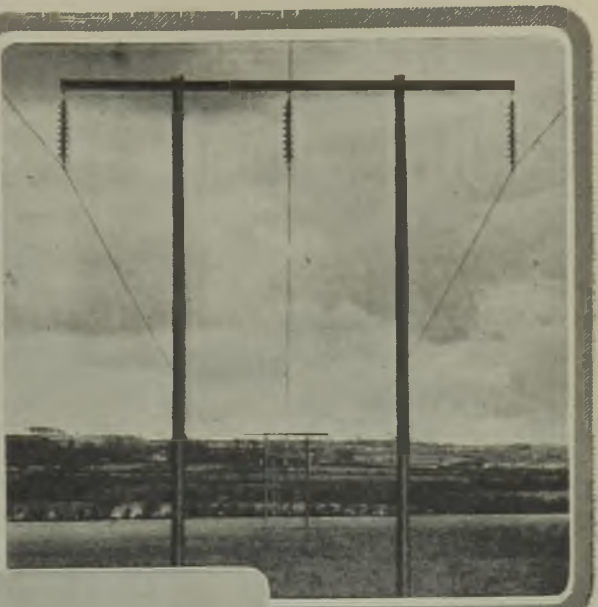
Superior qualities of finish and design, efficiency and durability have won for them a proud reputation in a world-wide market.

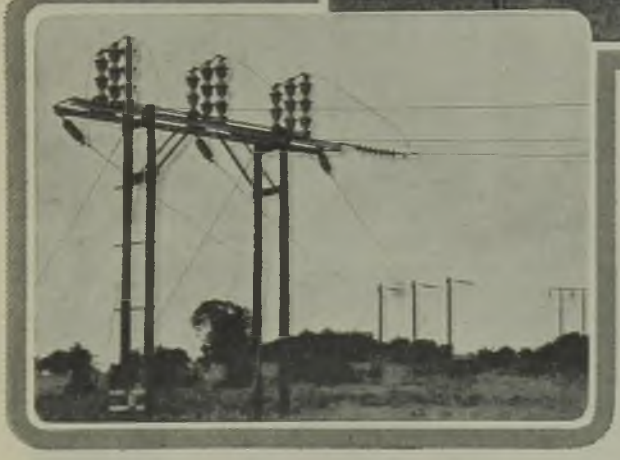
MOFFATS LIMITED

BLACKBURN • LANCASHIRE

MOFFAT ELECTRIC COOKERS & REFRIGERATORS—"SOLD THE WORLD OVER"

The first 110 kV. WOOD POLE LINE *in Great Britain*





This 110 kV. Line, recently completed by Henley Engineers, is 25 miles in length, with ·2 sq. inch copper conductors carried on wood poles throughout. The straight line poles are of the "H" Portal type (unbraced).

The lower illustration shows one of the several switching structures.

Photographs reproduced by courtesy of the Consulting Engineers, Messrs. Kennedy & Donkin.

HENLEY

CONTRACTORS FOR THE COMPLETE INSTALLATION OF UNDERGROUND AND OVERHEAD TRANSMISSION AND DISTRIBUTION SYSTEMS.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
MILTON COURT · WESTCOTT · DORKING · SURREY
PHONE: DORKING 3241 (10 LINES)
TELEGRAMS: HENLETEL, DORKING


Walsall
means everything
A.S.C.M.
Walsall
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WALSALL CONDUITS LTD. WEST BROMWICH

'English Electric'

DISTRIBUTION FUSEBOARDS TYPE 'SM'

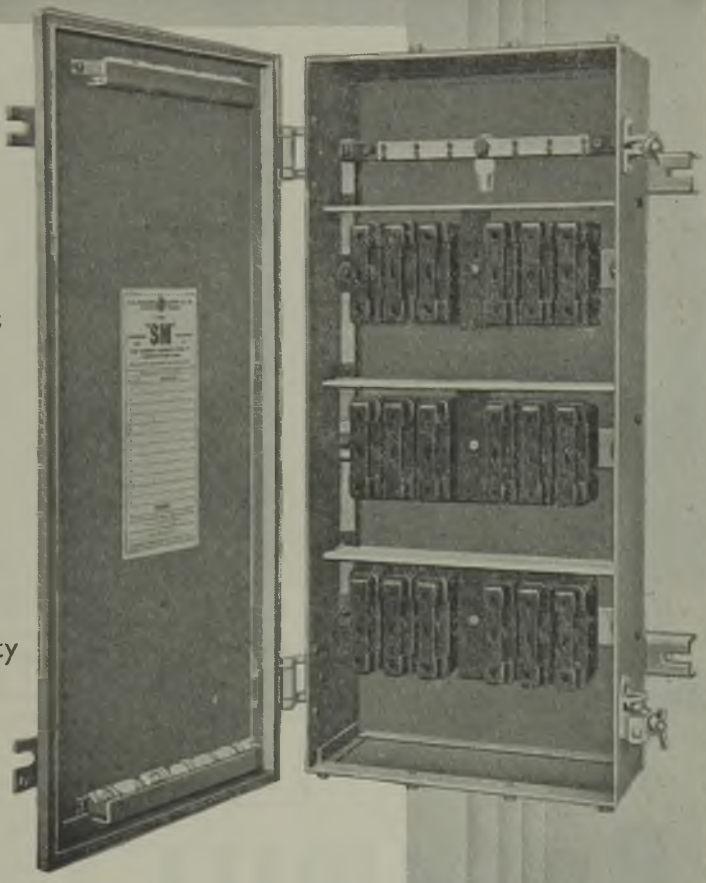
30 and 60 Amps Rating

Available up to 12 Ways

Rapid cabling facilities

Incorporating H.R.C. Fuses

Category of duty 440 A.C. 4



AVAILABLE FOR QUICK DELIVERY

Write for Publication No. FG. 112

THE ENGLISH ELECTRIC COMPANY LIMITED

London Office : QUEEN'S HOUSE, KINGSWAY, LONDON, W.C.2

FUSEGEAR WORKS - - - - STAFFORD

THE PAPER BEHIND THE POWER

ROTHMILL

CABLE INSULATING PAPER

The reliability of the generating plant is the same as that of its distributive cable. And the reliability of the cable is that of its insulation! That is why leading cable manufacturers use Tullis Russell Rothmill Cable Insulating Papers. Rothmill is renowned for its uniformly high quality, and is guaranteed free from metals and grit. A complete range is manufactured. Write for details.

Tullis Russell & Co. Ltd.

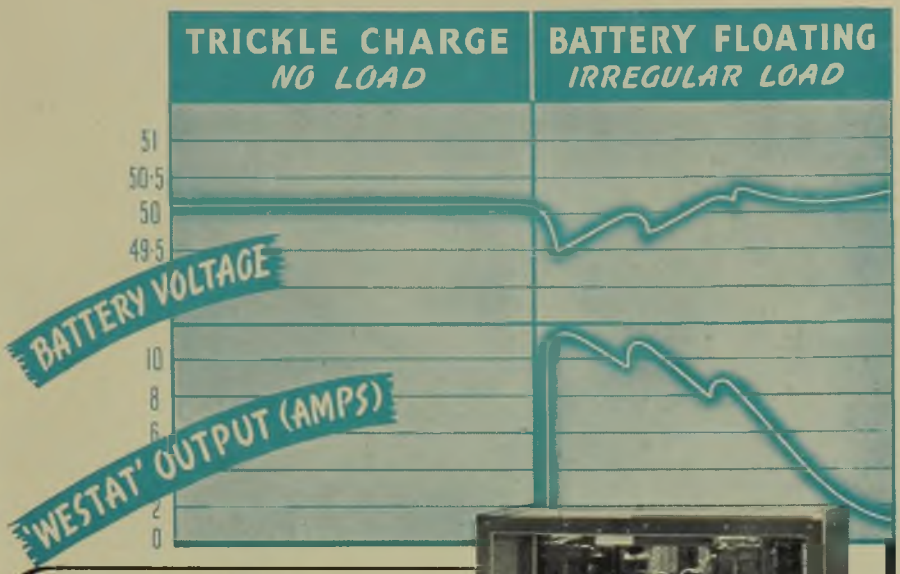
The Pioneers of Twin-wire Papers for Printers

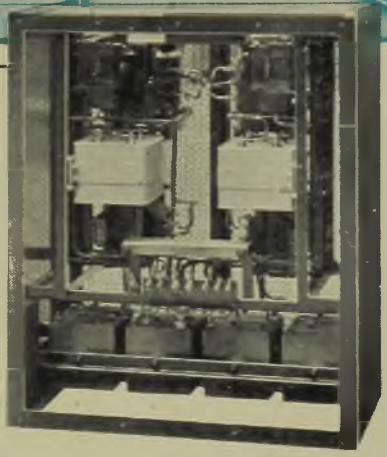
AUCHMUTY & ROTHES PAPER MILLS, MARKINCH, SCOTLAND

LONDON
1 Tudor Street, E.C.4

MANCHESTER
372 Corn Exchange Bldgs., Corporation Street

BIRMINGHAM
116 Colmore Row





◄WESTAT►

CONSTANT VOLTAGE RECTIFIER EQUIPMENT

for use with batteries

A fully automatic floating battery system, in which the battery can always be maintained within the required limits of voltage, is now possible by the use of a "Westat" Constant Voltage Rectifier Equipment.

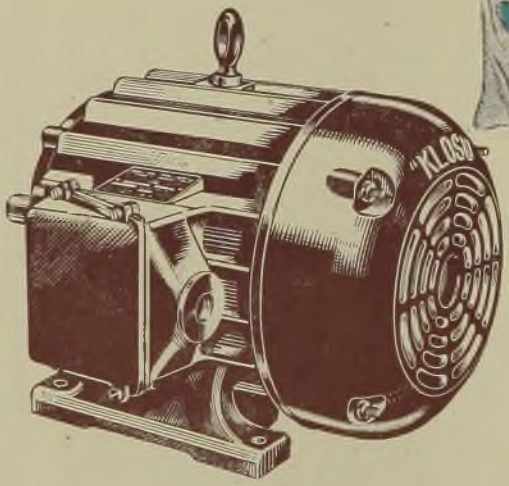
The curves show battery voltage and "Westat" output current for a 50-volt battery under varying load conditions. Note (a) the battery voltage is maintained between limits of ± 1% with constant mains, and (b) the instantaneous response of the "Westat" to changes in battery voltage.

WESTINGHOUSE

Write for descriptive pamphlet No. 11L

WESTINGHOUSE BRAKE & SIGNAL CO., LTD.
Pew Hill House, Chippenham, Wilts.

MOTORS that combine them all



Do you realise the scope of the Parkinson range of over 2,000 types of A.C. Motors? Do you realise how almost any need can be met out of the standard range? There is, for instance, the "QT" Motor for quiet running, the "Klosd" Motor for cool running in damp and dirty situations, and the "Tork" Motor for use when an exceptionally high starting torque with moderate starting current is required. But there is also the "QT-Klosd-Tork" Motor that combines all these features! And it is the same with other combinations of special duty features. Whatever the needs of the drive it is easy to select the correct motor by calling on the Parkinson A.C. Motor Service.

CROMPTON PARKINSON
LIMITED

ELECTRA HOUSE, VICTORIA EMBANKMENT, LONDON, W.C.2 *and Branches*

IN SUPPORT OF THE MINISTRY OF FOOD HERE IS ANOTHER RECIPE FOR YOUR DEMONSTRATIONS:

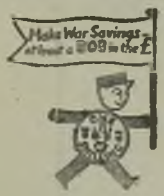
Peanut-Butter Cake

The Jackson COOKING CABINET

Ingredients.

8 ozs. Self-raising flour.
2 ozs. Peanut Butter.
½ Pint Milk.
2 ozs. Sugar.
2 Tablespoonsful Syrup.
1½ Teaspoonsful Ginger or Mixed Spice.
3 ozs. Sultanas.
½ Teaspoonful Bi-carbonate Soda.

Method.



Put the peanut butter, sugar, syrup and milk in a pan and warm it sufficiently to melt the peanut butter. Put all the other ingredients in a bowl and pour on the contents of the pan, beating well. Put at once into a greased cake tin and bake at 425° for about one hour.

Cat. No. 192J.

The Jackson ELECTRIC STOVE Co. Ltd.

143 SLOANE STREET, LONDON, S.W.1

CANNING

ELECTRO ZINCING

by

THE GALVANAX PROCESS

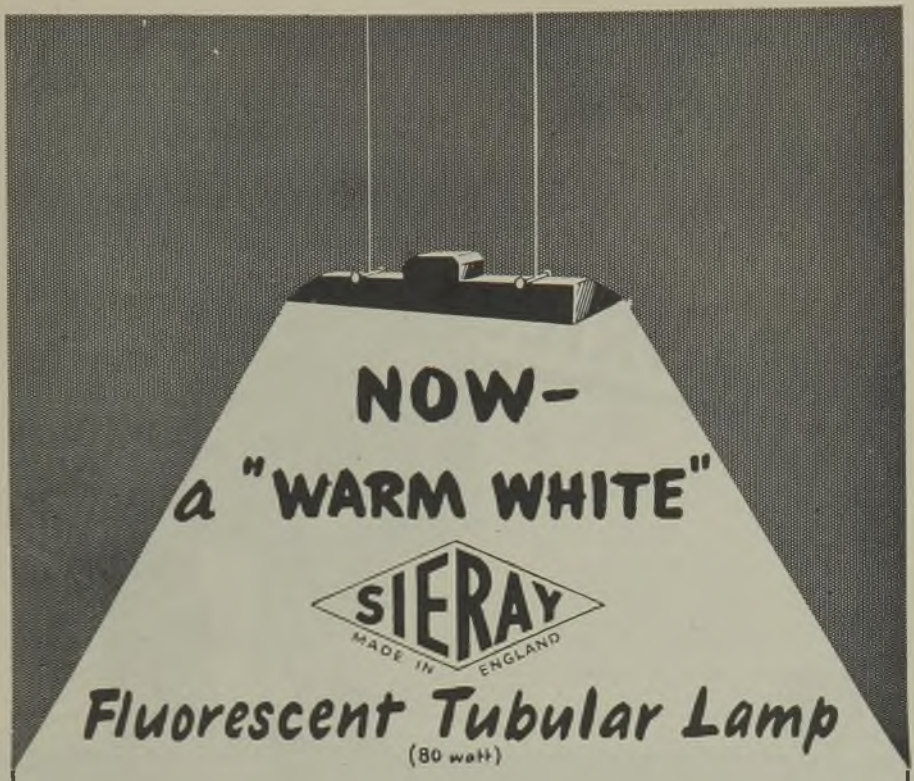
is approved by the A.I.D. when a zinc coating is specified as a substitute for Cadmium plating owing to a shortage of the latter metal.

For fast deposits on wrought iron and steel it is unequalled in colour, simple to operate, and has excellent throwing power besides providing efficient protection from rust.

W. CANNING & CO. LTD.

GREAT HAMPTON STREET

BIRMINGHAM 18



This new "Sieray" fluorescent lamp is identical with the Standard Siemens "Sieray" Daylight fluorescent lamp, except that it gives a warmer, and more pleasing light comparable to sunlight and possesses the same qualities of high efficiency and coolness in operation.

The two lamps are electrically interchangeable, so that existing installations of DAYLIGHT lamps can be changed to WARM WHITE without difficulty.

The importance of Planned Lighting in Essential Industrial Plants cannot be over-emphasised. Siemens lighting engineers are at your service without obligation.

You are invited to send for descriptive leaflet.

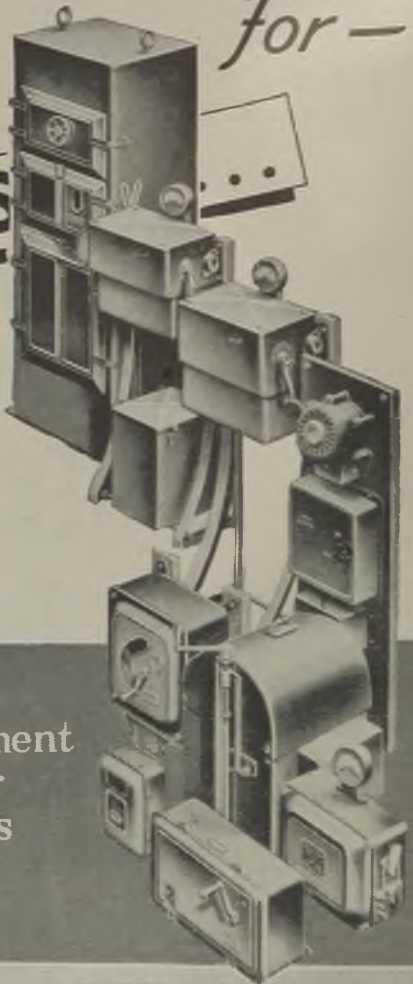
SIEMENS

SIEMENS ELECTRIC LAMPS AND SUPPLIES LIMITED 38/9 Upper Thames St., London, E.C.4

BRANCHES: BELFAST, BIRMINGHAM, BRISTOL, CARDIFF, DUBLIN, GLASGOW, LEEDS, LIVERPOOL, MANCHESTER, NEWCASTLE-ON-TYNE, NOTTINGHAM, SHEFFIELD

MOTOR CONTROL GEAR *for—*

FACTORIES ...



Metrovick
Motor Control Equipment
covers all types for
All applications

METROPOLITAN Vickers
ELECTRICAL CO. LTD.
TRAFFORD PARK ··· MANCHESTER 17.

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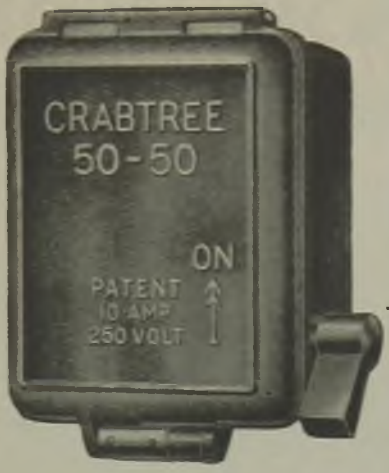
INCREASE PRODUCTION BY *Consulting* METROVICK'S ILLUMINATING ENGINEERS



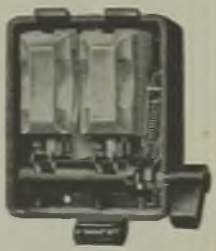
A switch-fuse *of* PROVED PERFORMANCE ★

★ *The Crabtree* "50-50" UNIT

THIS entirely shockproof 10 ampere (250 volt) switch-fuse is, in every way, as pleasing in appearance as a Crabtree tumbler switch. It is very simple to wire, both incoming and outgoing cables entering through the bottom of the case. No earthing wire is necessary and the erected unit can be sealed against tampering.

Due to the action of a powerful spring, acting upon a solid steel mechanism, the switch has a decisive "in" and "out" movement. The fuses, which are of highly vitrified English porcelain, have ample space for finger-grip and will be found most easy to rewire.

The Crabtree "Fifty-Fifty" switch-fuse is, in short, a typical Crabtree product providing high electrical and mechanical efficiency with sound design and good appearance.



Interior view of unit

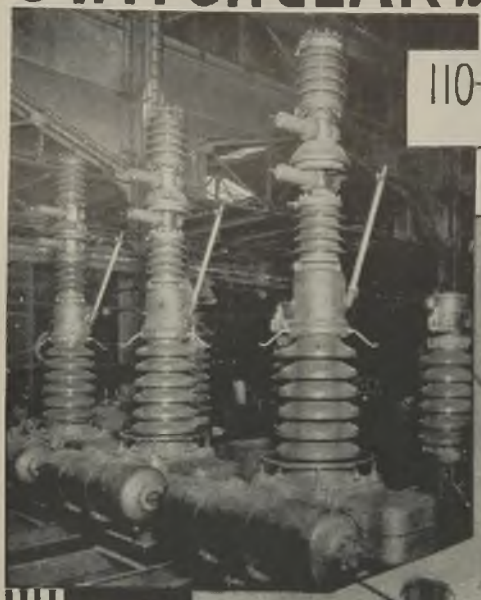
CRABTREE

A · NAME · SYNONYMOUS · WITH · PROGRESS · IN · ACCESSORIES · AND · SWITCHGEAR

"Crabtree" (Registered)

C5505. *Advt. of J. A. Crabtree & Co. Ltd., Walsall, England*

SWITCHGEAR *by* SPECIALISTS



110-kV AIR-BLAST SWITCHGEAR
BEFORE DESPATCH

66-kV AIR-BLAST SWITCHGEAR
ON SITE

REYROLLE

HEBBURN-ON-TYNE
ENGLAND

Another TELCON Triumph

As pioneers of the Industry TELCON were amongst the first to explore the potentialities of thermoplastic materials for cable insulation. Today TELCOVIN P.V.C. Cables ensure the utmost efficiency and dependability in service. Made to standard specification all materials conform to G.D.E.S. 18. Full details on request.

TELCON

TELCOVIN
REGD.

THERMOPLASTIC
P.V.C
CABLES

★ TELCON DESIGNED RADIO FREQUENCY CABLES ARE THE BASIS OF WORLD STANDARDS

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD. (Regd.)

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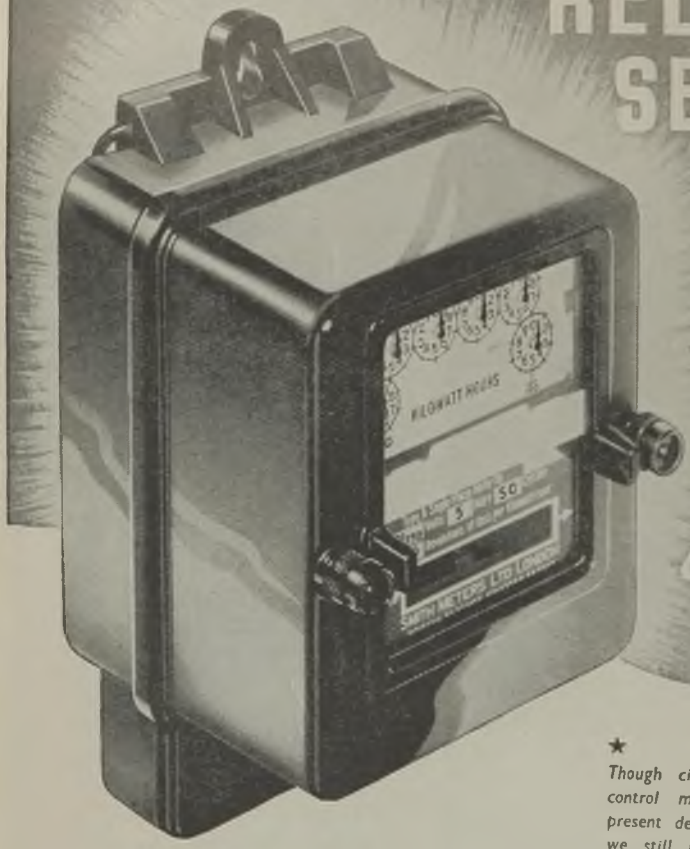

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Motor Maintenance Points & Problems

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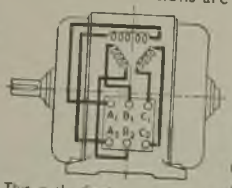
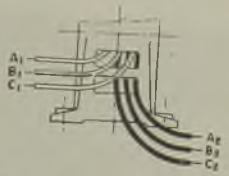
TRACING A SIX-WIRE "STAR-DELTA" MOTOR

when the connections are unknown.



This is the final connection to the terminal board when all six leads are correctly traced.

Check through with megger and you will obtain three circuits, mark one lead from each circuit as A_1, B_1, and C_1 respectively, and the corresponding finishing ends as A_2, B_2, and C_2.



Connect the three finishing ends together and connect A_1, B_1, C_1 to the supply. If correctly connected, motor will start and run quietly; if not, it will just turn and hum.

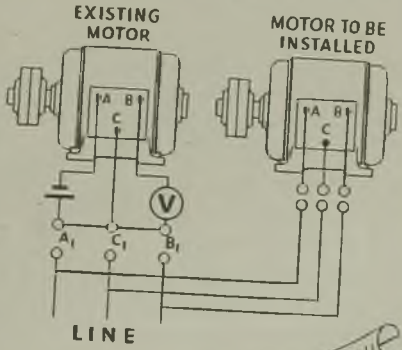
In this case reverse B_1 and B_2 and try again. The following are all the possible combinations—

(1)	(2)	(3)	(4)
A_1–B_1–C_1	A_1–B_2–C_1	A_1–B_2–C_2	A_1–B_1–C_2
A_2–B_2–C_2	A_2–B_1–C_2	A_2–B_1–C_1	A_2–B_2–C_1
Supply	Supply	Supply	Supply

DIRECTION OF ROTATION

It is sometimes necessary where duplicate plant is installed to ensure that the second motor will rotate in the same direction as the first machine. The normal method would be to run the machine light, but in the case of direct coupled plant, for instance, this is impracticable.

The mains are disconnected from the supply of the existing motor, and a battery and voltmeter connected as shown. The shaft is turned by hand in normal running direction, and the rise and fall of the voltmeter carefully noted for a definite mains connection A, B, C. The battery set is then connected across the motor to be installed and the shaft of this motor turned by hand. If connections are identical, the voltmeter will move in a similar manner to before. If not, leads A and C of this motor should be exchanged. If the mains connections to each motor are identical, then the new installed motor will move in the same direction as the existing one.



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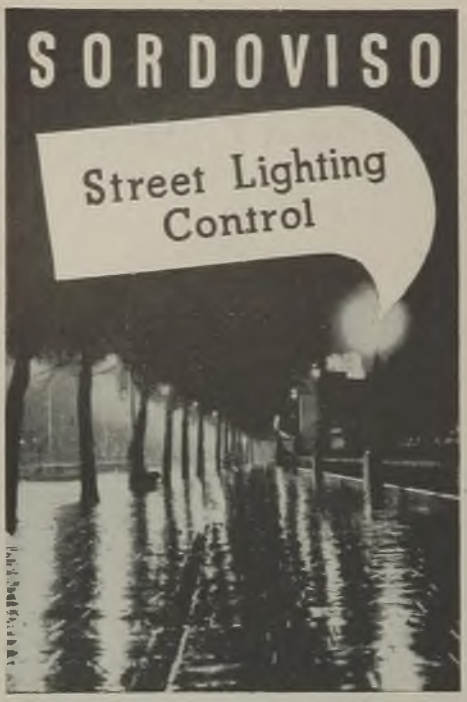

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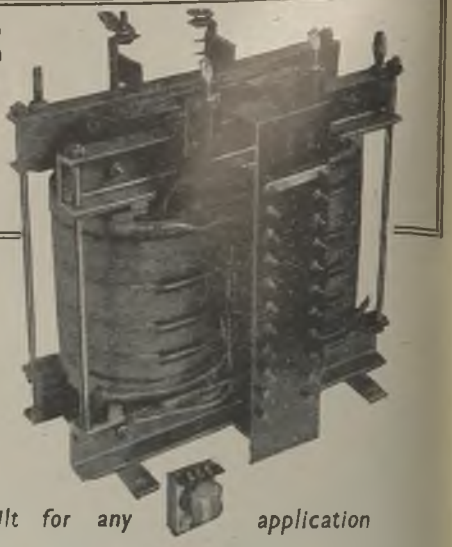

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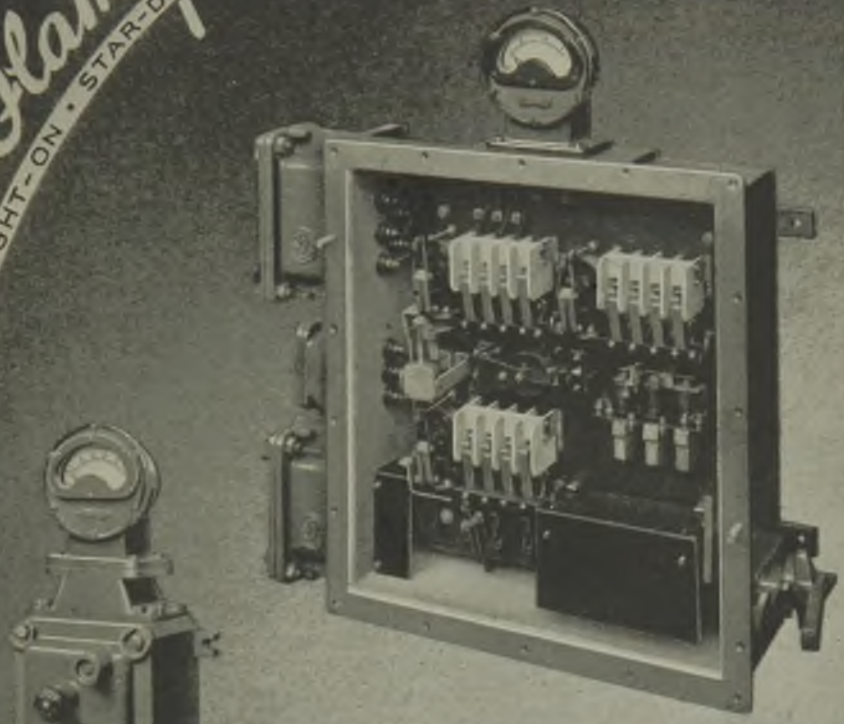

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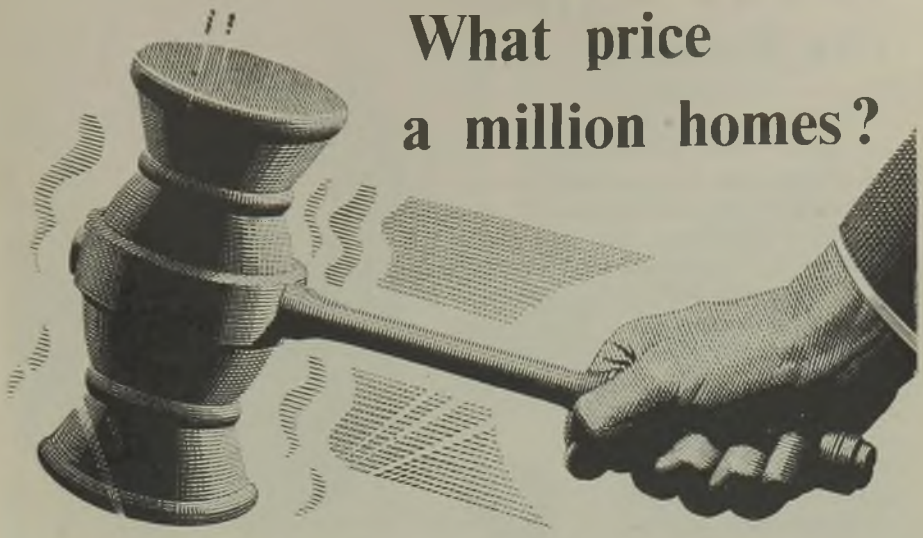

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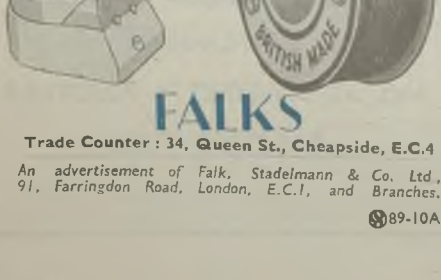

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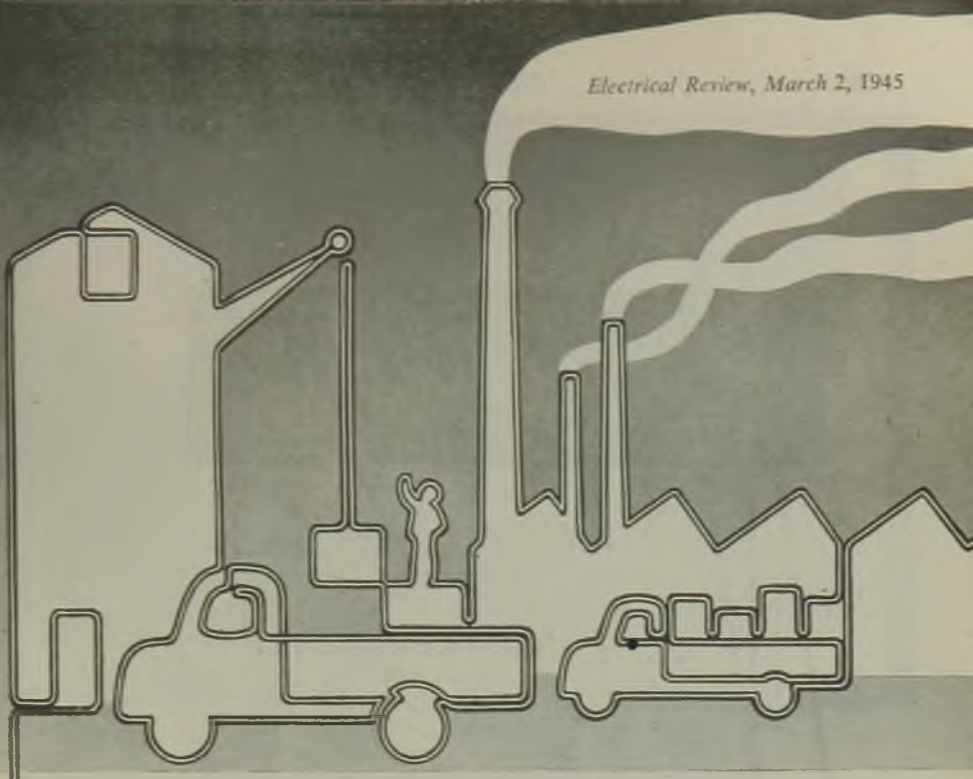

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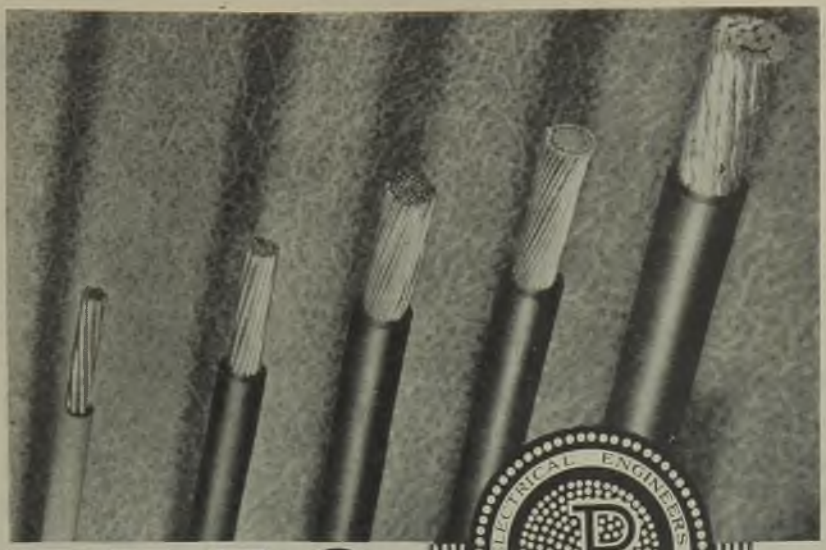

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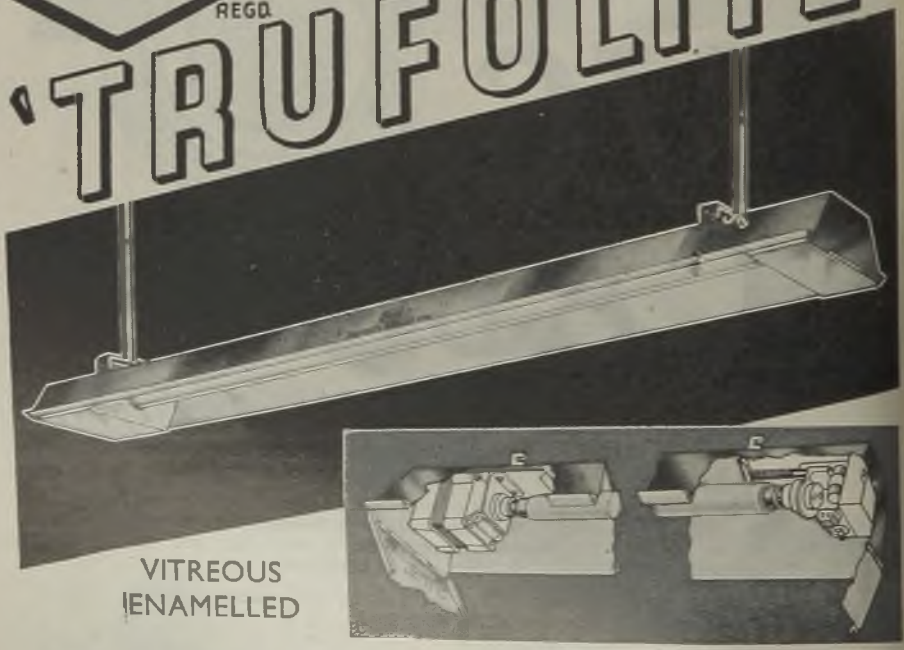

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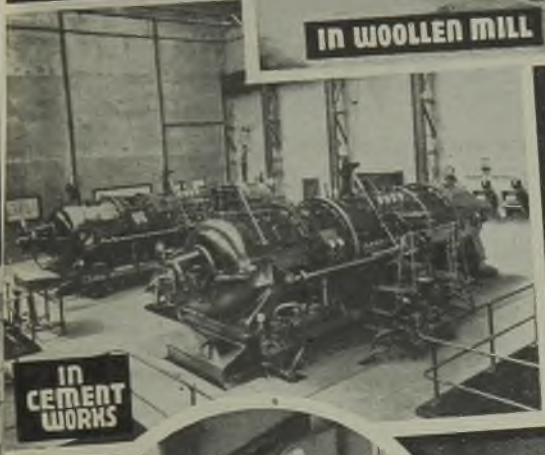

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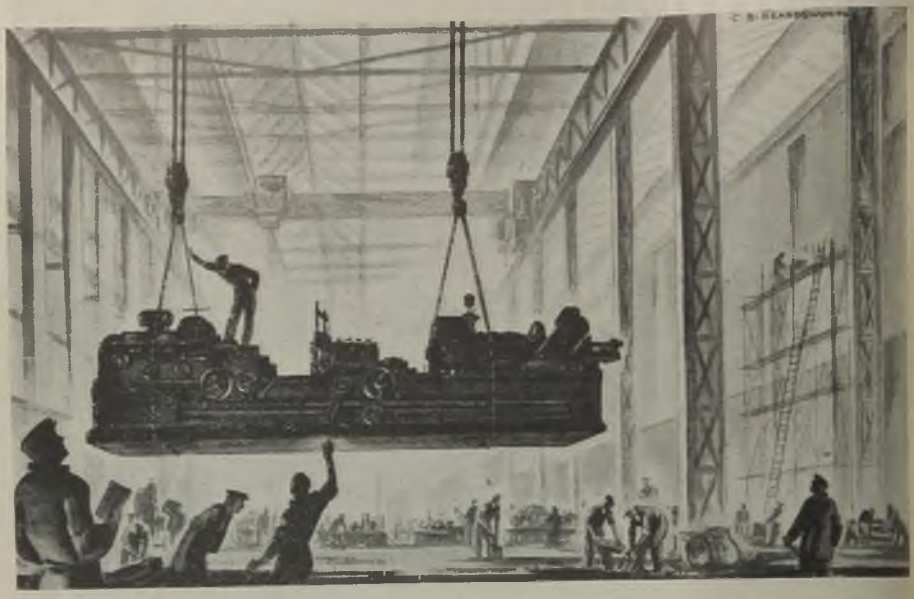

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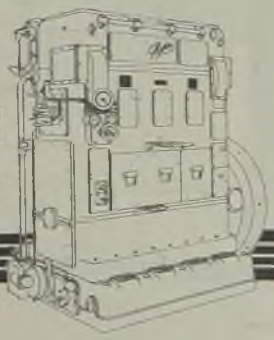

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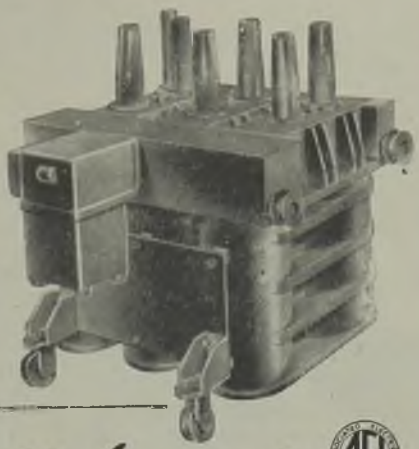

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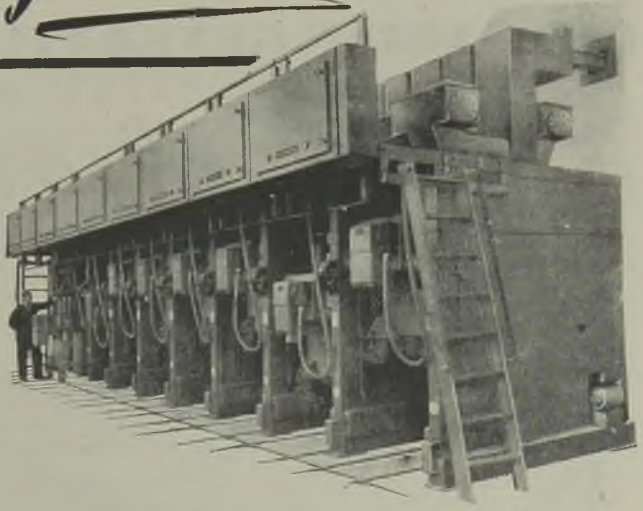

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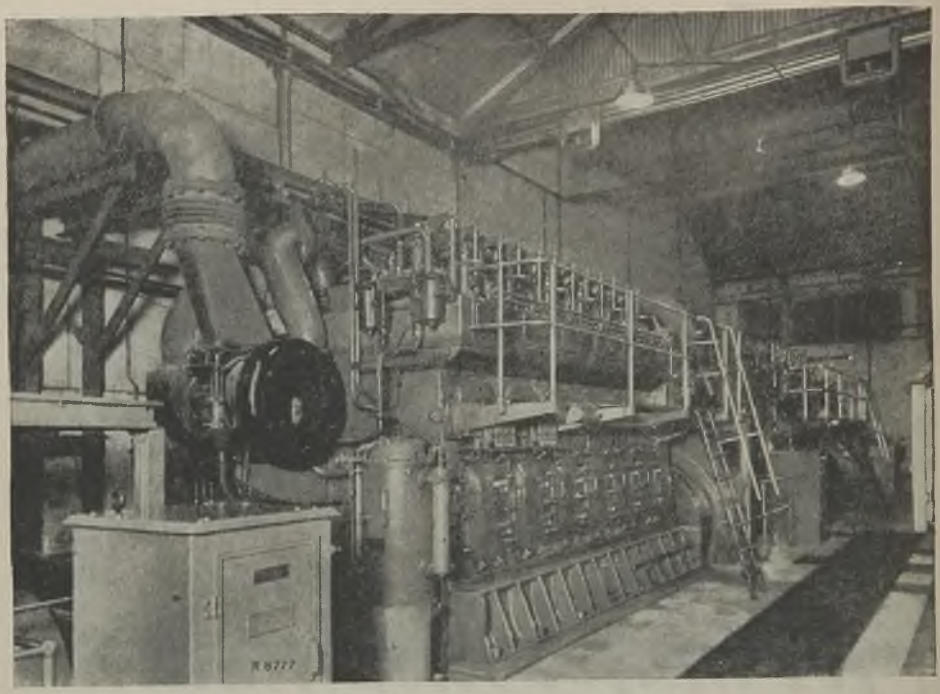

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ELECTRICAL REVIEW

March 2, 1945

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

Technical Editor :
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Commercial Editor :
J. H. Cosens

Contents :—

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Telegraphic Address : " Ageekay, Sedist, London." Code : ABC. Telephone No. : Waterloo 3333 (35 lines).

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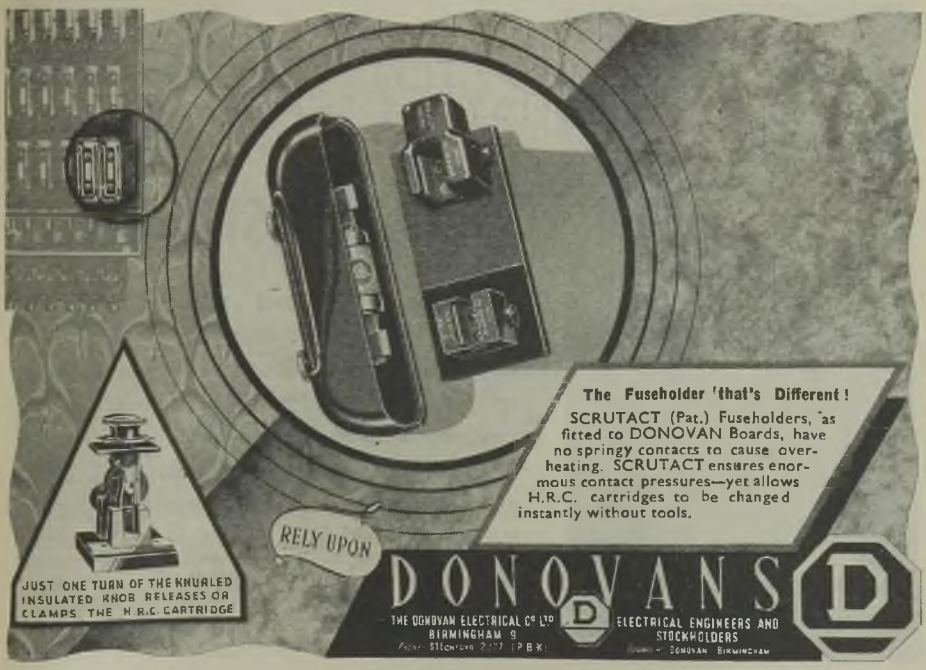

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THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVI. No. 3510. MARCH 2, 1945 9d. WEEKLY

Fuel and Power

Justification of Ministry's Continuance

WHEN the Ministry of Fuel and Power Bill came up for discussion in the House of Commons last Friday Major Lloyd George appealed to members not to make it an occasion for another debate on the coal industry. But it was inevitable that the Ministry's past should be discussed when Parliament was being asked to provide for its future and consequently the debate was concerned almost wholly with the mines and miners. As a result the other aspects of the Ministry's work were dealt with in a rather sketchy fashion.

No Extension of Powers

In moving the second reading Major Lloyd George made it quite clear that the Bill was designed mainly to confirm the transfer of powers and duties from other Departments to the Ministry, *e.g.*, those concerned with electricity from the Board of Trade. The Bill, he said, did not seek to continue any of the powers over industry and over consumers given by wartime regulations after the period of emergency was over. This was somewhat offset by a corollary that this did not mean that any Minister in the future would not be expected to introduce policies affecting the fuel and power industries.

Mr. David Grenfell expressed the opinion that the Ministry had done nothing to improve the production of coal; the Minister should ask for greater powers. Apparently this extended to the electricity supply industry, for Mr. Grenfell said later that the electricity and gas industries would have run just as well if he had been an absentee all the time. That was not quite fair, because, after all, the Electricity Commissioners are a part of the Ministry and the Minister is entitled to credit (even if it is of a negative kind) for refraining from too much interference with their very well conducted work.

Captain Duncan advocated the return of the various sections of the Ministry to their former homes, but surely that would be retrogressive, particularly if, as Captain Duncan suggested, electricity went back to the Ministry of Transport and not the Board of Trade. There is far too much in the fuel and power industries for a sub-department to handle; the coal industry alone is a sufficient subject for a separate Ministry.

Production Comes First

The Ministry's main task obviously lies in the coalfields. While the economical use of coal is a proper matter for its attention, production must come first. Co-ordination was referred to in the debate, but even if this is desirable (and the degree of co-ordination is a subject for discussion) the necessity for more and better coal is far greater.

Upon the whole the debate has confirmed us in our opinion expressed over two years ago (October 30th, 1942) that " if there is to be a regulation of the fuel and power industry it is logical to entrust it to a single body as has now been done, but how far is regulation to go? In our view the chief function of the Ministry is to see that sufficient coal is produced and that it is efficiently distributed. During the war it may be necessary for it to say

that certain things must be done by gas and others by electricity, for in this, as in other matters, the public must be directed for the one purpose of winning the war. When victory is achieved the people must once again be allowed some choice in the ordering of their affairs—or what are we fighting for?"

Coal Prices

A CRUCIAL need in the economical construction and operation of electric power stations is a price structure for coal based upon its suitability. This goes a good way beyond calorific value to include size, volatile, ash and moisture contents and swelling. The range of suitability in each of these respects was set out in a statement presented at the conference arranged on Wednesday by the N.W. Section of the Institute of Fuel between coal users and the coal industry. It is now up to the latter to say to what extent it is able to meet the requirements of power-station engineers at a price that is closely related to suitability, with a view to drawing up a standard specification.

Clearing the Air

REQUIREMENTS differ as between mechanical stokers and pulverised fuel. Thus ash content, which should not be greater than 7½ per cent. with pulverised-fuel firing is preferably at least 8 per cent. with chain grates. This has a wider import than the technical aspects. In a survey of flue-gas cleaning methods before a joint meeting last week between the Institute of Fuel and the National Smoke Abatement Society, Mr. John Bruce gave the proportion of original ash that might pass from the combustion chamber with mechanical stoking as 10 per cent., whereas with p.f. firing it might be as much as 70 per cent. Not only does electricity add no contamination to the atmosphere but, as the author claims, the supply industry is doing all that is scientifically possible to prevent emissions from power stations.

Combined Forces

IN these days when the tendency to form new associations in the industry is growing it is pleasing to see a combination of two existing bodies. It has occurred in the refrigeration industry: Mr. E. G. Batt, independent chairman of the Commercial Electric Refrigeration Association announced at the Association's second annual luncheon last week that the C.E.R.A. had decided to join with the Domestic Electric Refrigeration Association to form the British Refrigeration Association. Although there is, of course, a distinct difference in the classes of business in which the members of the two associations are engaged, they have a great deal in common and in such directions (important among them being research) unity should prove to be strength in the coming strenuous days. Mr. A. V. Alexander, First Lord of the Admiralty, at the same luncheon praised the refrigeration industry for its work during the war for the Royal Navy and the Merchant Service.

Severn Barrage

THE new Report on the Severn Barrage reviewed in this issue differs from that of 1933 in several material aspects, mainly as a result of altered conditions. Since costs of hydro-electric schemes consist mainly of capital charges, the lower rate of interest now anticipated (3 instead of 4 per cent.) and the reduction in capitalised interest during construction owing to the shorter period allowed for the work (eight instead of fifteen years) improve the economic aspects even without their being favourably weighted by the advancing price of coal. On the other hand costs of construction have gone up by some two-thirds, which adversely affects any advantages of pumped storage, the idea of which has now been abandoned.

Cheaper Aluminium

IN the earlier part of the war aluminium was in such demand for aircraft construction that people were asked to bring out their old pots and pans to enable the war in the air to be carried on. But as time went on production was stepped up to such a degree and aircraft construction changed so much in character that in 1944 there was actually a great and growing surplus. It is therefore not surprising that it has been possible to release the metal for non-military purposes and to reduce the price from £110 to £85 a ton—actually less than before the war. The cut brings the price of aluminium practically to the United States level of about £83 a ton. There is speculation as to the possible effect of the reduction upon the use and price of copper, a matter which closely concerns the electrical industry.

Llynfi : The New Generating Station in South Wales

AN installation designed around the principle of unit operation; firing by pulverised fuel, with special features in the system consequent on using Welsh coals; complete automatic control of combustion; the adoption of a unique ash-disposal scheme; supplementing cooling-tower operation with riverside working; the use of air-blast operated main switchgear and the complete absence of oil switchgear throughout the station. These are our impressions of the outstanding features of the new Llynfi generating station of the South Wales Electric Power Company after a recent visit. To the above might be added a word about the rapid building of the station: we believe that something of a record in quick construction was achieved in that the first section of the plant was put into commercial service in December, 1943, only nineteen months after civil work was commenced on the site.

Above: The station may be described as cooling-tower operated, with supplementation by river water; river intake in foreground

An extremely interesting point about the ash-disposal scheme is its possible influence, in relation to other factors, on the adoption of p.f. firing; ashes and water being pumped into the impound area

It was very soon evident that the same hand was employed in the design and construction of this station as in the case of Little Barford, which was described in the *Electrical Review* of January 19th last. Mr. H. Ewbank, chief engineer of Edmundsons Electricity Corporation, Ltd., who designed and constructed the station for the supply undertaking in question, and to whom we are indebted for permission to visit the station, was, of course, also the designer of the Little Barford station. Actually it was the intention to duplicate Little Barford as far as possible, but the original design has been considerably modified in consequence of the differences which prevail in local conditions, the operating requirements and the nature of the fuels consumed.

Despite these modifications, however, there is in the main a very close similarity in the two stations, and as Little Barford was described by us so recently we propose now merely to outline the points of similarity and to deal more fully with those characteristics of Llynfi which are not in line with Little Barford. The main purpose of the station is to supplement the supply from the Upper Boat generating station in meeting the requirements of the power company's system, and in this light the new station may be regarded, superficially, as an extension to Upper Boat. The Llynfi station is about 16 miles from Upper Boat, on one bank of the River Llynfi, from which the station takes the whole of its water supplies, and near the G.W.R. line connecting Bridgend

and Maesteg, so that the station is served reasonably well for both coal and water, particularly as there are so many collieries within a few miles of the position.

The station, which is essentially a base-load one and operates on a three - shift basis, is designed for an ultimate capacity of 120,000 kW, but the present plant capacity of just half this figure is given by two units,

houses, with the necessary connections to the 66-kV transmission lines.

Incoming coal wagons are received by a

Each of the pumps in the well is in series with a pump at a lower level, and each pair of pumps lifts the ashes and water to the disposal ground up the valley ; sluicing pumps are shown at floor level in the rear and sealing and quenching pumps are on the left

Pulverised fuel is delivered to twelve burners, *via* six feeder pipes, at the top of the combustion chamber because of the characteristics of the Welsh coal used

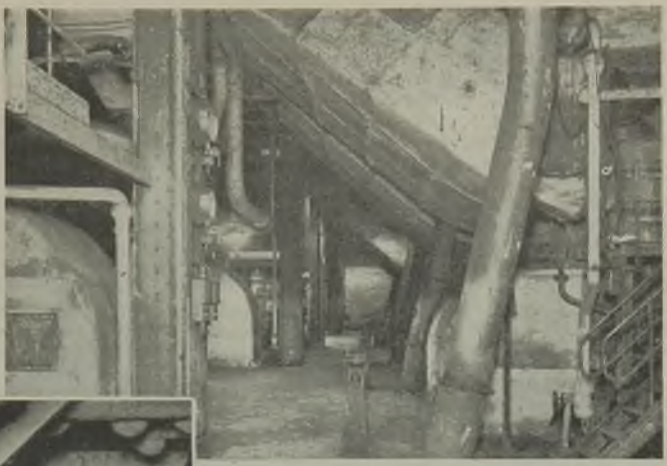
each consisting of a 300,000-lb. per hr. Stirling boiler serving a 30,000-kW English Electric turbo-alternator set. A reflection from the unit-operation design feature is the absence of partitioning of any sort between the boilers and the turbo-alternator sets. In terms of ground level there is no actual basement to the station, for the condenser and ash basements are actually at ground level and the whole of the plant is elevated from this. The boiler-firing floor and the turbine operating floor are at the same level of 28 ft. above the basement, the surge tanks are 56 ft. above the basement, the raw water tanks 72 ft., the top boiler drums and the top of the economiser 81 ft., and the top of the boiler house 109 ft. The present single stack is 275 ft. high. Following the plan from end to end of the station, roughly in a line parallel with the river bank on one side and the railway sidings on the other, we have the coal-handling plant, stack, boiler house, turbine room, cooling tower, and finally the transformers and switch-

double-platform side tippler which feeds the coal into a central hopper from which the fuel falls on to a horizontal underground belt conveyor. From this conveyor the coal is belt elevated in two stages to the boiler bunker house where a reversible travelling shuttle conveyor can be operated to feed any of the bunkers. At the junction of the two inclined belt conveyors, however, is crushing plant, and the coal from the first inclined belt is either delivered direct to this or chute fed to an adjacent storage ground with a capacity of 24,000 tons. For distribution and reclaiming over the storage ground a travelling grab crane is used, and recently the use of a bulldozer has given excellent results in transferring coal on the storage ground. The coal-handling system, which will deal with 120 tons per hr., is a product of Spencers (Melksham), Ltd.

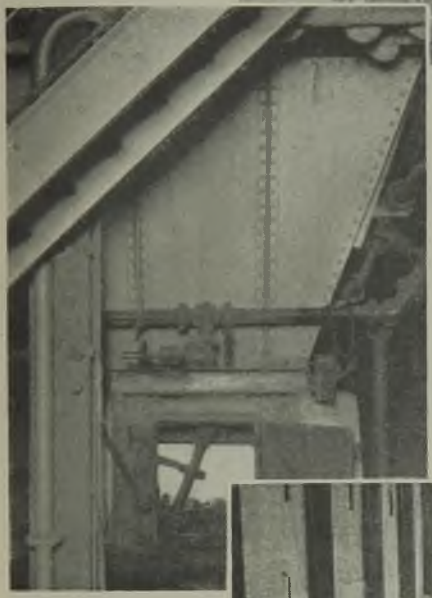
The boilers, which are designed for steaming conditions of 650 lb. per sq. in. and 910 deg. F., are of the tri-drum type and are equipped with horizontal multi-loop superheaters, straight-tube type economisers and Howden Ljungstrom rotary air pre-heaters. The combustion chamber has Bailey water-cooled walls. The top of the economiser is at about the same level as the two steaming drums and the air heater is at the firing-floor level, facing the burners. The principle heating surfaces are boiler

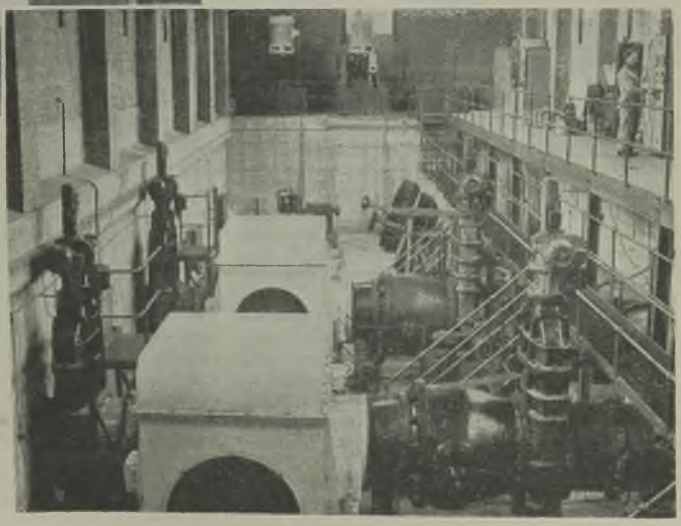
convection 4,282 sq. ft., water walls 9,820 sq. ft., superheaters (primary and secondary) 20,550 sq. ft., and economiser 67,200 sq. ft. The unit system of p.f. firing is employed largely on account of the base-load characteristic of the station. The pulverising mills are of the Babcock & Wilcox ball type and are housed at the basement level. There are three mills per boiler and any two of them will serve the boiler at 80 per cent. loading. The mills are fed with coal directly from the boiler bunkers and a primary-air fan immediately in front of each mill serves as the main transmission system to the burners which, on account of the different classes of fuel used, differ from those of Little Barford in that they enter the top of the combustion chamber so that the path inside the chamber is down one side and up the other. The quantity of fuel in the mill is stabilised by the differential air pressure between the mill inlet and outlet; this differential is the controlling medium for the fuel-feeder motor.

There are twelve downward fish-tail burners per boiler, each pair being served



The rotary air preheaters (right) are located at the firing-floor level and face the feeder ends of the boilers





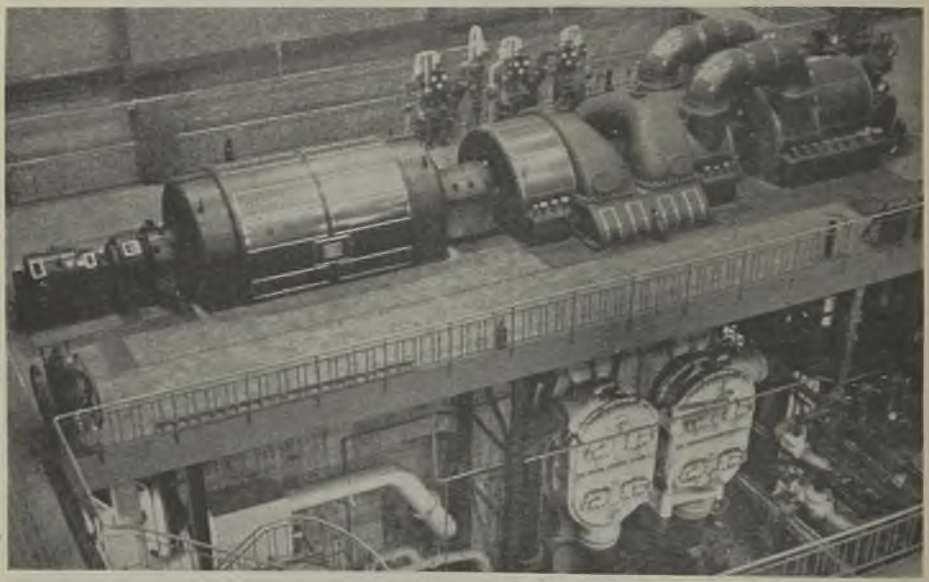
Above: Quenched ashes from the combustion chambers fall on to curved hearths from which they are sluiced by a traversing high-pressure water jet

Right : The vertical pumps in the rear lift the water from the River Llynfi, and the circulating-water pumps are those at the lower level

by a fuel pipe, two of which pipes are connected to each mill. The whole of the combustion air for each boiler is drawn by the duplicate f.d. fans from the top of the building, and the bulk of it is passed through the air preheater to the boiler wind box. From this wind box secondary air is taken to the front of the combustion chamber and admitted behind the burners so as to create the desired turbulence, and tertiary air is taken to side and back inlets to the combustion chamber. The secondary- and tertiary-air temperatures are both about 500 deg. F.

The primary-air fan is fed from the air line from the f.d. fan on both the cold and hot sides of the air preheater, and by suitable steam header pressure and the ratio between the air and fuel inputs. This ratio is further adjusted and kept constant by a steam-flow/air-flow recorder controller which acts as a subsidiary control to the master pressure controller, the latter having an over-riding influence on the fuel input.

Automatic control of the final steam temperature is obtained by means of a surface de-superheater connected between the primary and secondary boiler superheaters. Butterfly valves in the inlet and in the by-pass to the de-superheater are linked together in opposition, so that their position determines the proportions of steam which, respectively, pass through and by-pass the de-superheater. All the electrical control gear and the manual



The station has at present two units, each with a 30,000-kW turbo-alternator set served by a 300,000-lb. per hr. boiler; one turbo-alternator set shown

air-mixing controls the temperature entering the fan, and hence the mill, can be adjusted within fairly wide limits. To complete the combustion circuit the flue gases pass from the combustion chamber to the other side of the air preheater and then through the Sturtevant electrostatic precipitator and on *via* the i.d. fans to the chimney.

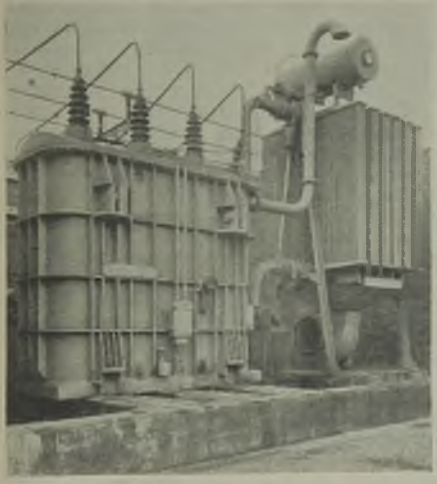
Complete automatic combustion control is provided for by means of the Bailey air-operated system in which air pistons and cylinders directly operate the fan vanes, the brush shifting gear of the variable-speed motors and the dampers. The loading air pressure is transmitted through selector valves associated with each cylinder, the degree of the pressure depending on the demand for steam as shown by the varying

pneumatic valves associated with the combustion system for each boiler are accommodated on the central section of a control board and desk situated between, and in line with, the boiler and turbo-alternator set of each unit.

The Babcock & Wilcox "Hydro-Jet" system of ash and dust handling is employed, in which the coarse ash from the boiler combustion chamber falls on to the two curved sloped hearths after being spray quenched above the hoppers. Extraction of the ash from the hearths is by means of sluicing with traversing high-pressure water jets. The water and ash pass along into a crusher and on to a sump from which it is lifted by duplicate sets of pumps in series, with a combined capacity of 1,500

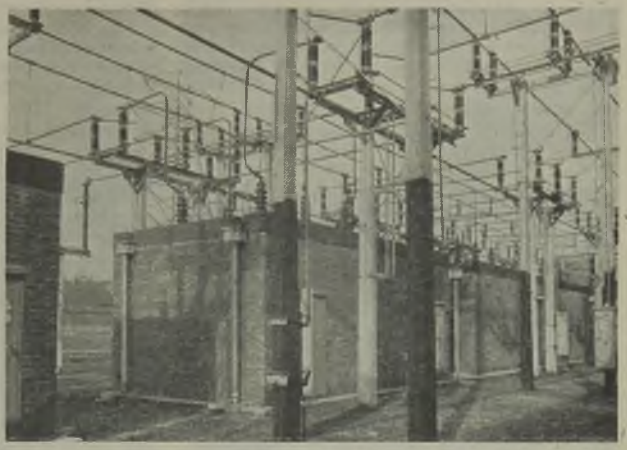
gal. per min. per set against a total head of 240 ft., to the storage ground of what we believe to be a unique ash-disposal scheme. This disposal ground is about half a mile up a valley running at right angles to the main direction of the river and constitutes an impound area formed by an embankment which once carried a mineral line across the foot of the valley. The ash and water mixture is discharged about 130 yards up-stream from the embankment, so that as the ash settles in the valley bottom the clear water leaves the area over a spillway and passes on to a long-established culvert by which the water is finally passed back to the River Llynfi through precautionary settling ponds, etc.

The spillway is fitted with removable concrete panels, so as to provide a weir at successively higher levels as the level of the deposited ash rises. An extremely interesting point about this ash-disposal scheme is its possible influence, in relation to other factors, on the adoption of p.f. firing, one of the main disadvantages of which method is the great difficulty in getting rid of the ashes, as compared with the disposal of stoker-firing ashes which have a market value.



Each alternator generates at 11 kV and is tied to a 37,500-kVA, 66-kV output transformer which is considered as part of the generation unit

Each of the 3,000-RPM turbines has three cylinders, including a h.p. one with 19 impulse stages and two inward-flow l.p. ones, each with eleven reaction stages. As the two turbines run in parallel the admission of steam is governed primarily by the centrifugal governor which is remotely operated from the unit control board. Steam is bled from each turbine at three points on the h.p. cylinder, at one point on the h.p. cylinder exhaust, and at one point at each of the l.p. cylinders. The combined exhaust of the l.p. cylinders passes to a condenser which is in two separate sections, each of which can be isolated to permit cleaning without shutting down the plant.



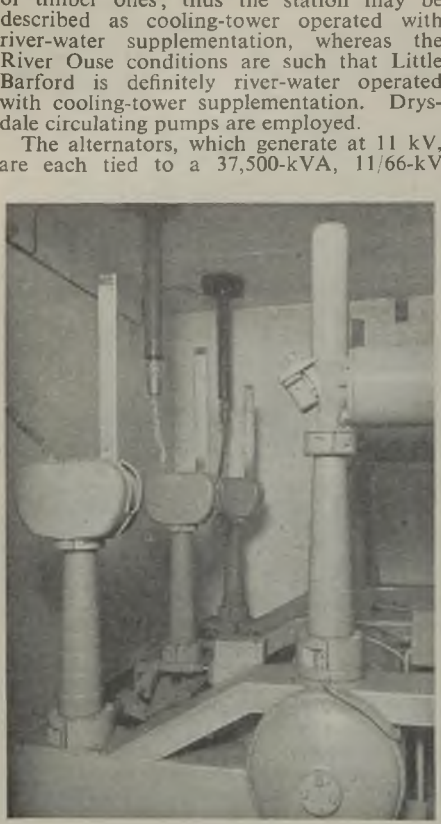
The main circuit-breakers are segregated from the main buildings and from each other by being housed in separate buildings

It is not necessary to repeat the heat cycle in this article, but a further reference to the arrangement of the Weir feed pumps may be useful because of its unusual character. For each unit there are one electrically-driven pump and one 100 per cent. duty steam-driven pump, and by orthodox operation the steam pump is regarded as a stand-by to the electric pump. There is a fifth and electrically-driven pump which serves as an overall stand-by to the present half of the station, *i.e.*, two units.

With regard to the circulating-water system, an interesting comparison can be made with that at Little Barford. The River Llynfi has a minimum flow of 250,000 gal. per hr. and at normal times the flow is grossly inadequate for direct condensing purposes for the present half of the station. Further, there are times, ironically at flood levels, when the water conditions are such that no water at all can be used directly. Hence provision has had to be made for providing for the whole of the present

plant on a cooling-tower operation basis, and this has been done by means of a Film concrete cooling tower which has a capacity of 2,500,000 gal. per hr. and is unique in that it has reinforced concrete fillings instead of timber ones; thus the station may be described as cooling-tower operated with river-water supplementation, whereas the River Ouse conditions are such that Little Barford is definitely river-water operated with cooling-tower supplementation. Drysdale circulating pumps are employed.

The alternators, which generate at 11 kV, are each tied to a 37,500-kVA, 11/66-kV



The main station switchgear is electro-pneumatically operated and air-blast arc controlled; a single segregated unit

unit transformer, so that from the operating viewpoint the alternator and transformer are together considered as the electrical end of the unit. Indeed, the generator transformer and the unit transformer for supplying the auxiliaries of the unit are included with the alternator windings in a Merz-Price current balance protective system. The main circuit-breakers are of the English Electric air-blast type, and each has a rupturing capacity of 1,500,000 kVA. The switches are segregated from the main station and from one another as they are in separate switch-houses, each of which contains at the most two switches in separate compartments. They are electro-pneumatically operated, and air for both operation and arc quenching purposes is provided by duplicate motor-driven automatically pressure controlled compressors, one at each end of the switching site. Two horizontal air receivers at the base of each circuit-breaker are constantly charged at 250 lb. per sq. in. from main vertical receivers in the compressor houses.

On interruption of the circuit, blast valves admit air from the switch receivers to interrupter units where spring-loaded piston contacts are forced away from the fixed contacts. The blast between the two sets of contacts blows the arc on to a supplementary contact where it is finally extinguished, the air escaping through exhaust coolers. This operation also admits air to a power cylinder which opens three series isolators immediately after the arc has been extinguished in the interrupter units. The blast valves are then closed, allowing the interrupter contacts to re-make, but the isolators remain open. To close the switch again, operation of the isolators by means of a power cylinder is all that is necessary. Control of the circuit-breakers is normally carried out remotely from the entirely separate main station control room, but there is a comprehensive system of local control in a separate chamber in each switch-house.

Supply for Auxiliaries

In addition to the unit transformers for supplying the 3·3-kV unit auxiliaries *via* "unit boards" there are two 3,000-kVA station transformers which are supplied from the 66-kV busbars to serve a 3·3-kV "station board." An interconnection between each "unit board" and the "station board" renders it possible to supply the unit auxiliaries when the station is shut down. Stand-by 3·3-kV auxiliaries are also connected to the station board. Step-down transformers are fed from these 3·3-kV switchboards to supply the smaller auxiliaries.

The 3·3-kV switchgear is all of the English Electric air-break truck type, with a rupturing capacity of 100,000 kVA, while all the 400-V switchgear is of the air-break contactor type and manufactured by Contactor Switchgear, Ltd. Thus we have the unusual, if not unique, picture of a complete power station without any oil-filled switchgear whatever.

Essential supplies in emergency are available from a 230-V lead-acid battery which is charged by pumpless steel cylinder mercury arc rectifiers from which an alternative DC supply can be obtained.

Our thanks are also due to Mr. E. McCabe, generation engineer, and to Mr. J. Palmer Rees, station superintendent, for their help in obtaining the information necessary for this article, and to the latter for his patient assistance in our quest for photographic views best depicting the outstanding and unusual features of the station.

PERSONAL and SOCIAL

News of Men and Women of the Industry

IT is announced by the Admiralty that **Sir James Pringle,** M.I.E.E., is relinquishing the appointment of Director of Electrical Engineering on March 31st. He will be succeeded by **Mr. H. D. MacLaren,** D.F.C., who is at present the acting Assistant Director of Electrical Engineering.

Following the appointment of **Mr. C. S. Brookes,** A.M.I.E.E., as electrical engineer and manager at Southwark, the position of deputy engineer and manager is vacant and an advertisement in our last issue invited applications for the post. The salary is in accordance with the N.J.B. Schedule, Class E, Grade 1 (London Area), and the present commencing salary is £732 per annum.

The new engineer, Mr. Brookes, was educated at Hereford Secondary School and Bolton Technical School. He received his training as an articled pupil of the borough electrical engineer at Hereford and between 1922 and 1924 served as switchboard attendant and afterwards as shift charge engineer in the undertaking. In the latter year he went to the Blaydon power station of the Newcastle-on-Tyne (now North-Eastern) Electric Supply Co. as temporary senior assistant and subsequently served as shift engineer at Bury before going to Darwen (Lancs) as shift charge engineer. In 1927 he joined the Peterborough Corporation Electricity Department as control engineer and assistant shift charge engineer and in 1933 became assistant mains engineer. He obtained an appointment with the Basingstoke Corporation Electricity Department in 1936 as junior assistant engineer, responsible for the mains department, and in the following year was appointed senior assistant engineer, this position being next to that of the borough electrical engineer. In 1940 he went to Nuneaton as principal technical assistant and in 1941 was appointed deputy electrical engineer and manager at Southwark.

Mr. C. S. Brookes

Mr. F. J. B. Chambers has been appointed general manager of the wholesale electrical division of the Artlang Manufacturing Co., Ltd. Until recently he was with Celestion, Ltd., and before the war was chief of the sales department of the Woking Electricity Supply Co., Ltd. Mr. H. Lewis is no longer connected with the Artlang company.

Philips Lamps, Ltd., Bristol, held their annual staff dance at the Victoria Rooms on February 9th. Five hundred people attended the function and two well-known dance bands provided continuous dancing from 7 to 11 p.m. The arrangement of dances was carried out under the control of Mr. H. Gwilliam, who organised competition events. Several people from Philips' London office were present. One of the principal guests was Mr. E. Stroud, president of the Illuminating Engineering Society, and many members of the Bath-Bristol Centre attended. Philips will be organising next season's dance in November.

Mr. Leslie Gamage (vice-chairman and joint managing director, General Electric Co., Ltd.) was re-elected president for the third year at the recent annual meeting of the Institute of Export.

On February 3rd the junior staff at Magnet House, Kingsway, London, W.C.2, were once again luncheon guests of the **Hon. Mrs. Gamage,** wife of Mr. Leslie Gamage. Afterwards they were entertained at the Stoll Theatre, Kingsway, where they saw J. M. Barrie's fantasy, "Peter Pan."

Lieut. (E) J. S. Anderson, R.N., son of Mr. S. Anderson, power station superintendent, Northampton Electric Light & Power Co., Ltd., has been awarded the M.B.E. "for outstanding courage and skill in life saving and in damage control."

Mr. T. G. Sandy, of George E. Taylor & Co. (London), Ltd., was recently invested with the M.B.E. for his services in connection with important electrical work carried out for the Admiralty in the Arctic.

Mr. A. E. L. Chorlton, M.P., has resigned from the position of chairman and director of Lancashire Dynamo & Crypto, Ltd., owing to pressure of other business. He is succeeded as chairman by **Mr. H. W. Bosworth,** managing director of the company.

The Standing Joint Committee of the Associated Municipal Electrical Engineers and E.P.E.A. has withdrawn its objection to its members applying for the position of engineer and manager of Blackpool Electricity Department.

Lieut.-Col. Sydney Smith, a joint managing director of Phelon & Moore, Ltd., and a director of the Cleckheaton Engineering & Motor Co., Ltd., has been appointed a director of the Yorkshire Electric Power Co.

Mr. Stuart Evans, managing director of Evans & Wheeler (Electrical Engineers), Ltd., has accepted the invitation of the Hoylake Urban District Council to be its chairman for the ensuing year.

A new wartime record for attendance marked the occasion of the Students' Lecture by **Dr. W. Wilson** to the London Students' Section of the Institution of Electrical Engineers on February 13th, over 430 members and friends being present in the lecture theatre.

Mr. C. C. Hill, B.Sc. (Eng.), M.I.E.E., deputy engineer and manager, Brighton electricity undertaking, has been appointed assistant general manager of the Northmet Power Co. as from May 1st. Consequent upon this the following appointments have been made at Brighton: **Mr. T. Yule,** M.Eng., A.M.I.Mech.E., power station superintendent, becomes deputy engineer and manager, and **Mr. W. J. Gibbons,** A.M.I.E.E., assistant power station superintendent, is promoted to take his place. Mr. Gibbons in turn is succeeded by **Mr. G. R. A.**

Carr, A.M.I.E.E., electrical maintenance and construction engineer. **Mr. F. Lynn,** at present sales engineer, becomes chief commercial assistant and sales engineer.

Mr. Hill was at the Brighton Technical College from 1920 to 1923 and while there took the London B.Sc. (Eng.) degree as an external student. From 1924 to 1926 he served a post-graduate apprenticeship with the Metropolitan-Vickers Electrical Co. and for three subsequent years gained experience with the company in London and Newcastle, upon the erection of power station plant and the installation of mining equipment. In 1929 he joined the Brighton Electricity Department as electrical technical assistant, later becoming assistant manager and deputy engineer.

Obituary

Professor F. G. Baily.—The death is announced from Edinburgh of Professor Francis Gibson Baily, M.A. (Cantab), F.R.S.E., who retired from the Chair of Electrical Engineering at Heriot-Watt College in 1933. He was in his seventy-seventh year. Professor Baily was educated at the University College School, London, and the Mining College, Germany, and he obtained the Natural Science Tripos (1st class), Parts I and II at Cambridge. In 1889 he served as a pupil with James Simpson & Co., pump makers, Pimlico, and during the following two years with Siemens Brothers & Co., at Woolwich. In 1892 he entered the Department of Electrotechnics, University College, Liverpool, under Sir Oliver Lodge where he remained for three years until taking up his appointment at Heriot-Watt College in 1896. He acted as examiner in science and engineering for the Civil Service and Cambridge, London, Edinburgh and other universities. In addition he undertook a considerable amount of consulting work, particularly in connection with electrical installations in country houses, hospitals, factories, etc. During the last war he was with the Ministry of Munitions and the War Office.

The late Professor F. G. Baily

His research work dealt with hysteresis in rotating and alternating magnetic fields, terrestrial magnetism, earth currents, etc. He became a member of the I.E.E., in 1900 and had served as chairman of the Scottish Centre. He was President of the Engineering Section of the British Association in 1934 and was also. a member of a number of Scottish associations.

Professor William Brown, B.Sc., M.I.E.E., formerly Professor of Applied Physics at the Royal College of Science, Dublin, has died in Dublin at the age of eighty-nine. For six years he worked under the late Lord Kelvin, acting as his representative in the construction of the Portrush and Giant's Causeway trams. He was appointed assistant physicist at the Royal College of Science in 1888, later becoming lecturer in electrotechnology and in 1909 Professor of Applied Physics. He was associated with Professor Barrett and Sir Robert Hadfield in research work on the magnetic properties of nickel-iron alloys. For many years he was treasurer of the Dublin Scientific Club and in 1910 was chairman of the I.E.E. Dublin Centre.

Mr. F. B. Collard.—We learn with regret of the death on February 20th of Mr. F. B. Collard, who until his retirement in 1942 was contracts manager to Callender's Cable & Construction Co., Ltd. Mr. Collard joined the company in May, 1895, and among the many important underground cable contracts for which he was responsible were the laying of a 6,000-V trunk main from Wallsend to Newcastle in 1901, when this voltage was considered very high. He was also in charge of the Metropolitan Electric Tramways contract in Middlesex, which was commenced in 1902 and continued for seven years. This was the largest single tramway electrification contract ever undertaken and included 57 miles of double track. In 1914 he was chief of the South Midlands District in connection with the G.P.O. development scheme. He was appointed engineer for the London District in January, 1923, and became responsible for the laying of super-voltage cables in many parts of London and surrounding districts for all the important London electric power companies. In June, 1929, he became contracts manager.

The late Mr. F. B. Collard

Mr. E. Calvert.—We regret to report the death on February 21st at the age of seventy-three of Mr. Edward Calvert, M.I.E.E., M.I.Mech.E., who until his retirement in March, 1936, was general manager and engineer of the Finchley Borough Council Electricity Department. Mr. Calvert was Finchley Council's first electrical engineer, being appointed on the establishment of the undertaking in 1901. For a number of years he was secretary of the Associated Muncipal Electrical Engineers and was on the Council of the Incorporated Municipal Electrical Association. He was one of the first members of the registration board and the executive committee of the National Register of Electrical Installation Contractors, to which body he was appointed technical adviser on his retirement from the Finchley undertaking in 1932.

The late Mr. E. Calvert

Mr. F. Ross.—The *New Zealand Electrical Journal* reports the death, after a brief illness, of Mr. Frank Ross, secretary of the N.Z. Electrical Traders' Federation, Cable Makers' Association, N.Z. Electric Lamp Manufacturers' Association and other trade organisations. He was fifty-six.

Tidal Power

Engineers' Report on the Severn Barrage Scheme

IN November, 1943, a panel of engineers was appointed by the Ministry of Fuel and Power to review the conclusions of the Severn Barrage Committee of 1933. The findings of the panel, the members of which were Mr. A. G. Vaughan-Lee, Sir William Halcrow and Mr. S. B. Donkin, have been issued this week in a document of thirty-two pages, including six appendices dealing with details, many of which are presented as curves and diagrams. (Stationery Office, 2s. 6d. net.)

The new Report agrees that English Stones provides the best site but proposes a different arrangement of sluices. The advantages of single-tide working are confirmed. The scheme is considered as a power scheme only. Since 1933, conditions have altered considerably, mainly as a result of the development of larger turbines and alternators, of grid interconnection and of increases in the price of coal. The original proposal for an ancillary system of pumped storage would, it was found, increase the capital cost of the scheme to-day by about 40 per cent. with a loss of 27 per cent. of the tidal energy, and it is considered that it is not essential and would not be economical.

The scheme now proposed envisages the installation of thirty-two generating units, each of 25,000 kW at 0·9 power factor, in two turbine dams. The turbines would be of the vertical-shaft Kaplan type running at not more than 50 RPM. Switching could be done at two substations on the Monmouth and Gloucester banks of the river.

Estimate of Available Power

Power available at spring tides would be 800,000 kW, allowing for overload capacity of the generating sets, and 2,365 million kWh generated, but restrictions necessitated by the absorptive capacity of the grid and transmission losses would reduce the effective output at the reception points to an annual average of 2,107 million kWh up to 1970. Of the maximum power, 400,000 kW would be transmitted to South-East and East England by four 220-kV circuits, 200,000 kW to Central England by two 220-kV circuits and 200,000 kW to South-West England and South Wales by six (already existing) 132-kV circuits.

Capital expenditure, based on an increase of 65 per cent. on 1936 prices, is estimated at £36 million for civil engineering works, plant and contingencies, plus £4·2 million as capitalised interest at 3 per cent. during construction, and £6·4 million for the transmission system, plus £0·4 million as capitalised interest, making £47 million in the aggregate. Interest and sinking fund charges have been taken at 3 per cent. per annum and the following repayment periods have been assumed: Civil engineering works, 80 years; power station plant, 35 years; transformers and switchgear, 20 years; transmission lines, 25 years. It is suggested that similar relief to that allowed for new hydro-electric stations in Scotland should be applicable to the Severn Barrage.

Total annual charges without transmission are assumed to be: Interest, £1,206,501; sinking fund, £350,727; operation and rates, £350,000; making a total of £1,907,228 or 4·74 per cent. on capital. Including transmission, these charges become £1,410,201, £555,038 and £450,000, making a total of £2,415,239 or 5·14 per cent. on capital.

Costs and Coal Saving

Overall costs per kWh are: Maximum at Barrage, 2,365 million kWh, 0·193d.; average for fifteen years from 1955 with restricted output at Barrage substations, 2,190 million kWh, 0·209d.; at reception points, 2,107 million kWh, 0·275d.; without restriction at Barrage substations, 2,294 million kWh, 0·199; at reception points, 2,207 million kWh, 0·262d. With coal saved at the estimated rate of 1·046 lb. per kWh (representing an average of 985,000 tons during the first fifteen years) the cost of coal into power station bunkers would have to be 37s. 3d. per ton to justify economically the figure of 0·209d. per kWh. Including full costs of transmission, the estimated cost at reception points of 0·275d. per kWh would correspond to 49s. 1d. per ton, as compared with an average price of 42s. 2d. for coal into bunkers in Southern England in August, 1944. After 80 years the capital cost of the civil engineering works would be written off, although these would have been maintained in a sound and usable condition, thus halving the total annual charges.

Quantities of materials required are estimated at 565,000 tons of cement, 251,600 tons of iron and steel and 20,000 tons of steel alloys and other materials, in addition to 4,512,000 tons of stone, granite, gravel, etc., most of which would be obtainable locally. Labour requirements (including transmission) would average annually over eight years 5,023 men directly employed and 6,704 employed in the manufacture of equipment. If the work started in 1947 the scheme could be put into commission in 1955, but some energy might be available earlier.

Television Transmission

Causes of Interference and Remedies

MULTIPATH interference with television transmission by signal reflections from buildings is dealt with in a paper by MR. D. I. LAWSON (Pye, Ltd.), read before the Radio Section of the Institution of Electrical Engineers on Wednesday.

Calculation of the field strength of reflections from idealised obstructions for various wavelengths and different distances between transmitter and receiver indicate that, although interference increases with frequency, most of it could be eliminated by the use of a simple directive antenna. The conclusion is that buildings near to the transmitter are not likely to be troublesome and that most interference will be caused by buildings to the flank and rear of the receiver. Even the worst case considered, with 405-line transmission, could be remedied by the employment of a small parabolic reflector about 1 ft. in diameter, while a simple dipole reflector would remove most of the trouble likely to be experienced on longer wavelengths. The size of the parabola might have to be increased by about 50 per cent. if the number of lines transmitted were doubled.

Polarisation of the transmitted wave has not been dealt with in this paper, but the author puts forward a plea for its consideration. If the wave is vertically polarised, the vertical surface of a building will have a reflecting coefficient that is independent of the angle of incidence; whereas a horizontally polarised transmission will be little reflected from a vertical surface at angles of incidence near to the Brewster angle.

Reference is made to a series of experiments carried out in America since this paper was written, which seem to suggest the existence of an unusual phenomenon that is not in accordance with present electromagnetic theory. The author rather suspects the effect to be not one of propagation, but due to some inadvertent frequency modulation at the transmitter.

Reclaiming Components

Electrodeposition Processes

THE reclamation and hardening of engineering components by electrodeposition is the subject of a paper by MR. H. MERRYWEATHER (Brailey Electrodepositors, Ltd.) which was read before the Manchester Association of Engineers last Friday.

The author differentiates between firms which undertake decorative plating, including various rust-proofing and utility finishing processes, and those which specialise in thick, homogeneous, firmly adherent deposits or thin coatings deposited to prescribed limits. The latter are very much in the minority, it being doubtful whether the work of more than ten firms in the British Isles is fully approved by the Armament Research Department of the Ministry of Supply for reclamation and hardening and by the Aeronautical Inspection Department of the Ministry of Aircraft Production for thin protective coatings.

Nickel and chromium are prominent salvage media. The advantages of cadmium for thin coatings tend to be overlooked; it makes a better, speedier and less costly job and its soft clinging properties render unnecessary final machining or grinding back to size. The paper contains useful recommendations relative to thickness of coatings and practical comments on their hardness factors, processing methods and control of deposits to specified limits. Examples of different applications are cited, but great difficulty is still encountered in the establishment of costing systems because of the varying nature of the work. Reclamation is most difficult, involving various types of suspension jigs and often causing unbalanced vat loadings, whereas chrome hardening and protection against abrasion are cheaper and speedier because they are usually done in larger quantities. Nickel can be applied to greater thicknesses than chromium, thus covering wider applications.

What were originally salvage operations are now being increasingly included in manufacturing specifications as preventive and protective processes. For instance, experience proved that salvaged aero-engine cylinder liners were capable of many more flying hours than untreated liners. Thus it has not only become essential to provide quality and thickness specifications, but also to ensure that the firm approached is capable of executing the work to the standards required.

Distant-reading Compass

Improved Aircraft Navigation

AN ingenious instrument, recently removed from the secret list, that has contributed materially to the better navigation of Bomber Command aircraft is a distant-reading compass which has been made in large numbers by more than one electrical manufacturer in England. It was designed by the R.A.E. in order to improve upon the ordinary magnetic compass, which functions normally only when the aircraft is flying on a dead level course. This was a distinct disadvantage in operational flying as, after dropping his bombs, a pilot should be able to take evasive action rather than be forced to fly straight for a spell in order to be able to take his bearing. It was also found that in the cockpit interference from electrical circuits and various metals was considerable. The D.R. compass overcomes these disadvantages. All interference is damped out and the pilot can "weave" with impunity. Also the compass remains unaffected by vibration from heavy gunfire, abnormal changes in speed, high altitudes, etc., and it can find the difference between true and magnetic north.

Ferranti, Ltd., were asked to tackle this complicated piece of apparatus in 1941, and using their own plant and equipment, buildings and skilled workpeople turned out an instrument within twelve months of the placing of a contract. The compass comprises a master unit, which is normally carried in the tail of the aircraft as far away as possible from magnetic disturbances, combining a gyroscopic direction indicator and a magnetic compass, each of which has the effect of checking on the other. Repeaters, situated elsewhere in the aircraft, transmit the indications of the compass and thus, by aligning the pointer and grid lines in the face of the repeater and then keeping the pointer and grid lines parallel, the pilot can steer his course. The directional indicators are also capable of controlling "George" (the automatic pilot) and among other instruments the Mark XIV bombsight.

CORRESPONDENCE

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

C.E.B. Supplies

NOW that the restrictions on the public use of data relating to electricity supply have been eased, it would be of considerable interest to the industry if more detailed information could be made available in regard to the operation of the 1926 Act.

To what extent, for instance, has the C.E.B. been able to give effect to the provision in Section 2 of the Act under which it is "charged with the duty of supplying electricity to authorised undertakings in accordance with the provisions of this Act", one of the provisions being (Section 10 (*a*)) that "the Board shall not supply electricity directly to authorised undertakers situated in the area of supply of a power company, etc."?

Again, it would be enlightening to know what proportion of the Board's revenue from the sale of electricity to authorised undertakers, is derived from sales under Sections 7, 11 and 13 of the Act. From time to time one hears values given to these proportions, which, if approximately correct, appear to show that the purpose and intention of the 1926 Act is being frustrated from a national standpoint by the continued existence of Section 13.

W. J. COOPER,
Hamilton. *Burgh Electrical Engineer.*

Vegetable Boilers

WITH reference to the letter signed "Progress" in your issue of February 16th on this subject, may I point out that electric vegetable boilers have been supplied by the makers of electric cooking equipment since about 1911 and that they have proved entirely satisfactory? During the war, however, there have been severe Government restrictions on the use of certain essential materials and for this reason it has not been possible to supply such boilers except in very limited quantities, chiefly for Government purposes.

Your correspondent may rest assured that as soon as the necessary materials are again obtainable, ample supplies of these boilers will be available for hotels, restaurants, canteen kitchens and other purposes.

POST-WAR.

Switches in the Neutral

THE other day I discovered accidentally that three tumbler switches in different parts of my house were connected in the neutral instead of in the phase. Two were installed over twenty-five years ago, the third within the last three years. Is it not possible for the industry to take steps to protect the life of the domestic consumer from the dangers set up by the carelessness of incompetent wiremen? It seems to me that the registration of electrical contractors (and their authorisation by supply authorities) coupled with the better and more regular inspection of domestic installations by supply authorities, is necessary.

More than 90 per cent. of domestic electrical consumers have no electro-technical knowledge and their lives are in the hands of the different sections of the industry—the supply authority, the manufacturer of apparatus, and the wireman. If any one of these sections fails in its duty to its customer, the efforts of the other two are nullified. It is the wireman or contractor who is in direct communication with the consumer, and who normally acts as adviser and consultant to him, and I suggest that so long as any person, trained or untrained, can come into the industry at will, and represent himself to be an electrical contractor, accepting payment for work however badly done, so long will the consumer be in danger.

Manchester. THOMAS ATHERTON.

Gas for Power Stations

MAY I put forward a scheme for co-operation between electricity and gas undertakings which to my mind would help our consumers and which I would recommend to the Fuel Advisory Council? Would it not be a great saving if gas was not used by domestic consumers and electricity catered for all their requirements? Gas could then be utilised by the electric power stations together with pulverised coal so that the gas undertakings would lose nothing. It is surely a waste of labour and material to have two competitive mains serving one purpose and if electricity became the sole source of lighting, heating and cooking, the electricity undertakings could lay larger mains to cater for the combined load at little extra cost. In addition central heating by electricity would provide a night (off-peak) load thus improving diversity factor.

Sevenoaks. A. M. J. ROPER.

Universal Domestic Tariff

ANSWERING Mr. Crowsley's letter published in your issue of February 16th, I would again point out some confusion in his statements. Take for example his remark "I see no logical reason for reducing the price to an individual consumer for an increase in load only." Surely, in view of the arbitrary nature of the fixed charge of

existing domestic two-part tariffs, such a statement has no practical relevance.

Then again, one cannot isolate load from consumption even though the two factors may not be *pro rata*. What Mr. Crowsley has overlooked is that in normal times the domestic kWh charge contains a component which is allocated to standing charges, and the fact that this component may have vanished under the present unhappy circumstances was quite outside the scope of my article.

Regarding Mr. Crowsley's hypothetical manufacturer, it is an old-fashioned custom in many undertakings to give manufacturers a block-rate tariff in which bigger consumption qualifies for a reduction in cost. Whether the bigger consumption is obtained in a desirable manner is just as debatable as whether the increase in demand of a domestic consumer is accompanied by a remunerative consumption of kWh, so again Mr. Crowsley's reasoning is hardly convincing. In any case, the previous paragraph should supply him with material for an adequate defence if the question does ever crop up.

Forty years' experience has shown the impracticability of trying to measure the demand of individual domestic consumers. The engineer must guide the domestic consumer in his installation expenditure so as to produce the desirable overall electrical results. It seems to me to be far better actually to spend money to this end than to buy fantastic devices designed to prevent or discourage consumers from using electricity. My proposed tariff seems better able to meet these future requirements than any other I have encountered.

Wolverhampton. J. L. FERNS.

Synchronous Machinery

Consideration of Stray Losses

AN endeavour to focus attention on the more important components of stray losses in synchronous electrical machinery is made by MR. P. RICHARDSON (C. A. Parsons & Co., Ltd.) in a paper submitted to the Institution of Electrical Engineers yesterday (Thursday).

The author first discusses the influence of the physical arrangement of an alternator on the eddy currents and then goes on to classify the components of stray losses, showing how the arrangement of the end-windings of a machine affect the shape of the end leakage field and thus the intensity of loss in the adjacent metallic structures, and how the loss in the core end-plate or end-shield can be estimated. The effect of magnetic and non-magnetic shielding arrangements is discussed, together with details of their arrangement. Experiments in connection with eddy-current losses in the stator end connections are described. Consideration is given to the iron loss which occurs in the stator core under steady 3-phase short-circuit conditions owing to the flux wave-shape, and the indications are that this provides at least a partial explanation why the stray losses can be so appreciably greater on short-circuit than they are on load.

Rotor and Pole-face Losses

The stray losses in the rotor are shown to be due to several effects, notably the concentration of ampere-conductors in one slot and irregularities present in the stator m.m.f. wave. Consideration is also given to the surface or pole-face losses resulting from the "tufting" of flux under the stator teeth, which loss is experienced under conditions of no load and is normally measured with the stator iron loss. The factors affecting the surface losses are discussed, together with methods for reducing them.

An indication is given of the relationship between the stay losses at the ends and those within the core length of an alternator, together with a description of the effect of load conditions on each of the components of stray loss.

The hope is expressed that when the relevant British Standard Specifications are revised consideration will be given to methods of estimating and allowing for stray losses in such a manner that the figures obtained will more nearly represent the true efficiency on load.

Queensland Proposals

Suggested Regional Authorities

THE Queensland Electricity Commission was constituted in January, 1938, for a term of seven years, which has now expired. In its report for the year ended June 30th last a detailed report of its activities during the seven years is given and proposals are made for the future. The Commission states that a parochial outlook on the part of local authorities has prevented the spread of electricity to the rural community and the tariffs have not been attractive enough to promote the use of electricity. It recommends the elimination of small undertakings, wherever possible. The application of regional planning is suggested. Actual development should be under the immediate control of regional authorities entirely separate from the local authorities and it is proposed that the Commission itself should control and direct the regional authorities. Two five-year programmes are suggested and a sum of £11,000,000 is mentioned as necessary expenditure for the development of four of the sixteen regions into which it is proposed that the State shall be divided.

Smoke Abatement

Conference in London

A JOINT conference of the Institute of Fuel and the National Smoke Abatement Society was held in London last week.

The effects of the Society's efforts are becoming manifest in the evidence of official approbation and wide support detailed in its fifteenth annual report for the year 1944, which contains information about the Society's constitution and objects, as well as showing the need for building up a reserve fund for extending activities during the next few years.

The conference was opened by Mr. TOM SMITH (Parliamentary Secretary to the Ministry of Fuel and Power), who said that because of the great importance of reducing domestic smoke the Minister had referred the matter of domestic heating to the newly appointed Fuel and Power Advisory Council as a subject of the highest priority. The gas and electricity industries would have to improve distribution and reduce cost. He could not discuss Government policy on that occasion, but the Heyworth Committee was looking into the gas industry and there had been a good deal of discussion with regard to policy concerning electricity.

In one of the eight short papers which were presented on different aspects of the subject Mr. John Bruce dealt with the cleaning of boiler plant flue gases in electricity generating stations. He drew attention to the more important of the Electricity Commissioners' recommendations (published in 1932) and to the conclusions reached by their Chimney Emissions Committee, as well as to methods of testing dust extraction plant (B.S.S. 893–1940), the development and selection of the latter being also commented upon. The author claimed that the electricity supply industry had done, and was doing, all that was scientifically and at present commercially possible to prevent atmospheric pollution by flue gases.

Gas Washing Plant

In the discussion following the papers SIR JOHN KENNEDY (vice-chairman, Electricity Commission) said the electricity supply industry had for many years been forced to consider the reduction of pollution because, if it had not made every possible endeavour to burn coal efficiently, it would not have been able to sell electricity at prices which the consumer could afford to pay. Furthermore, the Electricity Commissioners had been making more and more stringent conditions with regard to the extensions of existing power stations and the establishment of new ones and had insisted on the installation of the latest types of plant for the removal of grit from the flue gases. In the case of new power stations, the Commissioners insisted on space being left for the installation at a later date, if required, of gas washing plant for the removal of sulphur from the flue gases. That process was expensive and added to the cost of electricity, so at the request of the Commissioners not very long ago the Department of Scientific and Industrial Research set up a committee to make recommendations as to what form, if any, of gas washing plant should be installed in the future.

The electricity supply industry, although it was always prepared to play its full part in improving atmospheric conditions, did not feel that it ought to be penalised by insistence on gas washing plants in power stations unless similar conditions were imposed upon industry generally.

The combination of the supply of heat (in the form of steam and electricity) from power stations was under consideration by a subcommittee of the Heating and Ventilating Committee. A semi-political point as regarded conditions being imposed upon industry generally concerning cleaning of flue gases was that industrial power stations benefited from de-rating whereas public electric power stations had to pay rates in full.

Electrostatic Precipitation

With regard to the removal of grit from flue gases from pulverised fuel furnaces, he knew of no method except electrostatic precipitation. Another problem with pulverised fuel was the disposal of the ash after it had been removed from the flue gases, which was by no means an easy matter. In the electricity supply industry it was the practice to replace the whole of the generating plant every twenty years, and it had been found economic to do so. He would have thought the same would apply to steel and other furnaces which he had seen in Sheffield. Owing to the poor qualities of coal received during the war the extraction plants had not been able to cope with the situation and some steps would have to be taken with regard to those plants unless better qualities of coal were received in the future.

He considered that Mr. Blackie's table of comparative emissions of sulphur from coal, gas and electricity was not quite fair because, unless gas and coke were made from coal which had a lower sulphur content than the coal used in the generation of electricity, the total sulphur emission must be approximately the same. As to the new forms of domestic

grate that were being evolved, it rather appeared that the housewife would have to be trained as an expert stoker, and he felt there would be an inclination to change over to electricity or gas rather than handle the rather delicate apparatus which had been referred to.

Finally, with regard to railway smoke, Sir John said the obvious solution was the electrification of the railways, which would not only result in a saving of two-thirds of the coal used on steam railways, but would also mean that the coal required was burned under controlled conditions in a power house.

MR. G. P. TINKER (Birmingham Electric Furnaces, Ltd.) said sufficient credit had not been given to one type of furnace which was outstanding as regarded atmospheric pollution. The electric furnace had proved itself both efficient and reliable. Its efficiency quite easily reached 80 per cent. and even higher.

Canadian Water Power

Wartime Expansion Completed

THE Dominion Water and Power Bureau, Department of Mines and Resources of Canada, has issued its annual review of hydro-electric progress in the Dominion. This indicates that the programme of wartime expansion in hydro-electric facilities has been virtually completed and that power production for war purposes appears to have passed its peak.

New installations during the year aggregated 68,700 HP, increasing Canada's total hydraulic development to 10,283,213 HP. This is the smallest annual increase since 1939 and no large power projects are at present under construction. Last year's addition was almost wholly due to the completion of the Brilliant plant (68,000 HP) on the Kootenay River in British Columbia. Other activities during 1944 comprised, chiefly, improvements in transmission networks and substation facilities and the extension of electric services in certain rural areas. The monthly figures of output of central electric stations issued by the Dominion Bureau of Statistics indicates that the generation of electricity in 1944 will be about the same as in 1943 (40,378 million kWh).

Approximately one-fifth of Canada's total water-power plant, or 2,000,000 HP, has been installed in the past five years, almost wholly for war purposes, in addition to which much of the power developed before the war has been diverted from peacetime to wartime use. One industry alone—aluminium—has utilised at peak production one-quarter of all hydro-electric energy consumed in the Dominion. In the period of readjustment from war to peace, the initial effects of which are already in evidence, it can be anticipated that power surpluses will develop in certain areas. For the most part these surpluses should be moderate and should be absorbed within a reasonable time as industries change over from wartime to peacetime production. In the Province of Quebec, however, there is a special situation, brought about by the wartime development of water power for the aluminium industry, which may lead to a large power surplus centred in the Saguenay River district unless new uses for aluminium and adequate post-war export markets enable this Canadian industry to maintain operations at a high level or other large-power-consuming industries are attracted to the area.

Parliamentary News

By our Special Reporter

Severn Barrage

IN the House of Commons on February 20th, Mr. J. Griffiths asked the Minister of Fuel and Power, if he had now considered the report on the suggested Severn Barrage and if he could make a statement as to the Government's policy.

Major Lloyd George said he was engaged in examining the report of the panel of experts on the proposed Severn Barrage, but he was not yet in a position to make a statement on the policy to be adopted towards the proposal.

Central Board's Policy

Mr. Ellis Smith asked the Minister of Fuel and Power if he had given consideration to the report and policy of the Central Electricity Board; was he satisfied with that policy; and what steps were being taken to bring about an increase in power to be distributed as cheaply and as soon as possible after the termination of hostilities.

Major Lloyd George said he was constantly in consultation with the Board and was satisfied with the policy which it had pursued with regard to the provision of adequate supplies of electricity. He would like to take this opportunity of expressing his appreciation of the services that the Board had rendered during the war. The increase in generating capacity to be provided during the next few years was receiving his active consideration but he was not yet in a position to make any statement.

Power Plant Production

On February 22nd Mr. Higgs asked the Minister of Labour what provision he was making for releasing labour in order to accelerate the manufacture of the 3,000,000 kW of new electrical plant that was to be installed before the winter of 1948.

Mr. Bevin said that this at present was regarded as post-war production, and it could not be given labour which might otherwise be employed on war production. Subject to this, his department would do what it could to supply labour, as he was well aware of the importance of heavy electrical plant.

State Trading in New Zealand

IN the debate on the Statutes Amendment Bill in the New Zealand House of Representatives exception was taken to several clauses empowering the Minister of Works to purchase and sell electrical appliances. It was suggested that this was another instalment of State competition against the private trader. Mr. Semple replied that the powers had already been in operation in the former Southland E.P.B. district where the State took over the concern after the original authority had " made a bungle of it." The clause was general, but the Government did not intend to apply the principle generally.

COMMERCE and INDUSTRY

Restrictions on New Capital. Spreading Industrial Employment.

Aluminium Price Cut

SINCE 1940 the Ministry of Aircraft Production has been the sole seller of virgin aluminium in the United Kingdom. As from March 1st this control is relaxed to the extent that rolling blocks and slabs, billets and wire bars will be obtainable under licence issued by the Light Metals Control. At the same time the price per ton of virgin aluminium in ingot or notch bar form is reduced from £110 (the price fixed in 1939) to £85 delivered at consumers' premises. The pre-war price of aluminium ingots was £94 per ton.

Control of Capital Issues

Sir John Anderson stated in the House of Commons last week that the Treasury regulations relating to the issue of new capital are to be maintained. He said that it had been the policy that essential non-Government issues should not be made to the public but placed with investment institutions. This, too, will continue and these institutions will be asked to agree, as a condition of sanction, that they will not sell any stock or apply for permission to deal for six months and then to apply to the Capital Issues Committee if permission to deal is desired.

These arrangements apply only to present conditions. During the change-over period there will be relaxation but a measure of control will still have to be exercised to ensure an orderly flow of investment.

Several issues of capital which had been held up in anticipation of a statement by the Chancellor of the Exchequer are now being placed. Among them is an issue of £1,500,000 of 3¼ per cent. second mortgage debenture stock of the North Metropolitan Power Station Co. Of this £825,500 is to be devoted to the extension of the company's power stations and the balance to the conversion of the company's 5 per cent. second mortgage debenture stock. Another placing is £412,300 of 3¼ per cent. debenture stock of the Yorkshire Electric Power Co. to finance extensions.

Distribution of Industry

The Distribution of Industry Bill now before Parliament is designed to secure an even spread of employment throughout the country by the development of areas in which there is a special danger of lack of industry. It empowers the Board of Trade to acquire land in development areas and prepare sites for the provision of factories and other industrial buildings. The Board is also empowered to make loans to non-profit-making trading or industrial estate companies to further the provision of industrial premises in these areas. Under Clause 4 the Treasury may give financial assistance in respect of capital requirements of industrial undertakings in the areas by means of annual grants or loans. The Bill repeals the Special Areas (Development and Improvement) Acts, 1934 and 1937, and provides for the winding-up of existing arrangements, including the continuance of any agreement with a Commissioner by the appropriate Minister. The development areas are specified in the first schedule; they are the North-Eastern, West Cumberland, South Wales and Monmouthshire and the Scottish areas.

The Bill also makes it necessary for the Board of Trade to be notified of all proposals to erect industrial buildings with an aggregate floor space exceeding 3,000 sq. ft. and forming part of new industrial units. In certain areas the erection or extension of industrial buildings with an aggregate floor space of over 3,000 sq. ft. will be subject to the consent of the Board of Trade but certain classes of building may be exempted from these requirements. The second schedule deals with the compulsory acquisition of land.

Commodity Insurance Scheme

The Board of Trade announces that all policies for fixed sums under the Commodity Insurance Scheme which are in force on March 2nd (whether policies extended without payment from December 2nd or new policies), will be extended until June 2nd without further payment of premium or the necessity for further action. Holders of adjustable policies will be required to continue weekly declarations and to pay premium on any excess of the average cover during the three months of extension over the average cover in the three months ending December 2nd or, in the case of policies effected during the period ending March 2nd on any excess over the average cover in that period. For new or additional insurance the rate of premium will continue to be 2s. 6d. per cent. for the three months March 3rd to June 2nd, with a minimum of 5s.

Northern Ireland Industry

It has been announced by Sir Basil Brooke, Prime Minister of Northern Ireland, that he intends to visit London to see Mr. Churchill and other Ministers regarding means of maintaining employment in Ulster. The Northern Ireland Government, he says, is endeavouring to attract new industries and he specifically mentions vacuum cleaners, dry cells, thermostatic apparatus and "general electrical equipment."

Australian Imports

Certain particulars relating to Australia's overseas trade are now being released. For 1942-43 summarised figures of imports have been issued and for 1941-42 full details. In 1942-43 the total value of electrical machinery and appliances imported into Australia was £4,078,000 (compared with £3,650,000 in 1941-42), classified as follows:—Cable and wire, covered, £1,014,000 (£1,029,000); dynamo electric machines, £559,000 (£581,000); telegraph instruments, telephones and telephone switchboards, £401,000 (£368,000); lamps £135,000 (£179,000); batteries and accumulators,

£76,000 (£58,000); and "other" £1,893,000 (£1,435,000). The 1941-42 figures showed a decrease of about 25 per cent. on 1938-39.

A comparison of the detailed figures for 1941-42 with those of the previous year reveals a whole series of decreases. They extended, on balance, to the cable group, although certain kinds showed an increase. Power plant for the most part also declined. The only outstanding increases were in radio parts and valves and unspecified electrical appliances. The United Kingdom and the United States shared about equally in the loss of trade.

Oil Engine Exports

In order to assist in regaining the export markets for British oil engines a new company, British Oil Engines (Export), Ltd., has now taken over the export sales of engines manufactured by Petters, Ltd., Mirrlees, Bickerton & Day, Ltd., J. & H. McLaren, Ltd., Oil Engines (Coventry), Ltd., and Fielding & Platt, Ltd. Mr. F. S. Mitman is chairman of the company and Captain R. C. Petter has been appointed managing director. Messrs. A. P. Good, A. P. Quarrell, S. A. Lane and F. A. Vaughan are also on the board. Temporary offices have been obtained at 27, Gilbert Street, London, W.1 (tel.: Mayfair 0352).

The company will be able to offer a complete range of engines from 1½ to 1,500 BHP for industrial, marine and traction purposes. Over 150 agents have already been appointed, with resident superintendents for India, Australia, South Africa and Central America. Certain territories are not yet covered and firms of first-class standing with technical organisations who are interested in representation are invited to communicate with the company at the above address.

Fifty Years of Wireless

Commercial wireless communication is about to celebrate its jubilee, for it was in the early summer of 1895 that Marconi began the experiments in transmitting signals through space by means of Hertzian waves. The famous British patent No. 12,039 of June 2nd, 1896, the foundation of the wireless industry, was followed in 1897 by the establishment of Marconi's Wireless Telegraph Co., Ltd. (originally the Wireless Telegraph & Signal Co.) which will thus shortly celebrate its own jubilee.

The spade work was done by Marconi and his devoted band of British engineers, including Sir Ambrose Fleming, Messrs. C. S. Franklin, P. W. Paget, G. S. Kemp, Andrew Gray, C. E. Rickard, R. N. Vyvyan, A. H. Ginman and Captain H. J. Round, who, with the exceptions of Marconi and Kemp, are happily still alive to celebrate this jubilee anniversary.

Industrial Concentration

A paper recently read before the Royal Statistical Society on "The Structure of British Industry" by Mr. H. Leak, assistant secretary, Statistics Department, Board of Trade, and Mr. A. Maizels, is reviewed in the *Board of Trade Journal* of February 24th. In the course of this paper the authors deal with the extent to which industries are in the hands of a small number of large producers. They take the "degree of concentration" as represented by the proportion of the total numbers in a trade that is employed by the three largest units in that trade. On these lines they give a list of industries which includes electric vacuum cleaner manufacture (85 per cent. "concentration"), radio valve production (85 per cent.), manufacture of gasfilled electric lamps, 20 V and over (61 per cent.) and telegraph and telephone wires and cables (55 per cent.).

Model Electric Kitchens

Two demonstration electric kitchens were opened in the St. Helens Electricity Showrooms last week by the Mayor (Councillor G. Marsden). The kitchens, in different colour schemes, were illuminated with fluorescent lighting. Appliances on view included thermostatically controlled cookers, water-heaters, washing machines and smaller equipment.

A model post-war electric kitchen illuminated by fluorescent tubes is also being exhibited at Paisley. At the formal opening ceremony, performed by Provost J. Chambers, Lieut.-Col. D. S. Allan, convener of the Electricity Committee, said that the equipment on view could be fitted into the kitchen of any house with a space of 12 ft. by 9 ft.

I.C.I. Fellowships

Members of the Institution of Electrical Engineers who wish to apply for an I.C.I. research fellowship in engineering, tenable at the University of Oxford, can obtain full information from Dr. E. B. Moullin, Department of Engineering Science, Parks Road, Oxford.

I.H.V.E. Examinations

The 1945 examinations for associate membership and graduateship of the Institution of Heating and Ventilating Engineers are to be held on Saturday, April 28th. Completed application forms should be in the hands of the acting secretary of the Institution at 72-74, Victoria Street, S.W.1, by March 5th, at the latest.

Export of Goods

The Board of Trade has published a revised list of goods the exportation of which is controlled under the Export of Goods (Control) (No. 10) Order, 1943. The booklet ("Control of Export," Stationery Office, price 6d. net) shows the position at January 15th last.

Radio Components Exhibition

Although not open to the general public, there was a very large attendance at the three-day exhibition organised in London last week by the Radio Component Manufacturers' Federation under the auspices of the recently formed Radio Industry Council. Admission was restricted to ticket holders for security reasons, the display being intended chiefly to benefit civilian research staffs and technicians serving in the armed forces.

Many of the component parts on view had been "tropicalised" and some were shown totally immersed in water. A prominent feature was the "miniature" size in which many instruments and accessories are now being made for reducing the weight and dimensions of the apparatus into which they are built.

While most of the component parts and materials displayed represented wartime developments incorporated in Service equipment, there is every likelihood that many of them will influence the design of post-war radio receivers for home use.

The equipment displayed by ninety exhibitors included loudspeakers and microphones, transformers and chokes, capacitors, resistors, switches, valve holders, vibrators, multi-circuit plugs and sockets; wires, cables, sleeving, mouldings and the newer insulating materials, as well as a great variety of small accessories and general components.

Technical Education in Scotland

An interim report has been made by a Special Committee of the Advisory Council on Education in Scotland, dealing with technical education. It makes a number of recommendations which still have to be considered by the Secretary of State for Scotland. They relate to the organisation of technical education in central institutions and local technical colleges for those who have left school, and the setting up of national and regional advisory councils is proposed. More generous financial assistance for technical institutions is considered necessary. Copies of the report (3d.) are available from the Stationery Office.

Metric System Advocated

At the recent International Business Conference held at Rye, New York, which was attended by representatives of fifty-two nations: it was recommended that there should be adopted, for use in international trade, a single system of weights and measures, preferably the metric system, and a standardisation of containers with reasonable tolerances. Mr. Harry Allcock, in drawing our attention to this, says that it is a very useful step forward to the time when the producers, distributors and consumers of all classes of goods in all the markets of the world will be described in metric terms.

New Institute of Physics Branch

The Board of the Institute of Physics has authorised the formation of a South Wales Branch which is to be centred on Swansea. The inaugural meeting will take place at 2.30 p.m. on March 10th in the Physics Department of University College, Swansea (Singleton Park), when Dr. C. Sykes, F.R.S., will deliver an illustrated lecture on "Physics in Metallurgy."

Cable Company's Programme

Mr. Laurence Bennett, chairman of the Britannic Electric Cable & Construction Co., Ltd., which is now a member of the Philco Group, said at a recent meeting that it was intended to continue the company's independent policy. It was formed principally to produce paper insulated cables, but a rubber shop to deal with the manufacture of comparatively heavy conductors to meet certain industrial needs was included in the plant. This side of Britannic production had grown considerably during the war, while demands for paper insulated cables had been reduced to the minimum. During the war the plant had been extended and the company had an up-to-date cable laying department. Plans were in hand to effect a quick change over at the end of the war in Europe.

Mr. A. S. McHugh is the managing director of the company. Research and development is catered for by the Philco Group's central research establishment, P.R.T. Laboratories, Ltd., under the director of research Group-Captain C. K. Chandler. The cable research section will be under the direction of Flight-Lieut. Mildner.

B.S.I. Luncheon

The annual luncheon of the British Standards Institution is being held at the Savoy Hotel on Tuesday next, March 6th, at 12.45 for 1 p.m.

All-Electric House Limitation

The Stoke Newington Borough Council has been informed by the Ministry of Health that, on account of supply difficulties, not more than 1,000 of the first 3,000 temporary houses now being delivered can be fitted with electric cookers, and the balance will have to be provided with gas appliances. The Ministry therefore requests the Council, in indicating its wishes on the matter, to limit its request for all-electric houses to not more than one-third of the number of houses to be allocated to the borough. It is hoped that for subsequent deliveries freedom of choice will be possible. The Housing Committee, in its report to the Council on Wednesday, states that the Town Clerk has written to the Ministry urging that all the borough's temporary houses shall be electrically equipped.

Trade Announcement

Lodge-Cottrell, Ltd., have relinquished their wartime office at 16, Church Street, Godalming, and are moving into new offices at Drayton House, Gordon Street, London, W.C.1 (tel.: Euston 5565).

TRADE MARKS

THE following applications have been made for trade marks. Objections may be entered within a month from February 21st:—

MODUPLEX. No. B626,737, Class 9. Wireless telegraphic and telephonic transmitting and receiving apparatus; radio apparatus for converting graphic, printed or pictorial subject matter into electric signals for transmission to a distance, and apparatus for receiving such signals and reproducing the subject matter thereof.—Press Wireless, Inc., Chicago. Address, for service: c/o Frank B. Dehn & Co., Kingsway House, 103, Kingsway, London, W.C.2.

ZEPHYR. No. 627,221, Class 9. Radio receiving apparatus; television receiving and amplifying apparatus; radio valves; phonographs; talking machine records; and batteries. —Zenith Radio Cpn., Chicago. Address for service: c/o Lloyd Wise & Co., 10, New Court, Lincoln's Inn, London, W.C.2.

TYRESOLES. No. 631,484, Class 9. Electrical apparatus and instruments (none being included in other classes) for use in the repair of tyres of india-rubber, artificial rubber or synthetic rubber.—Henry Simon, Ltd., Bird Hall Lane, Cheadle Heath, near Stockport.

Ministry of Fuel and Power

Second Reading of Continuation Bill

THERE was a five-hour debate in the House of Commons on Friday last when Major G. Lloyd George, Minister of Fuel and Power, moved the second reading of the Ministry of Fuel and Power Bill which provides for the continuation of the Ministry after the war. The Minister stressed that the Bill did not seek to continue any of the powers over industry and over consumers given by wartime regulations after the period of emergency was over. That did not mean that he or any future Minister would not be expected to introduce policies affecting the fuel and power industries.

He contended that it was in the post-war period that the claim of the fuel industries to a separate Ministry could best be justified. The Ministry was created to deal with the serious fuel and power situation which was arising in 1942. It had had to meet the same difficulties almost continuously ever since. In spite of this the post-war position had not been entirely overlooked. The Government was examining the future organisation of the generation and distribution of electricity and the organisation of the gas industry. The experts re-examining the Severn Barrage proposals had reported.* The Ministry's Fuel and Power Advisory Council was looking into the problem of domestic heating.

Regional surveys of our coal resources had been completed and would be published as soon as possible and a report on technical steps needed to increase the efficiency of the coal-mining industry would be in his hands fairly soon. Among other matters on which work would be necessary were the utilisation of waste heat from electrical generation and the efficient use of fuel in the future. All these matters would make the Minister's task a whole-time one for many years to come.

Members' Varying Views

During the subsequent debate Mr. David Grenfell expressed the view that the Minister could not face the post-war period successfully unless he possessed much greater powers. He referred particularly to the continued decline in coal production. The Minister must not claim too much for his supervision of the electricity and gas industries which would have run just as well without him. He hoped the House would very soon come to an examination of the problem of carrying out the functions set out in Clause 1 of the Bill relating to the effective and co-ordinated development of coal, petroleum and other minerals and sources of fuel and power and improving the conditions of persons employed in the mines.

Mr. Horrabin supported the Bill and said that if the Ministry were not continued its functions would go back to various Departments and lack of co-ordination would persist. The Bill gave the machinery for a comprehensive co-ordinated fuel policy when the war was over.

On the other hand, Captain Duncan contended that as distribution was a major consideration coal should go back to a Mines Department of the Board of Trade, gas was a matter for the Board of Trade and electricity should go back to the Ministry of Transport. Gas and electricity, competing industries, might use the same or different sources of power. Was it right that in a district one Minister should have to choose between gas and electricity when making an order for the distribution of one or the other?

Lieut.-Col. H. Guest said that the Board of Trade was going to be one of the busiest Departments in the State and whether it would be able to administer fuel, light, etc., was a matter for consideration. We would probably need a Ministry of Fuel and Power but it would be most unwise to set up such a Ministry for all time until the matter of nationalisation or no nationalisation had been settled.

Commander Prior raised the subjects of disparity in systems of electricity supply and of district heating. He said that if the Ministry's functions were distributed among other Ministries it would not be possible to face the great problems of fuel consumption which must arise. Would it be possible for those various Ministers to negotiate with the utility companies and the local authorities to co-ordinate their supplies of electricity and gas? It would be much simpler for one Ministry to conduct these negotiations.

After a number of other members had spoken, mainly on the situation in the mining industry, Mr. Tom Williams, Parliamentary Secretary to the Ministry, wound up the debate and the Bill was read a second time and committed to a committee of the whole House.

* The Report is summarised on page 305.

Technical Teachers' Salaries

PROPOSALS for scales of salary for teachers in technical (and commercial) colleges and institutes, art colleges and art schools have been agreed by the Burnham Technical Committee and are being submitted to the Ministry of Education. The scales apply to full-time teachers employed in these establishments "maintained" by a local education authority and "assisted" schools but not to those departments of a school administered under the Code of Regulations for Secondary Schools.

The proposals provide for four classes of heads of departments with ranges of £600-£750 (women £480-£600); £750-£850 (women £600-£680); £900-£1,000 (women £720-£800); and over £1,000 (women over £800), scales by agreement with the Minister in each case. The scales for senior assistants range from £600 to £750 for men and from £480 to £600 for women; and those for assistants from £300 to £525 for men and from £270 to £420 for women. In addition certain supplementary allowances will be granted to assistants in respect of approved training and degrees and for certain special posts. There will be an additional payment for the London area. These scales are to come into operation as from April 1st next and will continue until March 31st, 1948.

The salaries of principals are to be reviewed with a view to establishing standard scales.

Refrigeration Industry

Decision to Combine Associations

AT the second annual luncheon of the Commercial Electric Refrigeration Association at the Connaught Rooms, London, W.C., on February 21st, MR. E. G. BATT (independent chairman), who presided over a gathering of about 350 members and guests, announced a decision to amalgamate the Association and the Domestic Electric Refrigeration Association.

The principal guest was MR. A. V. ALEXANDER, First Lord of the Admiralty, who, in proposing the toast of "The Association," thanked the refrigeration industry for its valuable services to the Royal Navy and Merchant Service during the war. He mentioned as a preliminary the importance of the Co-operative Wholesale Society (with which he is connected) as a customer for refrigerating plant, stating that the C.W.S. was responsible for 20 per cent. of the retail sales of meat and for 27 per cent. of the retail milk distribution of the country.

Mr. E. G. Batt, independent chairman of the C.E.R.A.

Mr. Alexander said that the ships of the Royal Navy had to be prepared at a moment's notice to sail from arctic to tropical regions; it was an all-weather navy and the industry had enabled it to solve many problems—the preservation of food, the supply of ice, air conditioning, the maintenance of even temperatures in magazines, storing serum, etc. The largest warships used half a ton of ice a day and even larger plant would be needed in the future. The men of the Navy in the Pacific, far from sources of supply and entertainment, were being provided with "amenity ships" which would need a great deal of refrigeration including machines for brewing plants which they would carry.

As regards the Merchant Navy, the speaker congratulated the industry on having provided ample refrigerated space in a very short time so that it had been possible to maintain the country's meat and bacon rations. He wished the industry the progress and prosperity which it had merited by its war service.

In the course of his response Mr. Batt said that the membership now totalled 249 firms representing machinery manufacturers, insulation contractors, distributors and service engineers with their separate sections under the general direction of the Council. In conjunction with the Government Departments the Association continued to handle the bulk distribution of such things as freon, bitumen, timber and motors for servicing requirements.

After a reference to the work of the area committees which had been set up, Mr. Batt said that the Council had collected the views of all members on the post-war rehabilitation of the industry and had presented comprehensive reports to the Board of Trade on the subject. The Council had asked the Departments concerned for representation on any body which was set up to deal with the disposal of surplus Government stores.

The British Standards Institution was considering the preparation of a Standard Specification for condensing units and the insulation contractors were investigating the possibility of fixing standard dimensions for service cabinets and small coldrooms normally supplied with commercial refrigeration installations. Special sub-committees had been set up to deal with the subject of a fair trading code for the industry.

Mr. Batt then turned to the subject of export trade. The latest official returns showed that shipments of refrigeration machinery had dropped from 2,830 tons (£396,373) in 1938 to 516 tons (£108,990) in 1943. Their domestic programme and needs must not distract their attention from the development of export trade on an unprecedented scale. The development and experience during the war equipped the refrigeration industry to fully play its part in the future of mankind. In the homes of the future refrigeration should come to be regarded as a necessity and he hoped that they would be able to produce equipment of adequate size within the limits of everybody's purchasing power.

Trade Co-operation

Strong and active trade organisations were the best means of achieving these hopes. He did not mean monopolies but bodies whose genuine object was to provide the consumer at home and abroad with the best equipment at the lowest economical price. This could best be achieved by co-operative action, research and standardisation on the part of the producers.

It was their belief in this policy that led to the formation of the C.E.R.A. Experience had now led them to decide that changes should be made to ensure effective handling of home and export problems affecting any

size of plant from the smallest domestic to the largest industrial unit. Consequently it had been decided to absorb the C.E.R.A. and the Domestic Electric Refrigeration Association, together with the interests of the larger plants, in one association to be called the British Refrigeration Association. Thus they had passed another milestone in their history and would go forward as one body resolved to do their best for all concerned and ensure that everyone possible might enjoy the advantages of refrigeration.

Mr. Batt then said that in the absence through ill-health of Mr. Walter Riggs he had to propose the health of the guests. He referred particularly to the presence of Sir Harry Railing (President, I.E.E. and chairman of the B.E.A.M.A. Council), Dr. Dorey (President, Institute of Refrigeration), Mr. Buchanan (Federation of Building Trades Employers), Mr. J. Ramsey (vice-president, R.I.B.A.), Mr. L. C. Gamage (President, Institute of Export), Mr. Clarke (Dairy Engineers' Association) and Mr. E. E. Hoadley (member of the E.D.A. Council). Mr. HOADLEY responded to the toast.

Forthcoming Events

Saturday, March 3rd. — *London.* — Lysbeth Hall, Soho Square, 6.30 to 10.30 p.m. I.E.E. London Students' dance (date altered from March 10th).

Leeds. — At Y.M.C.A. Albion Place, 4 p.m. Engineer Surveyors' Association. "Electricity as Applied to Mining," by B. Buckland.

Ystrad Mynach.—Tredomen Works of the Powell Duffryn Co. Association of Mining Electrical and Mechanical Engineers (South Wales Branch). Film show (3 p.m.), tea (4.45) and "Brains Trust" (5.15).

Monday, March 5th. — *London.* — Institution of Electrical Engineers, 7 p.m. London Students' Section. "Mercury-arc and Mercury-vapour Rectifiers in Transmitters," by T. M. Ellison.

Liverpool.—Royal Institution, Colquitt Street, 5.30 p.m. I.E.E. Mersey and North Wales Centre. "Development of Polythene as a High-frequency Dielectric," by Prof. Willis Jackson and J. S. Forsyth.

Dundee.—Royal Hotel, Union Street, 7 p.m. (tea, 6 p.m.). I.E.E. Dundee Sub-Centre. "Electrical Research," by H. W. H. Warren.

Tuesday, March 6th.—*London.*—Brook Green Hotel, Hammersmith, 7.30 p.m. A.S.E.E. North-West London Branch. "Street Lighting Control," by N. S. Smart.

Manchester.—Engineers' Club, 6 p.m. I.E.E. North-Western Centre Installations Group. "Industrial Fire Risks," by, W. Fordham Cooper and F. H. Mann.

Coventry. — At 6.30 p.m. I.E.E. South Midland Students' Section. "High-frequency Transmission," by D. H. Ray.

Birmingham.—James Watt Institute, 6 p.m. Electrodepositors' Technical Society. "Nickel Plating," by E. J. Dobbs.

Wednesday, March 7th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Radio Section. "Frequency Modulation," by Dr. K. R. Sturley.

Newcastle-on-Tyne. — Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. Lecture on "Adventures in Transport," by Mr. Poulson.

Birmingham. — James Watt Institute, 6.30 p.m. Junior Institution of Engineers (Midland Section). "The Engineer and the Rest of the World," by K. S. Jewson.

Thursday, March 8th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Installations Section. "Modern Electric Lift Practice," by L. S. Atkinson.

London.—Lighting Service Bureau, Savoy Hill, W.C.2, 6 p.m. British Display Association. "Colour in Display," by W. C. Houston (manager, lighting section, B.T.H. Co.).

Dundee.—Royal Hotel, Union Street, 6 p.m. I.E.E. Dundee Sub-Centre. Annual dinner. 7.30 p.m. "The Electrical Aspect of Farm Mechanisation," by C. A. Cameron Brown.

Friday, March 9th.—*Cardiff.*—I.E.E. Cardiff Students' Section. "Carrier Telephony," by W. P. Warren.

Saturday, March 10th.—*London.*—Connaught Rooms, W.C.2, 12.30 for 1 p.m. Association of Supervising Electrical Engineers. Annual luncheon.

Swansea. — Physics Department, University College, 2.30 p.m. Institute of Physics (South Wales Branch). Inaugural meeting. "Physics in Metallurgy," by Dr. C. Sykes.

Monday, March 12th. — *Newcastle-on-Tyne.* —Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Operation, Maintenance and Testing of Overhead Lines and Associated Outdoor Equipment on AC Systems," by R. C. Hatton and Dr. J. McCombe.

Cardiff.—South Wales Institute of Engineers, 5 p.m. I.E.E. Western Centre. "Cable Terminations," by D. B. Irving.

Tuesday, March 13th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Radio Section. Discussion on "Colour Television," to be opened by L. C. Jesty.

Manchester. — Engineers' Club, 6 p.m. I.E.E. North-Western Centre. "Operational Control of Electricity Supply Systems," by W. Kidd and E. M. S. McWhirter.

Glasgow. — Royal Technical College, 6.15 p.m. I.E.E. Scottish Centre. "Modern Submarine Cable Telephony and the Use of Submerged Repeaters," by R. J. Halsey.

Liverpool. — Corporation Electricity Showrooms, Whitechapel, 2.30 p.m. Illuminating Engineering Society. "Review of Light and Lighting Progress," by W. J. Jones.

Wednesday, March 14th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Transmission Section. "Operational Control of Electricity Supply Systems," by W. Kidd and E. M. S. McWhirter.

Friday, March 16th.—*London.*—Connaught Rooms, W.C.2, 12.15 for 12.45 p.m. E.D.A. annual luncheon at which the principal guest will be Sir Stafford Cripps, K.C., the Minister of Aircraft Production.

Wattmeter Testing

A Phase Shifting Device

By A. G. Hewitt, B.Eng.

IN any industrial undertaking, electricity supply or factory, where electrical instruments are used, it is essential, if accurate results are required, to calibrate all instruments at frequent intervals against suitable standards. The testing of ammeters and voltmeters is comparatively straightforward, but for wattmeters a more complicated procedure is necessary, because of the three possible independent variables, *i.e.*, voltage, current and power factor. The following notes will give an indication of one method designed to calibrate wattmeters at any condition of load.

In order that the calibration may be quite general it is necessary that the three variable quantities (voltage, current and power factor) shall be capable of independent adjustment. Variation of the first two is easily effected by the use of tapped transformers and variable rheostats. For the adjustment of the power factor a phase-shifting transformer is normally employed, but it is rather costly and at present delivery periods are likely to be long.

Another method, possessing the advantages of simplicity and cheapness, utilises different combinations of the three supply phases to obtain fictitious loads for wattmeter and watthour meter testing with phase angles between the voltage and current of 0, 30, 60 and 90 deg., lagging or leading. This is illustrated in Fig. 1, in which the voltage coil is connected through a transformer to the phase voltage AO and the current coil again by means of a transformer to

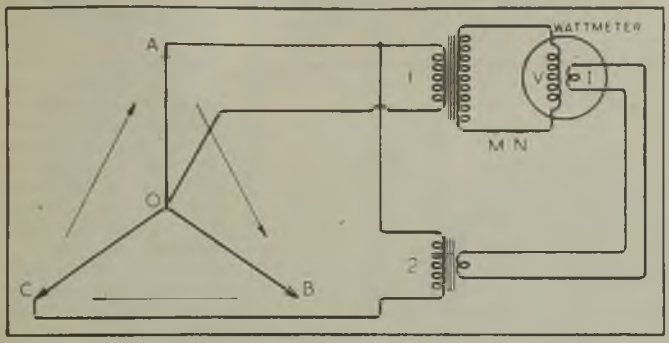


Fig. 1.—Circuit diagram of phase combinations

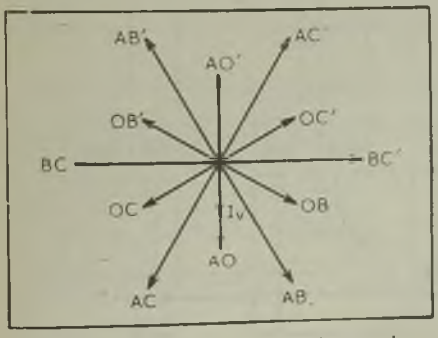


Fig. 2.—Possible values of vector phase angles

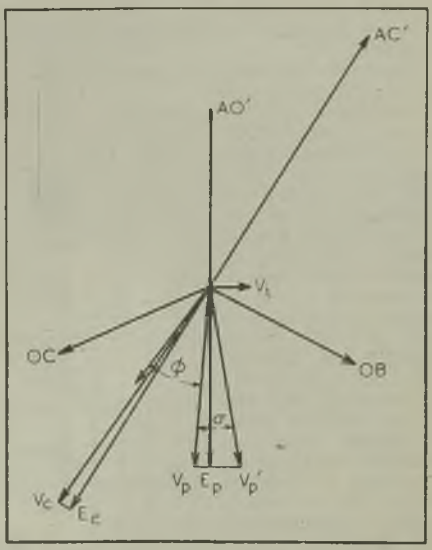


Fig. 3.—Voltage variation vector diagram

AO', OB, OC = phase voltages (circuit diagram of Fig. 1).
AC' = voltage applied to primary of transformer (2).
E_c = secondary EMF of transformer (2).
V_c = secondary terminal volts of transformer (2).
I_c = current in wattmeter current coils.
E_p = secondary EMF of transformer (1).
V_p = secondary terminal volts of transformer (1).
V_i = injected volts, in quadrature with E_p.

AC. It is clear then that with this arrangement a phase difference of 30 deg. is obtained between the currents passing through the two coils of the wattmeter, neglecting for the moment any effect of inductance or leakage reactance.

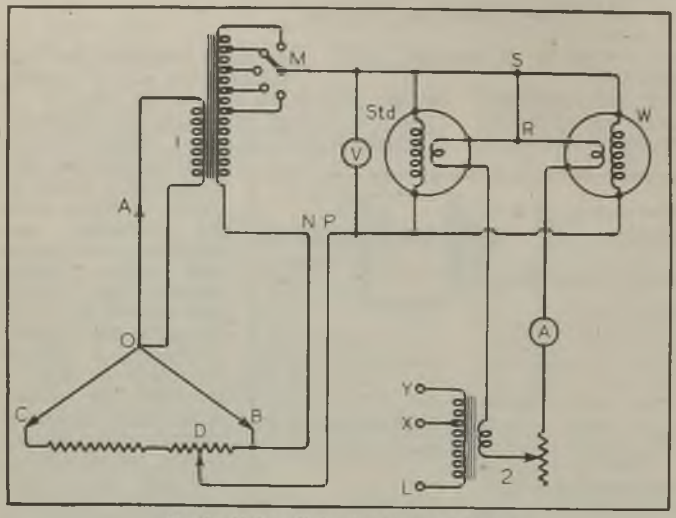


Fig. 4.—Voltage injection circuit diagram

Hence by the use of a suitable selector switch the current coil transformer can be tapped at any of the following line or phase voltages; AO′, AC′, OC′, BC′, to give phase angles of 0, 30, 60 and 90 deg. lagging, respectively. Corresponding angles of lead may be obtained by taking the vectors, starting with AO′ in the reverse direction of rotation, AO′, AB′, OB′ and BC, so that Fig. 2 indicates all the possible values of phase angle this method will allow, assuming a constant vector for I_v representing the current in the volt coil of the wattmeter.

Due, however, to the fact that the two transformers have magnetising losses and leakage reactances the vector diagram (Fig. 2) cannot be considered strictly accurate, but compensation for these effects can be applied by injecting a voltage in the volt coil circuit (Fig. 1) in quadrature with that due to transformer (1). This causes the minimum variation in the magnitude of the voltage applied to the volt coil for a given phase shift. A shift of 5 deg. causes an increase in volts of approximately 0·8 per cent. The vector diagram (Fig. 3) shows how the voltage V_3 is varied by the injection of a quadrature voltage at the points MN in the Fig. 1 circuit, so that V_p^1 is then the resultant of V_p and V_i, the phase angle between V_p and V_p^1 being σ. The angle between the voltage and current will be given by $(\phi + \sigma)$, or with V_i reversed by $(\phi - \sigma)$.

The method adopted for injecting the voltage V_i is by the use of a potentiometer regulator connected across the lines BC (Fig. 4) so that σ can be made quite large by

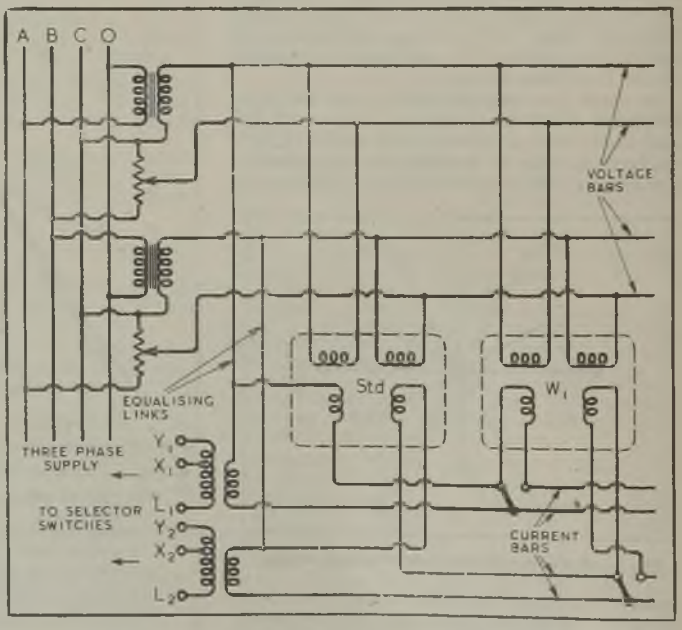


Fig. 5.—Essential connections for three-phase working

the movement of the tapping point D, but as it is not necessary to have σ greater than 30 deg. the potentiometer can be made of a fixed section with a variable section in series. Since a value of σ of 30 deg. causes an increase in the voltage V_p^1 of approximately 15 per cent., tappings are necessary on the transformer (1) to bring it back to normal; they are shown at M (Fig. 4).

The primary of transformer (2) is tapped in order that it may be connected to either the line or phase voltages as required, and the connections to be made to obtain the various power factor steps are tabulated.

TRANSFORMER CONNECTION

Power Factor	L	X	Y
Unity	O	A	—
0·866 lag.	A	—	C
0·866 lead.	B	—	A
0·5 lag.	O	C	—
0·5 lead.	O	B	—
Zero lag.	C	—	B
Zero lead.	B	—	C

The switching operations are performed by means of a double pole seven-way rotary selector switch of simple construction.

It will be noticed that points S and R (Fig. 4) are joined. This is necessary when using a sensitive standard wattmeter to eliminate any possible electrostatic forces between the two wattmeter coils.

This method of phase shifting can quite easily be adapted for use with three-phase power and energy meters, and it has the added advantage that it can be used with banks of either three-phase or single-phase wattmeters by switching on all or half the equipment.

The advantages of this arrangement can be enumerated as follows:—Low initial cost, which is apparent from the apparatus required as compared with other arrangements. Good regulation is ensured by the use of straightforward transformers without air gaps. The waveform is as good as that of the supply available, as the magnetising currents and the transformer primary circuit impedance are kept very small. The method is as easy to operate as a circuit containing a motor generator set or phase-shifting transformer, for in all cases accurate power factor readings must be deduced from the ratio of watts and volt-amps. The apparatus can be constructed into a relatively small self-contained unit with simple three terminal input and four terminal output panels.

Coal Suitability

Meeting Consumers' Requirements

THE object of last week's conference at Manchester of the North-Western Section of the Institute of Fuel was to discuss the qualities of coal required by different sections of industry in this country, including the problems incidental to and the cost of preparing fuels for particular needs.

In the past the demands of consumers have too often been determined merely by custom and prejudice, together with the desire to avoid modification of their established methods, frequently without appreciation of the technicalities involved. The cost of this has often been quite out of proportion to the benefit derived by the consumer.

Accordingly short statements were prepared for the conference by representatives of the main branches of industry in the hope that discussion might indicate how those "specifications" could be modified so as to lessen the expense of preparing fuel without materially affecting the efficiency of the process concerned. Simultaneously summarised statements submitted by the coal producers showed not only that technically all the various demands of industrial consumers could be satisfied, but also emphasised the direct cost of cleaning coal and, what is seldom appreciated, that the losses which occur in rejects represent a very appreciable proportion of the heat content of the raw coal. Whoever may pay for those losses (collieries often claim to be the victims) from the national point of view they cannot be tolerated any longer unless proved to be absolutely unavoidable.

One of the statements submitted included a set of suitability factor curves illustrating what power station operators considered to be the range of fuels most desirable for generating electricity. General conclusions to be formed from them are that for use on chain grate stokers the fuel's moisture content should be between 7·5 and 12 per cent., ash from 8 to 12 per cent., volatiles exceeding 29 per cent., BSS swelling index up to 3·25 per cent. and so graded that 19 per cent. would be retained on 0·75 in. mesh screening after passing 1·5 in. mesh of the remainder. For pulverised fuel firing both moisture and ash should be low, to 7·5 per cent., with volatiles exceeding 29·5 per cent. and fine enough to pass through 0·75 in. mesh screening. The sulphur content should be as small as possible, not more than 2 per cent. in small consignments and not frequently exceeding 1·5 per cent. in large or continued deliveries.

Instrument Technology

A MEETING of the Society of Instrument Technology will be held at the London School of Tropical Medicine, Keppel Street, London, W.C.1, on Saturday, April 21st, with sessions commencing at 11 a.m. and 2.30 p.m. The president, Sir G. P. Thomson, M.A., F.R.S., will be in the chair and three papers will be read and discussed. Any non-members of the Society who wish to attend should apply to the hon. secretary, Mr. L. B. Lambert, 55, Tudor Gardens, London, W.3.

Views on the News

Reflections on Current Topics

ELECTRICITY consumers who are anxiously waiting to renew their aluminium cooking utensils must not place too much hope of lower prices upon the recent 23 per cent. cut in the price of the raw material. When the new utensils become available their prices, for the time being, will be based on the old price of aluminium; revision is promised when the lower-priced metal is in use by manufacturers. A list was given in last week's *Board of Trade Journal* of the maximum prices for the new utensils and they are by no means cheap. For instance, the smallest size of drawn aluminium stewpan for hotplates (6¼ in.) with lid will cost 15s. 3d.; a 3-pint kettle 22s. 6d.; and an 8-in. frying pan 14s. 3d.

* * *

Should meter readers' duties be strictly confined to the reading of meters and collection of money? This question has been raised in tragic circumstances at Banbury where, at the inquest on the eight victims of a gas accident, the coroner remarked that "employees should be encouraged to use discretion in making reports of defects and not live in water-tight compartments." For the management it was stated that collectors were expected to report complaints although it was not their duty. Actually in this case the collector who pushed a fallen meter back to the wall said he reported the complaint but knew now that it had not been received by the company. He maintained, however, that his job was to collect money. To my mind if meter readers and collectors are expected to report complaints it should be made part of their duty and the necessary machinery should be provided. I have often thought that there is a good case for raising the status of the meter reader.

* * *

It is a weakness of the two-part tariff that the fixed charge remains fixed in periods when economy is enjoined upon and is exercised by the consumer. Those who really understand the system know that it is an attempt to apportion standing charges equitably but extremely few consumers understand this. All they know is that they are "paying for something they haven't had" and many of them write to the papers to say so. Flat-rate consumers have been protected by a limitation of the minimum charge which may be made by a supply authority but those on two-part tariffs, although probably entitled to as much consideration (apart from any question of justice to the supply authorities), receive, as they think, no relief at all. The trouble arises, only on special occasions or in individual cases but it isn't a good thing. Block tariffs would probably get over much of the difficulty.

* * *

A *Manchester Guardian* correspondent seems to have been overwhelmed by the magnificence of the kitchens arranged at Liverpool by the Corporation Electricity Department and the local gas company. He says:—"If in this workaday paradise gas is made to seem glamorous, electricity seems positively lyrical in its own self-advertisement." He, in his turn, becomes a little lyrical in his description of the "bulkhead lights to show up the resplendence of cooker, refrigerator, washing machine, etc." But he has his doubts about the cost of all these things even if, as stated, the cost of the whole installation would be considerably less than £100. Of course, in these matters care should be taken that the residents do not live beyond the ratepayers' means.

* * *

Glancing through a South African journal I came upon some remarks by Dr. H. J. van der Bijl on the subject of health in industry. He quoted the case of forty European boys who were all undersized, undernourished and hardly capable of doing their work when they started at the Colenso power station. Within a short time good feeding and decent living conditions created such a change that they were doing the work of 80 natives and had developed one of the best football teams in Natal. Whatever people may say about power stations—and most proposals to construct them seem to be the signal for a public outcry nowadays—they are apparently not unhealthy places to work in.

* * *

Cheerful note from Cleethorpes. The Council has included £600 in its year's estimates for the provision of illuminations for the season, as well as £200 for the lighting of the Promenade and Cliff Steps, "if circumstances permit." I am sure we all hope that circumstances will.

* * *

John Bull, never at a loss for solutions of problems of all sorts, has now told us how to overcome the effects of power plant shortage. The remedy is simple—"A rationalised and nationalised fuel and power industry."—

REFLECTOR.

Heating Buildings

Survey of Electrical Methods

By H. C. Harris,
M.I.E.E., A.M.I.Mech.E.

ELECTRIC heaters are of two main types, *viz.* those from which heat is emitted as radiation and those which warm the air by convection from a heated surface. Most heaters are a combination of the two.

Electric fires consist essentially of high-temperature (1,000 to 1,600 deg. F.) wire-resistance elements either fixed in front of a flat refractory base or wound on a cylindrical refractory support, backed with a metal reflector. In the first the proportions of radiant and convected heat are about equal and in the second the ratio is 3/1. Neither is very suitable for thermostatic control owing to the distraction caused by switching on and off.

Tubular heaters usually comprise 2-in. diameter pipes heated internally by wire resistances supported by insulating blocks. The radiant/convection heat ratio is 9/11 when so fixed as to radiate heat over a wide angle and 3/7 if fixed low down by the skirting board where at least 75 per cent. of the tube surface is exposed to the wall. The low temperature of the elements makes them practically indestructible. Maximum surface temperature can be attained in about 20 min.; hence thermostatic control is suitable. Owing to the small differences in the temperatures of the air meeting and leaving the heated surface the convection currents have the low velocity that is necessary for comfort. At the usual loading of 60 W per ft. run, the surface temperature is about 180 deg. F. when the surrounding air is at 60 deg. F.

Electric hot-water radiators are misnamed since 80 to 85 per cent. of the heat is dissipated by convection. Surface temperatures range from 150 to 250 deg. F. The relatively high velocity of the convection currents results in a high-temperature gradient and draughts across the floor. As their thermal capacity is high they heat up slowly and are unsuitable for thermostatic control, but they are useful in situations where the fire risk is high. Oil is sometimes used instead of water on account of its much lower specific heat and density, which reduces the thermal capacity by nearly 50 per cent. This results in nearly twice as quick a rate of heating up and cooling down, making them suitable for thermostatic control.

With convectors, as their name implies, practically all heat is convected. The wire-resistance elements being run at a black or dull-red heat are almost everlasting. The velocity of air currents is even higher than with hot water radiators, but they are often employed where it is desirable to heat the air rapidly in larger buildings.

One form incorporates a small fan which blows air over the heating elements, thus enabling smaller elements to be used and the air to be heated at a greater rate. This, however, exaggerates the disadvantage common to all convectors that the temperature of the air tends to become higher than that of the walls.

Electric panel heaters run at temperatures varying from as low as 90 to 400 deg. F. according to position. The heat emitted is practically all radiant when heaters are fixed horizontally but 3/2 radiant to convected when fixed vertically. A well dispersed amount of radiant heat can be emitted in all directions, thus enabling a comparatively low air temperature to be maintained without discomfort. Comfort conditions are reached in about 20 min.

Another method of heating that is almost all radiant is provided by a flexible fabric 1 mm. thick ("Dulrae") which is usually applied to ceilings. Multiple busbar wiring is incorporated longitudinally along the edge with loops for connections at each section. The fabric is sandwiched between two layers of ¼-in. fireproof plasterboard and finished with a lining of ordinary ceiling paper. Owing to its low-surface temperature (95 to 100 deg. F.) heat is radiated at low intensity. Comfort conditions are quickly attainable. The loading is about 18 W per sq. ft.

Unit heaters are of two types, *viz.* suspended with propeller fan and floor-mounted with centrifugal fan. Steam radiators or electrical resistance elements are fixed in a sheet-iron body over which a centrifugal fan blows the air. Discharge velocities vary considerably according to the duties required, reaching 1,200 ft. per min. or more. These heaters are suitable for rapidly heating the air of factories, garages, warehouses and similar buildings. Their effect is purely convective and considerable air velocities are created giving temperature gradients of as much as 2 deg. F. per ft. Floor types occupy only about half the ground area taken by ordinary hot water or steam radiators, while the suspended types leave the floor clear.

Electrically heated skirting boards have been produced experimentally of plastic mouldings with resistance wires embedded in them, providing an inconspicuous means of background heating.

Heating appliances fixed against walls or ceilings should always be backed with a layer

of thermal insulation to prevent loss of heat in the fabric of the building. Aluminium or bronze paint on radiation surfaces reduces the heat transmitted by 10 per cent. or more, but ordinary paints (irrespective of colour) have no such effect. Thermostatic control can save upwards of 25 per cent. in energy.

A far more advantageous method of producing heat by means of electricity than from the I^2R of resistances is provided by the heat pump or reversed refrigerator. Several installations are in use in Switzerland, where it is estimated that 2,400 million kilo-calories per hr. (2,800,000 kW) could be produced during the winter by lowering the temperature of all rivers by 1 deg. C. About 800,000 kW would be required to drive the pumps. In the United States portable air conditioning units have given 9,200 BThU (2·7 kW) for an expenditure of 0·5 kW for driving the pump (*i.e.* over five times the efficiency of resistance heating). In the summer the cycle can be reversed to give a cooling effect.

Comfort does not depend solely on air temperature. Radiant heat, relative humidity and air movement are all important factors. Relative humidity and air movement control the rate of evaporation of moisture from the human body, and hence affect the temperature of the skin. Physical conditions which would be comfortable for a sedentary worker would cause a manual worker to feel uncomfortably hot. The average body heat dissipated (radiated, convected and that owing to latent heat of evaporation of moisture) under comfortable conditions varies from 384 BThU per hr. for sedentary conditions to 1,800 BThU for physically active conditions.

During the winter the relative humidity inside a building in this country varies little, hence evaporation loss in still air is fairly constant, but air movement will increase it. An air temperature of between 60 and 65 deg. F. has hitherto been considered in this country to give reasonable comfort for a sedentary worker, but this is not so where a large proportion of the heat is radiant or air movements are considerable.

An instrument produced by the Building Research Station, the "eupatheoscope," is used for measuring the "equivalent temperature" of an environment, *i.e.* the temperature of a uniform enclosure with still air in which a sizeable black body would lose heat at the same rate as in the environment. The apparatus consists of a hollow black metal cylinder mounted on a wooden base with its internal temperature maintained constant at 78 deg. F. by means of two standard electric lamps controlled by a bi-metallic thermostat, the average surface temperature then being 75 deg. F., which approximates to the surface temperature of the clothed human body. The equivalent temperature is read directly in degrees from a mercury thermometer, the bulb of which is inside the cylinder. An electric heating coil is wound round the bulb and the flow of current in the coil is regulated automatically according to the heat loss from the cylinder. This method ignores the effect of humidity, but under normal conditions this is negligible in Great Britain.

TABLE I—COEFFICIENTS FOR WALLS

Orientation	S. W.SW.SE. NW. N.NE.E.	Exposure to Wind. Sh = Sheltered, N = Normal, Se = Severe					
		Sh	N	Se	—	—	—
		—	Sh	N	Se	—	—
		—	—	Sh	N	Se	—
		—	—	Sh	N	—	Se
Brickwork.—							
Solid, unplastered, 9 in.		0·39	0·42	0·44	0·47	0·50	0·53
Solid, plastered, 9 in.		0·36	0·38	0·41	0·43	0·45	0·48
Glass, single window		0·70	0·79	0·88	1·00	1·14	1·30
Wood, tongued and grooved, 1 in.		0·41	0·44	0·47	0·50	0·53	0·56
Sheet asbestos, ¼ in.		0·64	0·72	0·80	0·89	1·00	1·12
Corrugated iron, $\frac{1}{16}$ in.		0·79	0·91	1·04	1·20	1·40	1·67

Vane anemometers are not suitable for measuring draughts (which cause discomfort if in excess of 40 ft. per min.), as they are usually very inaccurate for air speeds below 200 ft. per min. and are only suitable for measuring a steady air flow in one direction. Reasonably accurate results can, however, be obtained from the katathermometer, which is affected by all movements, whatever their direction and variation of speed. This is a spirit thermometer with a large bulb, which was used for measuring comfort conditions before the introduction of the eupatheoscope, the rate of cooling from 100 to 95 deg. F. indicating the condition of the environment. In buildings, air movements are usually small and constantly changing in direction. The rate of cooling of the katathermometer is measured at an average temperature of 97·5 deg. F. and depends upon the difference between this temperature and that of the surrounding air. In a constant air temperature the rate of cooling will bear a fixed relation to the air velocity as given by $\frac{H}{\theta} = 0{\cdot}1086 + 0{\cdot}01584\sqrt{v}$, where: H = cooling power, which is the ratio of a constant depending on the individual characteristics of each instrument to the time taken to cool

from 100 to 95 deg. F., $\theta = 97{\cdot}5$ deg. F. minus the air temperature, and v = air velocity in ft. per min.

Economy can be effected by employing a low air temperature, the greater proportion of heat being provided in the form of radiation from the walls, ceiling and floor, while using only a small proportion for heating the air by convection to a considerably lower temperature (say 50 deg. F.). Rooms thus heated by radiation may frequently require 25 to 40 per cent. less power than if heated by convection. Radiating surfaces should be evenly distributed so that the occupants will not feel chilled where shielded from the source. In addition, the area of radiation should be large and the temperature low (between 90 and 100 deg. F.) as otherwise heat distribution would be uneven. The temperature of the floor radiators should not exceed 75 deg. F. for comfort. Unless the ceilings are over 12 ft. high, downward radiation causes discomfort if the temperature is not kept low.

For calculating the heat requirements of the building in the following example, the figures in the tables have been extracted from "The Computation of Heat Requirements for Buildings" published by the Institution of Heating and Ventilating Engineers. Tables 1, 2 and 3 give the heat transmittance coefficients in BThU per sq. ft. per hr. for each deg. F. difference of air temperature. Table 4 shows the additional heat energy required to bring the temperature of an intermittently heated building up to requirements within a prescribed period. Heat requirements will be further increased on account of the height of the space to be warmed. From 13 to 14 ft. the addition is

TABLE 2—COEFFICIENTS FOR FLOORS

Floors on Ground	Coefficients	
Ventilated, wood on joists, air bricks on more than one side, bare boards	0·40	
Floors in contact with earth, hardcore, etc.: concrete	0·20	
Wood block on concrete	0·15	
Intermediate Floors	**Heat flow downwards**	**Heat flow upwards**
Wood on joists, plaster ceiling	0·22	0·29
6 in. concrete with 2 in. screed	0·35	0·43

2 per cent.; from 15 to 16 ft., 4 per cent.; from 17 to 18 ft., 6 per cent.; from 19 to 20 ft., 8 per cent.

Suppose it is required to heat a small single-storey workshop in a built-up area, sheltered by other buildings, in Southern England. The building is 30 ft. by 15 ft. by 13 ft. high with 9 in. solid brick walls plastered on the inside and a flat roof composed of 6 in. of concrete covered with asphalt. The 30-ft. sides of the building face east and west and each has two windows 8 ft. long by 5 ft. high and the south end has a window of the same size. A wooden door 6 ft. wide by 10 ft. high and 1 in. thick is in the middle of the north-end wall. The temperature rise required is 30 deg. F. with two and a half air changes per hr.

The heat loss in BThU per hr. through the walls, floor and roof for a temperature difference of 1 deg. F. is calculated by multiplying the areas in sq. ft. of the walls, windows and doors by the appropriate constants from the tables, as follows:— South wall, $155 \times 0{\cdot}36 = 55{\cdot}8$; window, $40 \times 0{\cdot}7 = 28$. West wall, $310 \times 0{\cdot}38 = 117{\cdot}8$; windows, $80 \times 0{\cdot}79 = 63{\cdot}2$. North and east walls, $445 \times 0{\cdot}41 = 182{\cdot}4$; windows,

TABLE 3—COEFFICIENTS FOR ROOFS

Construction of Roof	Sh	N	Se
Flat:			
Asphalt on 6 in. concrete	0·53	0·57	0·62
Asphalt on 6 in. of concrete with 1 in. cork	0·20	0·21	0·22
Pitched:			
Tiles on battens	1·22	1·50	2·0
Tiles on boards and felt	0·33	0·35	0·37
Plaster ceiling with space above:			
with tiles and battens	0·50	0·56	0·64
with tiles on boards and felt	0·28	0·30	0·32
Skylight	1·00	1·20	1·40

$80 \times 0{\cdot}88 = 70{\cdot}4$; door, $60 \times 0{\cdot}47 = 28{\cdot}2$. Floor, $450 \times 0{\cdot}2 = 90$. Roof, $450 \times 0{\cdot}53 = 238{\cdot}5$. Heat required to raise temperature of air in the building (5850 cu. ft.) with the specified number of changes per hr., the specific heat of air being 0·02 BThU per cu. ft. per 1 deg. F. = 292·5. Allowance for height, 2 per cent. = 23·3. Total, 1,190·1.

The above calculation relates to the heat required to maintain a constant temperature. Assuming the workshop to be closed down at nights, Saturday afternoons and Sundays, and that a preheating period of six hours is required, 40 per cent. must be added to the total of 1,190 BThU per hr., making 1,666 BThU to give a temperature rise of 1 deg. F. Therefore the amount of heat required for a 30 deg. F. temperature rise is $1{,}666 \times 30$ or 50,000 BThU per hr. approximately.

As 1 BThU per hr. = 0·000293 kW, the maximum demand is 14·65 kW, but the average consumption required to keep the temperature in the workshop at 30 deg. F. above the outside air is only about two-thirds of this figure.

If tubular heaters are employed, consuming 60 W per ft. run, 244 ft. are required. These could be installed in four rows one above the other along the sides and ends of the shop. Thermostatic control would prevent the temperature becoming much too high after the initial period of warming up and from varying according to outside conditions.

In calculating the price per kWh at which

the cost of electricity would compete with that of coke for maintaining a constant temperature under the specified conditions, the BThU needed can be taken as 35,700 per hr. (equivalent to 10·46 kWh). Coke of 12,500 BThU per lb. now costs in Southern England about 61s. per ton. The thermal efficiency of a hand-fired coke boiler with water radiators is about 50 per cent.; therefore the coke required per hr. has to contain 71,500 BThU, which can be obtained from

TABLE 4—ADDITIONAL POWER REQUIRED FOR INTERMITTENT HEATING

Preheating Period	Period of Occupation (days per week)		
	7 days	5½ days	1 day
3 hours..	per cent. 40	per cent. 55	per cent. not recommended
6 hours	25	40	150
24 hours	nil	20	90

These figures are for buildings of heavy construction. For buildings of light construction and consequent low thermal capacity half these values may be taken for a top floor and three-quarters for other floors in multi-storey buildings.

5·71 lb. costing 1·86d. A part-time stoker's wage, say one-eighth of 1s. 4d. per hr., would add 2d. Adding higher capital charges, maintenance costs, supervision, etc., the total cost would be about 4·8d. per hr. Electricity would therefore have to be available at 0·46d. per kWh.

Cost of electricity, however, is not the only matter to be taken into consideration. There are also such other items in its favour as absence of fumes and dirt (and consequent longer periods between painting), saving of manpower in wartime, non-dependence on human stokers, no coke delivery or storage or ash disposal. On the other hand, although a coke-fired boiler involves expense in banking, it still warms the building and so a smaller percentage increase for intermittent heating is required, *i.e.* 15 instead of the 40 per cent. for electric heating.

The importance of good thermal insulation as an economiser of power consumption should be emphasised. In the workshop referred to above, the heat conducting properties of the roof could be reduced by over 60 per cent. by adding an additional layer of one inch of cork; this would reduce the power requirements by between 12 and 13 per cent. thus effecting a saving of about £11 per annum with electricity at 0·46d. per kWh. About £9 would also be saved on the capital cost of tubular heaters. If the cost of the cork insulation were £65, the saving would pay for the insulation in five years. With light structures the saving would be very considerably increased.

"Loudaphones" at Leicester

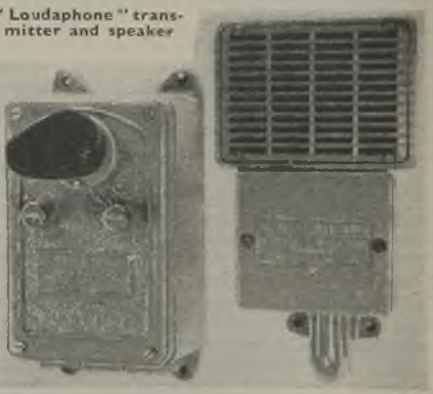
Facilitating Traffic Control

AT Leicester Central station the L.N.E.R. has recently introduced a "Loudaphone" system to effect co-operation between the booking office staff and the ticket collectors at busy intermediate stations. Two-way speaking (and, if required, calling, which permits acknowledgment and coding) is provided. When the ticket collector advises the booking clerk of a train position, he presses a "speak" switch and a microphone amplifies his voice yet eliminates surrounding "unwanted" noises. Similar working applies in the reverse direction, or, alternatively, two-way conversation can take place.

As the booking clerk is thus able to receive advice from the barrier he can continue to issue tickets until just before the train starts. Both the booking clerk and the ticket collector can receive a message without having to leave their respective positions. As the booking clerk can be aware of the train position, he is often able (without additional effort) to set at ease agitated "late arrivals."

The equipment consists of a fixed microphone transmitter and loud speaker fitted at both positions and fed from the mains through a rectifier and smoothing circuit. The microphone operates differentially through a split primary transformer at from 0·5 to 0·75 A. The primary current can be adjusted by a pre-set resistance, so that the apparatus is adaptable to different input voltages, or can be worked from an accumulator. A separate pair of conductors is used for each speech direction, a two-pair cable being used to connect the two locations, to minimise "anti-sidetone," but it is possible to adapt the equipment for use on a single pair of wires if required. The loud speaker is a conical

"Loudaphone" transmitter and speaker



diaphragm operated by a pair of coils and fitted with an exponential metal horn. The gear is metal-clad throughout and no valve amplifier is used; it was supplied by Clifford & Snell, Ltd., of Sutton, Surrey.

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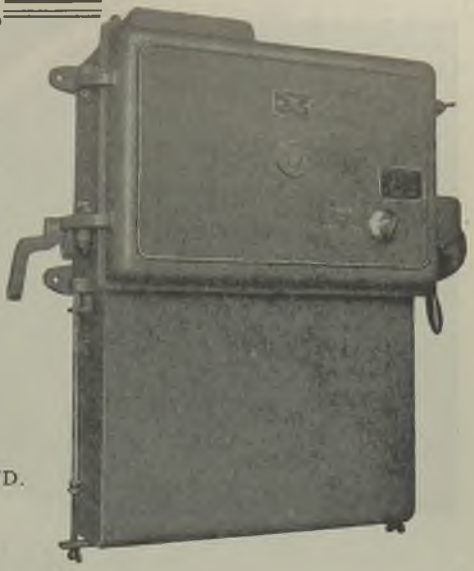

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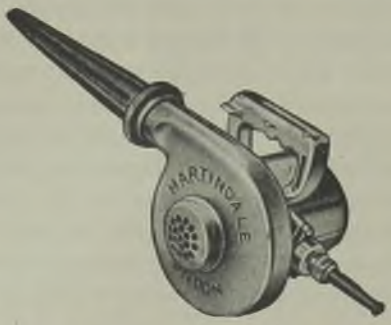

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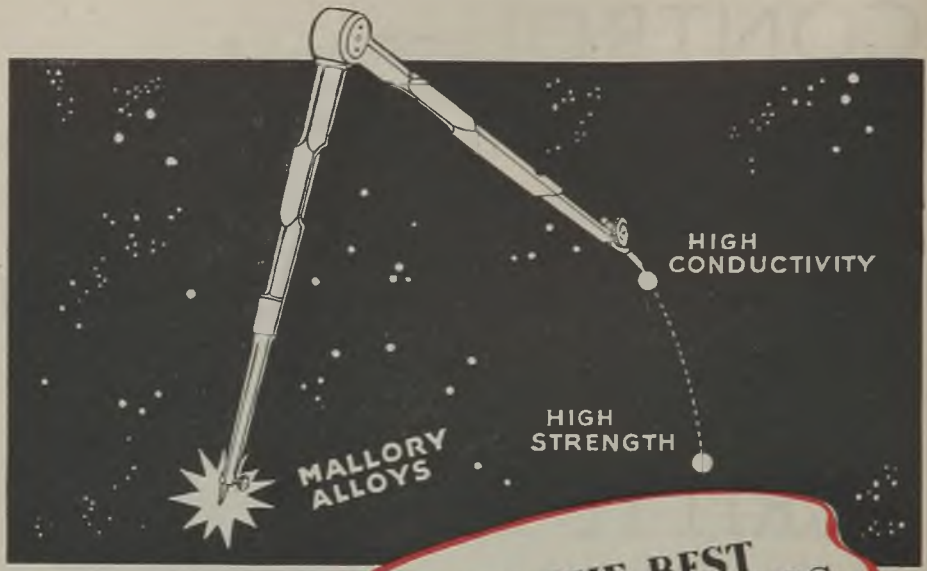

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ELECTRICITY SUPPLY

Extensions at Plymouth. Irish Bill Passed.

Barrow-in-Furness.—SUPPLY TO FARMS.—The Electricity Committee is to provide a supply to a farm at Kendal Ground at a cost of £370, subject to a £55 revenue guarantee for five years. The supply to Greenmoor Farm, Pennington, is to be improved at a cost of £205.

Brighton. — REVISED HIRE CHARGES. — A revised scale of rentals for domestic electrical apparatus on hire to come into force on July 1st next is recommended by Brighton Public Utilities Committee.

Cheltenham.—JUBILEE IN MAY.—The Electricity Committee is to make arrangements for jubilee celebrations in May, when the undertaking will have been in existence for fifty years.

Eston (Yorkshire).—EQUIPMENT FOR TEMPORARY HOUSES.—The Urban District Council has approved a recommendation of the Housing Committee to install electrical equipment in proposed prefabricated houses.

Glasgow.—PUMPING EQUIPMENT.—The hydro-pump, filter circulating pump, etc., at Maryhill and Springburn baths are to be changed from steam to electrically driven units.

Glendale (Northumberland). — RURAL SUPPLIES.—The Rural Council has been informed that the post-war plans of the North-Eastern Electric Supply Co., Ltd., include the supply of electricity to the villages of Ingram, Old Bewick, New Bewick, Wooperton, Roseden, Ilderton, South and North Middleton, Chatton, Chillingham, Humbledon, Akeld, Doddington and Nesbit.

Middlesex. — FOOD CONVEYORS. — The County Health Committee is to purchase 44 electrically heated food conveyors for the West Middlesex Hospital at an estimated cost of £2,652.

Nuneaton. — INSTALLATIONS IN TEMPORARY HOUSES.—The Council has submitted site and lay-out plans for 299 temporary houses in which the cookers and wash boilers are to be electrically operated.

Penrith.—LIGHTING OF COUNCIL OFFICES.—The U.D.C. recommends the installation of electric lighting at the Council offices.

Plymouth. — DISTRIBUTION EXTENSIONS. — It was recently reported to the Electricity and Street Lighting Committee that the conversion of houses into flats, a procedure which has been carried out to an increased extent because of the housing shortage, together with the erection of temporary houses and industrial requirements, have resulted in an increased load, to meet which it is proposed to erect new substations and extend existing substations and low-voltage mains. The cost is estimated to be £24,455.

Salford.—COTTON INDUSTRY CAMPAIGN.—The *Salford City Reporter* states that the Light, Heat and Power Committee has agreed to participate in a co-operative advertisement of electricity undertakings interested in supplies to the cotton industry, which is to be displayed on a conspicuous site at the Manchester Royal Exchange.

Saltcoats (Ayrshire).—KITCHEN EQUIPMENT.—The Town Council favours the installation of electric cookers, refrigerators and wash boilers in all temporary houses.

Scarborough. — LOAN FOR COOKERS. — Sanction has been received by the Town Council to borrow £500 for consumers' electrical apparatus (cookers).

Stockton-on-Tees.—LOAN.—The Town Council has applied to the Electricity Commissioners for sanction to borrow £10,000 to cover miscellaneous expenditure in connection with low voltage mains.

Swansea.—BOILER TESTS.—In connection with boiler tests under the terms of a contract with International Combustion, Ltd., the Electricity Committee has appointed Mr. G. Hilder to act as neutral observer at a fee of fifty guineas. The services of University College students are to be utilised as instrument observers, etc.

Overseas

Eire. — ELECTRICITY BILL PASSED. — The Dail last week passed the Electricity (Supply) (Amendment) Bill which authorises the Electricity Supply Board to carry out post-war projects involving a probable expenditure of £40,000,000.

France.—END OF RATIONING IN PARIS.—Normal electricity supply was restored in Paris last week, according to a Paris radio message quoted by *Reuter*. The supply has been cut off during certain hours each day in the past, owing to the coal shortage.

TRANSPORT

Glasgow. — INCREASE IN FARES VETOED. — The Minister of War Transport has declined to sanction the proposal by the Transport Department to increase the fares on municipal trams and buses. The proposal was the subject of a public inquiry last year (*Electrical Review*, December 29th, page 913).

South Shields.—TROLLEY-BUS PROPOSALS.—The Northern General Transport Co., Ltd., and the Economic Bus Co. have offered to withdraw their opposition to the Corporation's Bill before Parliament (which seeks powers, among other things, for running additional trolley-buses) if the Corporation will rescind its decision to run trolley-buses on routes 16 and 17. The Corporation has agreed to do this.

Sunderland. — TRAMWAY EXTENSION. — The Town Council has decided to re-submit to the Ministry of War Transport a plan which was rejected by the Ministry fifteen months ago for laying an additional tram track for a distance of 440 yd. at a cost of £7,000 in Durham Road.

Wolverhampton. — NEW TROLLEY-BUSES. — The purchase of twenty-two new trolley-buses, at a cost of £70,000, for delivery in 1946, has been approved by the Town Council. Alderman Alan Davies, chairman of the Transport Committee, said the undertaking wanted thirty vehicles a year for renewal of the present fleet, half of which was obsolete.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Franco Signs, Ltd.—At an extrordinary general meeting on February 22nd resolutions were passed increasing the capital to £300,000 by the creation of 200,000 new shares of 10s. each. Explaining the reason for the increase, the chairman (Mr. J. F. Mallabar) said that since the war started the group had been engaged almost wholly on Government contracts. Additional working capital had been found by way of bank loans but the outlay on factories, plant and machinery had encroached upon funds which would normally represent the working capital of the group and the board felt that additional capital should now be raised to consolidate the liquid position. Their increased manufacturing capacity would enable electrical apparatus and light engineering products to be manufactured on a wider scale than before the war. It was anticipated that there would be a large demand for the group's ordinary sign production when normal conditions returned.

It was proposed to offer forthwith 160.000 new shares to present shareholders at 13s. per share, in the proportion of two new shares for every five held. He (the chairman) had agreed to subscribe for any shares not taken up, at 13s. per share. Mr. Mallabar concluded by predicting that the results for the current year would be at least as favourable as those of the previous year.

The English Electric Co., Ltd., reports a trading profit, including dividend received from D. Napier & Son, Ltd., of £584,773 for 1944, against £570,582 for the preceding year. The net profit, after paying debenture interest, depreciation, etc., was £434,984, as compared with £419,376. As already reported, the ordinary dividend is maintained at 10 per cent. and the general reserve again receives £100,000. The balance carried forward rises from £62,631 to £87,870. It is stated that the liquid assets at December 31st last amounted to £3,003,183 (against £2,987,603).

Broom & Wade, Ltd., record a profit for the year ended September 30th last amounting to £256,685, as compared with £237,533 in the year 1942-43. After providing for depreciation and taxation the net profit was £36,633 (£55,455). The ordinary dividend is maintained at 22½ per cent. and £32,333 (£33,718) is carried forward. No contribution is made to the general reserve, whereas in the previous year a sum of £17,692 was allocated. Application has been made for permission to issue at a premium to shareholders a part of the 440,000 ordinary shares of 5s. each created in 1942.

Clarke, Chapman & Co., Ltd., report an increase in profit of £12,845 to £135,292 for the past year. A sum of £20,000 is again put to reserve and £20,000 (against £10,000) is transferred to staff pensions reserve. The ordinary dividend is again 12½ per cent. and the balance carried forward is increased from £38,903 to £41,415.

The Midland Counties Electric Supply Co., Ltd., is paying a final dividend of 5 per cent., again making 8 per cent. for the year. The trading profits of the company and the operating companies, after taxation, were £850,919 (against £854,041) of which £521,987 (against £528,072) is appropriated for the operating companies' depreciation and reserves. The company's net revenue after meeting debenture and loan interest and tax, rose from £267,779 to £275,902.

The North Eastern Electric Supply Co., Ltd., is paying a final dividend of 4½ per cent., again making 7 per cent. The trading profit amounted to £2,237,240, compared with £2,031,510 in the previous year. The net profit was £261,152 (£262,481), after providing for interest, taxation, depreciation, debenture stock redemption, plant renewals, improvements and deferred repairs. The carry-forward is increased from £232,595 to £234,409.

The County of London Electric Supply Co., Ltd., is maintaining its ordinary dividend for the year at 8 per cent. by a final payment of 5 per cent. Preliminary figures give the net profit for 1944 as £534,923 against £520,968 for the previous year.

The South London Electric Supply Corporation, Ltd., announces a first and final dividend of 7 per cent., the same as last year, which is again to be paid in part by drawing from reserve. The net profit for 1944 was £22,965 (against £31,354).

The Notting Hill Electric Lighting Co., Ltd., is to pay the dividend on its 6 per cent. cumulative preference shares for the 3½ years ended December 31st, 1942. The net revenue for 1944 was £46,579, as against £36,713 in 1943. A sum of £55,317 is carried forward.

The Richmond (Surrey) Electric Light & Power Co., Ltd., recommends a first and final dividend of 6 per cent. (same). The net profit for 1944 was £9,313 (against (£8,574).

The City of London Electric Lighting Co., Ltd., is raising its ordinary dividend from 5½ to 6 per cent. for 1944. The net profit was £88,450 contrasted with £55,623 for 1943.

The British Power & Light Corporation, Ltd., from a net profit of £382,432 (against £335,483) is maintaining its dividend at 7 per cent. by a final payment of 5 per cent.

The North Wales Power Co. is again paying a dividend of 5½ per cent.

The Lancashire Electric Light & Power Co. announces a profit of £369,588 for 1944 (against £370,466) from which a final dividend of 5 per cent. (making 7½ per cent.) is again paid.

The Clyde Valley Electrical Power Co. is again paying a final ordinary dividend of 5 per cent., making 8 per cent. for the year.

Electrical Distribution of Yorkshire, Ltd., announces a final dividend of 4½ per cent., making 9 per cent. for the year (same).

The Northampton Electric Light & Power Co., Ltd., is to pay a dividend of 6 per cent., again making 10 per cent. for the year. The net profit, after providing for all taxation, was £62,365 (£66,421) and the carry-forward £98,290 (£95,738).

The Rushden & District Electric Supply Co., Ltd., proposes to pay a final dividend of 5 per cent., making 9 per cent. (same) for the year ended December 31st last. The net profit, after taxation, amounted to £5,908 (£7,639), £13,799 (£12,941) being carried forward.

The Llanelly & District Electric Supply Co., Ltd., is paying a 6 per cent. dividend (same) for the past year.

The Farnham Gas & Electricity Co. proposes to pay a final dividend of 3 $\frac{1}{2}$ per cent., making 6$\frac{1}{8}$ per cent. for the year (against 6 $\frac{1}{2}$ per cent.).

Crabtree Electrical Industries, Ltd., are maintaining their interim dividend at 5 per cent.

The Ransome & Marles Bearing Co., Ltd., is again paying an interim dividend of 9 per cent.

The Delhi Electric Supply & Traction Co., Ltd., has been notified of the Provincial Government's intention to purchase the undertaking referred to in the "Electric Licence" which is considered to include the tramways.

Taylor Tunnicliff (Electrical Industries), Ltd., are maintaining their dividend at 10 per cent.

New Companies

Tyne & Wear Electrical Co., Ltd.—Private company. Registered February 15th. Capital, £15,000. Objects: To acquire the businesses carried on at East Boldon as the Tyne & Wear Electrical Co., and at Sunderland as Cowper Shaw & Co. Directors: A. N. Cowper, 44, Dykelands Road, Sunderland; and R. J. Morgan, 7, Natley Avenue, East Boldon. Registered office: Station Approach, East Boldon, Durham.

Hales & Co. (East Anglia), Ltd.—Private company. Registered February 15th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, radio and electrical apparatus and accessories, etc. First directors: W. J. Hales and Joy M. Hales, both of 162, Lowestoft Road, Gorleston, which is the registered office.

Headlands Refrigerator Parts, Ltd.—Private company. Registered February 15th. Capital, £5,000. Objects: To carry on the business of manufacturers of, and dealers in, refrigerators and parts, electrical and general engineers, etc. Directors: T. P. Headland, 50, Abbotswood Road, S.W.16; and L. T. P. Headland, 36a, Eaton Place, Brighton, both directors of Thos. P. Headland, Ltd.; and W. Curtis, 72, Highbury New Park, N.5. Registered office: 164/8, Westminster Bridge Road, S.E.1.

Lloyd-Metcalfe Designs, Ltd.—Private company. Registered February 14th. Capital, £100. Objects: To carry on the business of electrical, mechanical and general engineers, designers for engineers, manufacturers of, and dealers in, radio apparatus and cinema and theatre equipment, etc. Directors: P. H. Lloyd, 13, York Road, Leamington Spa; and E. G. Metcalfe, 34, Chandos Street, Leamington Spa. Secretary: M. G. Haden. Registered office: 13, York Road, Leamington Spa.

Companies' Returns

Statements of Capital

Electricity Services, Ltd.—Capital, £5,000 in £1 shares. Return dated November 16th, 1944. 4,975 shares taken up. £4,915 paid. £60 considered as paid. Mortgages and charges: Nil.

Woodstock & District Electrical Distribution Co., Ltd.—Capital, £10,000 in 10,000 ordinary shares of £1 each. Return dated June 21st (filed August 20th, 1944). 3,978 shares taken up. £304 paid. £3,674 considered as paid. Mortgages and charges: £5,000.

Increase of Capital

Stanley Cooper, Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 ordinary shares beyond the registered capital of £500.

Mortgages and Charges

Electroflow Battery & Engineering Co., Ltd.—Debenture dated January 29th to secure £750, charged on the company's undertaking and property, including uncalled capital. Holders: M. Pomeroy and Marcus Harris & Lewis, Ltd.

Bankruptcies

K. G. Burfield, electrical contractor, Espere, Couchmore Avenue, Clayhall Avenue, Ilford, Essex.—The adjourned public examination of this debtor was held recently at the Shire Hall, Chelmsford. It had been reported previously that the statement of affairs showed a deficiency of £300 on liabilities of £406. In January, 1944, debtor commenced trading in partnership at Claybury Broadway, Ilford. Shortly afterwards the business was transferred to a limited company. In June, 1944, debtor's co-director resigned, and his holding in the company was taken by debtor's wife. The company's business suffered through evacuation of customers, and in October last year a winding-up order was made. The goodwill and effects of the company's business were sold for £360. He attributed his failure to inadequate remuneration from the company and his own ill-health. The examination was adjourned.

E. C. Mould, electrical retailer, 24, Westrow Gardens, Seven Kings, and lately 28, Clements Road, Ilford, and The Facade, High Road, Goodmayes.—First and final dividend of 1s. 10$\frac{1}{2}$d. in the £ payable March 7th at 42, Tavistock Square, London, W.C.1.

P. W. Penty, electrical contractor, trading as the Sackville Electrical Co., 38, Mannville Terrace, Bradford, Yorks. — Order made February 15th rescinding the receiving order and dismissing the petition dated April 19th, 1928, as debts have been paid in full.

G. C. Pinney and **A. E. Miller,** wireless and electrical dealers, trading as Granby Service Co., 4, Granby Street, Littleport, Cambridge.—Application for discharge to be heard on March 21st at the Guildhall, Cambridge.

J. Gibbons, radio dealer, 176, Abbey Street and lately 240, Abbey Street, Derby.—Proofs for dividend by March 7th to the trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

STOCKS AND SHARES

TUESDAY EVENING.

THE outstanding feature in the Stock Exchange markets is the strength of securities of all kinds, more particularly those of the gilt-edged description and what has come to be called the " blue-chip " class of ordinary shares. Amongst the latter there are British Insulated, Callender's, Henley's, Tube Investments and various others in companies which have achieved a financial position which entitles their shares to be considered front-rank industrials. The more speculative issues, such, for instance, as those in the radio group, have rather fallen into the background for the time being.

It is of passing interest to notice the American " Poor Man's Boom," as New York calls it. This has taken place in the Wall Street Stock Exchange, and where speculative shares of American railroads and industrials have substantially improved in price under the pressure of popular demand. There is, by the way, a proposal in America to tax the profits made by speculators in property and in stocks and shares, the tax to be levied on profits made by wartime speculation. The suggestion comes from the chairman of the Federal Reserve Board.

Movements in Prices

The only recordable change in electrical gilt-edged stocks is a rise of 1 to 107 in Central Electricity Board 4½ per cent. of 1951–73. Ordinary shares in the front-rank class of manufacturing and equipment companies are, however, mostly better. Callender's, for example, tread close upon the heels of £6. Midland Electric Manufacturing are 2s. 6d. higher at 7⅜. De la Rue shares have got into double figures: Tube Investments recovered to 5½. On the other hand, declines have made British Insulated 5 13/16, Murex 5 1/16 and Westinghouse Brakes 76s. Revo went back 6d. to 43s. 6d. and there were falls of a few pence in two or three other prices in this group. Shares of companies engaged in the heavy industries are attracting more support. Babcock & Wilcox at 54s. and Vickers at 19s. 3d. are better.

The Electrical Distribution of Yorkshire, Ltd., has declared the usual dividend, making 9 per cent. for the year. A similar rate has been paid for at least fifteen years and the profit has steadily increased since 1930. The shares are quoted at 46s. Lancashire Electrics are 6d. better on the week at 38s. and Llanelly at 28s. have gained 1s. Clyde Valley at 2⅛ and Scottish Power at 41s. have both advanced.

Canadian Marconis reacted a trifle, to 12s. 6d., after the recent sharp rise. International " Tel. & Tel." hold their advanced figure of 30. The Cable & Wireless market is uninteresting, the 5½ per cent. preference being 10s. lower at 117½.

Matters of Moment

The City of London Electric Lighting Co. gave the market a pleasant surprise by raising to 6 per cent. the dividend on the ordinary shares. Last year's dividend was 5½ per cent.—not fully earned on the year's operations. The price of 40s. is thought likely to go better. Franco Signs has made its new issue at 13s., and the shares are quoted at 2s. 3d. premium. Crabtree Electrical Industries change hands on the basis of 44s. cum the usual interim dividend of 5 per cent. just declared. Watford Electrics are a shade harder at 6s. 3d.

Indian buying is said to have caused the rally to 66s. 6d. in Calcutta Trams. Brazilian Tractions rose a further $\frac{1}{2}$; the increase in earnings attracts attention. A number of final dividends for 1944 have been declared by Home electricity supply companies; most of them are at the same rate as in the preceding year.

Notting Hill Electric

After being out of the dividend list for 3½ years, the Notting Hill Electric Lighting Co. returns with a payment on its 6 per cent. preference shares of 21 per cent. less tax. The ordinary shares are all held by the Metropolitan Electric Supply Co. Before the war, they used to receive good dividends. For the three years 1933 to 1935, the annual dividend was a little over 11 per cent. It fell away to 8 per cent. for the two following years and for 1938, 5 per cent. was paid. For 1939 the ordinary received nothing. The price of the 6 per cent. preference dropped to a nominal £8 per share, but so small was the amount of business in them that the official quotation was removed. There has always been a limited market, and for some time past buyers have predominated. This is the case at the present time, the £10 shares being quoted at 12¾, a rise of 45s. on the week.

New Issues

The Yorkshire Electric Power Co., requiring money to finance extensions now in course of completion, has placed privately £412,300 3¼ per cent. debenture stock at 99½. The stock has been issued to institutional investors and, the brokerage being ¼ per cent., the company will receive 99¼. There is already an amount of £1½ million of this stock quoted in the market at 100½, but the new stock will not be dealt in for at least six months.

The North Metropolitan Power Station Co. has decided to redeem its outstanding 5 per cent. second mortgage debenture stock and at the same time to offer the conversion right into a new 3¼ per cent. stock. The amount of the latter required for the conversion is £674,500, in addition to which,

expenditure on the construction programme will require another £825,500, bringing the total issue up to £1,500,000.

Radio Hopes

The market in radio shares is attracting less attention than usual owing, it may be, to other speculative departments being more interesting at the moment. There continues to be a fair turnover in the popular shares, of which Cossor and Philco are representative examples. The business is so evenly balanced between buyers and sellers that the daily fluctuations in prices are mostly on a narrow scale. Cossors are 9d. higher at 32s. 9d. The disposition is to wait upon the course of events. Justification for the present high prices is to be found, according to the supporters of this market, in the idea that the post-war possibilities are as extensive as they are vague. Speculation loves nothing so much as prospects, and when these are favourable, Stock Exchange prices conform to a sentiment which carries with it more optimism than logic.

B.T.H. Shares

Holders of British Thomson-Houston 7 per cent. preference shares have now received the formal offer of the Associated Electrical Industries 6 per cent. preference shares, particulars of which were published early in the month. On the strength of this proposal, B.T.H. 7 per cent. preference rose 1s. 6d. to 36s., the price at which Associated Electrical Industries will pay for fractions when these come to be dealt with. All past experience goes to show that some shareholders neglect to take advantage of their opportunity for converting, and this paragraph may serve as a reminder to B.T.H. preference shareholders that they should not fail to accept the offer.

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.

AKT.-GES. Brown Boveri & Cie.—" Electric switching devices." 6908/43. May 6th, 1942. (567359.)

Belling & Lee, Ltd., and C. W. Heath.—" Spring-contact prongs for electrical connections." 9874. June 18th, 1943. (567302.)

Belling & Lee, Ltd., and E. M. Lee.—" Spring-contact prongs for electrical connections." 9875. June 18th, 1943. (567303.)

Bendix Aviation Corpn.—" Emergency transmitters." 12757/43. July 10th, 1942. (567334.)

H. E. Brain and Automatic Telegraph & Radio Transceiver Co., Ltd.—" Electro-mechanical switch." 15626. September 23rd, 1943. (567277.)

British Thomson-Houston Co., Ltd.—" Method of making electric coils and coils produced thereby." 7938/43. May 19th, 1942. (567319.) " Electric circuit overload protective apparatus, particularly for use in electric distribution systems." 12814/43. August 15th, 1942. (567386.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" Apparatus for testing by X-ray ionisation." 17512. October 25th, 1943. (567280.)

British Thomson-Houston Co., Ltd., and C. J. E. Dixon.—" Earthing of electrical networks." 8208. May 24th, 1943. (567264.)

British Thomson-Houston Co., Ltd., and G. T. Grapes.—" Circuit arrangement for operating electric discharge lamps." 5394. April 5th, 1943. (567377.)

British Thomson-Houston Co., Ltd., J. G. Wellings and B. Withers.—" Operation of electric fuses." 12190. July 27th, 1943. (567347.)

Chloride Electrical Storage Co., Ltd. (J. C. Duddy).—" Electric storage batteries or accumulators." 2080. February 8th, 1943. (567294.) " Containers for electric storage batteries or accumulators." 2081. February 8th, 1943. (567295.)

Duratube & Wire, Ltd., and J. Veit.—" Electrical conductors and cables." 6630. April 27th, 1943. (567317.)

Electric Transmission, Ltd., and E. C. Gumbrell.—" Electric switches and contact arrangements therefor." 12672. August 5th, 1943. (567329.)

Electroflo Meters Co., Ltd., and H. W. Beara.—" Indicating or controlling means or devices." 7457. May 11th, 1943. (567300.)

Electrolux, Ltd.—" Vacuum cleaners." 13786/43. July 24th, 1942. (Addition to 536850.) (567351.)

General Electric Co., Ltd., and E. M. Hickin.—" Concentric cables and wave guides." 1990. February 13th, 1942. (567287.)

R. P. H. Hinds.—" Portable electric hand lamps such as inspection lamps." 18767. November 11th, 1943. (567314.)

Londex, Ltd., and W. H. Smith.—" Devices for detecting, measuring or controlling the electric conductivity of liquids." 14003. August 27th, 1943. (567275.)

Mallory Metallurgical Products, Ltd.—" Welding electrode holders." 12833/43. August 7th, 1942. (567387.)

Philips Lamps, Ltd., and J. H. De Boer.—" Photographic flashlight lamps." 420. January 8th, 1943. (567363.)

Revo Electric Co., Ltd., and F. H. Reeves.—" Lighting fittings embodying a linear light source." 14603. September 7th, 1943. (567276.)

Standard Telephones & Cables, Ltd.—" Carrier wave circuit protection." 13995/43. June 23rd, 1942. (567352.)

J. Stone & Co., Ltd., and G. H. Kyte.—" Electric regulators of the carbon pile type." 5080. March 30th, 1943. (567341.)

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.

Belfast.—March 6th. Electricity Department. Materials including feeder and section pillars, armourclad compound-filled 6,600-V switchgear, meters and instrument transformers, l.v. fuse units, cut-outs, joint boxes, cables, lamps, switch tripping batteries and charging equipments, etc. (February 9th.)

Leeds.—March 14th. Transport Department. 750-kW automatic mercury-arc rectifier equipment, complete with high- and low-voltage DC switchgear. (See this issue.)

Plymouth.—March 10th. Electricity Department. Synchronous motor-driven time switches. (February 23rd.)

Southend-on-Sea.—March 31st. Electricity Department. House service meters. (See this issue.)

Orders Placed

Bedford.—Electricity Committee. Accepted for twelve months.. Cables.—Siemens Bros. Lamps.—Cryselco.

London. — FULHAM. — Electricity Committee. Accepted. Low-pressure pipework. Stewarts & Lloyds. Turbo-alternator and condenser.—Metropolitan Vickers.

Middlesbrough. — Corporation. Accepted. Electric battery for refuse collecting vehicle (£202).—Young Accumulator Co.

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.

Alfreton.—Pithead baths, Pilsley Colliery; Architects' Department, Miners' Welfare Commission, Ashley Court, Ashtead, Surrey.

Beeston.—Houses, Dovecot Lane (£4,400), for U.D.C.; Briggs & Co., builders, Beechdale Road, Nottingham.

Blackburn.—Buildings; W. Livesey & Sons, Ltd., Nova Scotia Saw Mill.

Brighton.—Adaptation of Royal Sussex Hotel as training college extension; borough architect.

Bristol.—Restoration of offices at Council House (£8,000); H. M. Webb, borough engineer, 7, College Fields, Clifton.

Bromsgrove.—Houses at Cobnall Lane, Catshill, Burcott Road and Rubery for U.D.C.; J. E. Seabright, architect, 1, Corbett Avenue, Droitwich.

Cumberland. — Maternity Home, Penrith (£13,360); Leslie & Sons, Ltd., builders, Coach Road, Whitehaven.

Darwen.—Central bus station (£50,000); E. Marsden, borough surveyor, Town Hall.

Gateshead.—Conversion of premises in Bensham Road, Saltwell Road, Victoria Road and Askew Road into flats; borough engineer.

Glasgow.—Substation, etc.; Scottish Farmers' Dairy Co., Ltd.

Kent.—School improvements, huts and equipment (£43,000); county architect.

Leicestershire.—School canteens (£8,288); county architect.

London.—CATFORD.—Mill extension and transformer house, Loampit Vale; C. G. Eaglen.

Manchester.—Works additions for R. P. Lawson, Ltd.; W. Thorpe & Son, Ltd., building contractors, Chester Road, Cornbrook, Manchester, 16.

Middlesex.—Mortuary, West Middlesex Hospital (£2,350) and adaptation of Hampton Court House as institution; county architect.

Newcastle - on - Tyne.—Additions for the Woodbine Laundry; T. Hutchinson & Son, builders, Elswick Road.

Northants.—Extensions to Wellingborough Grammar School; J. Perkins, county architect, County Hall, Northampton.

North Riding.—Additional temporary accommodation at Clifton Without Junior and Infant School and Saltburn School (£2,700); county architect, County Hall, Northallerton.

Northwick Park.—New Charing Cross Hospital; governors.

Pendleton.—Dining room and kitchen; Yarwood's, Ltd., building contractors, Moss Lane Bridge, Altrincham, Cheshire.

Peterhead.—Proposal to install plant for freezing fresh herrings at Peterhead and Fraserburgh for Herring Industry Board; T. Buchan, chairman of Peterhead Fishermen's Committee.

Reddish.—School kitchen and dining room; Henry Bardsley & Sons, Ltd., builders, Booth Street, Stockport.

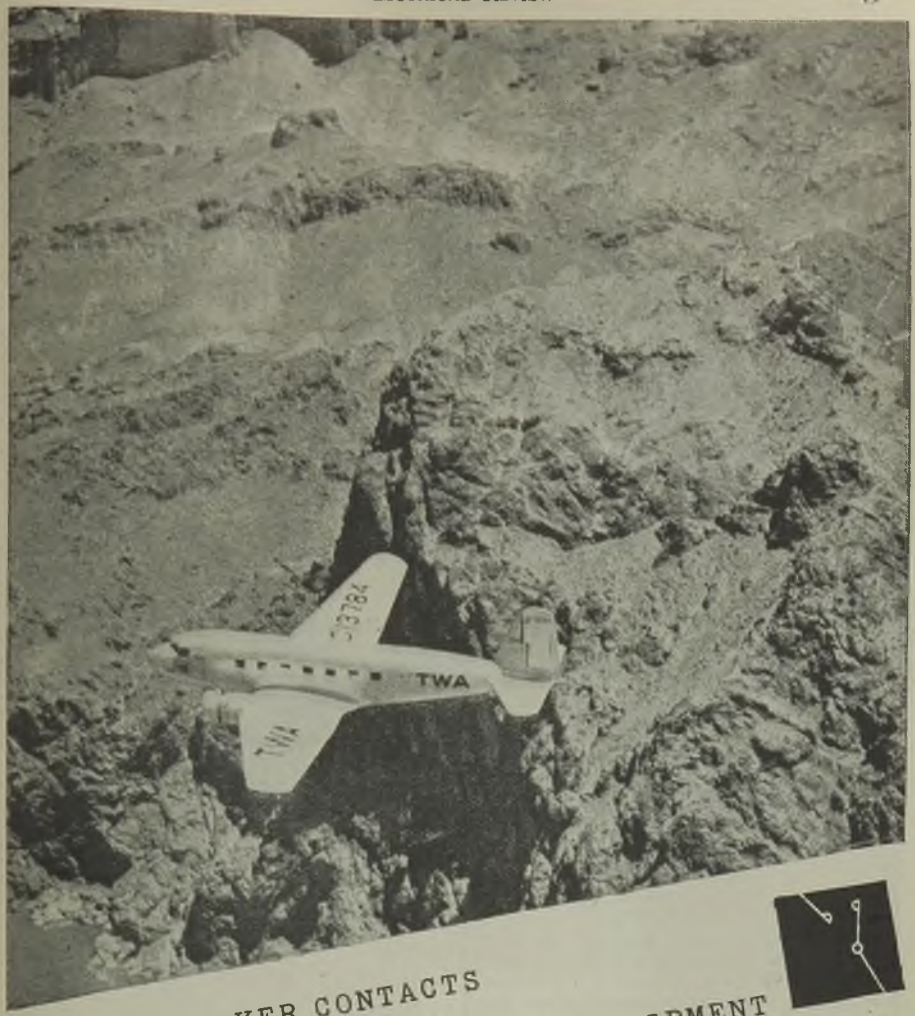
Sharston.—Central kitchen for school meals; Mertees Construction Co., Ltd., building contractors, 25, Cross Street, Manchester, 2.

Warrington.—Works additions; Williams, Tarr, Ltd., building contractors, Bewsey Road. Mortuary, Isolation Hospital; J. Y. Hughes, borough surveyor, Municipal Offices.

Warwickshire.—Additions, Rugby Technical College (£2,000); county architect.

Nikola Tesla

THE Commemorative Lecture on Nikola Tesla given by Dr. (now Sir Arthur) Fleming at the Institution of Electrical Engineers on November 25th, 1943, has now been published by the Yugoslav Government. In this edition, which runs to twenty-four pages and includes eight plates illustrative of Tesla's researches, the lecture is preceded by a short foreword relating to conditions in the Balkans, which at that time caused Tesla to leave his country for the United States, and a map of the historical provinces of Yugoslavia.



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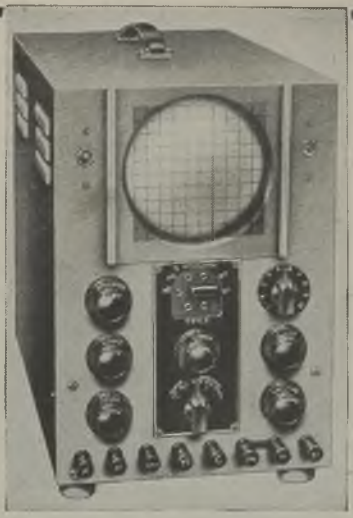

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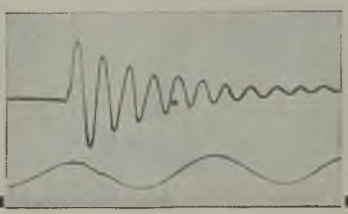

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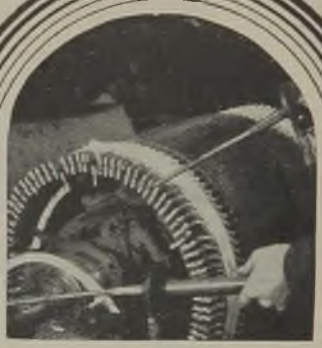

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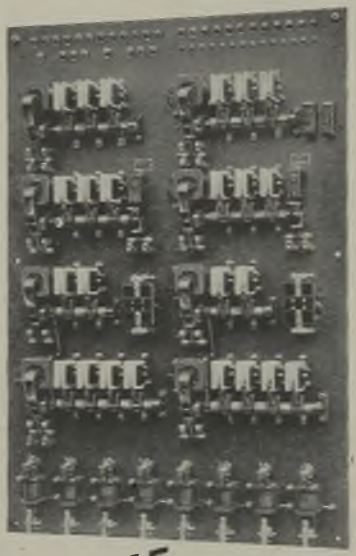

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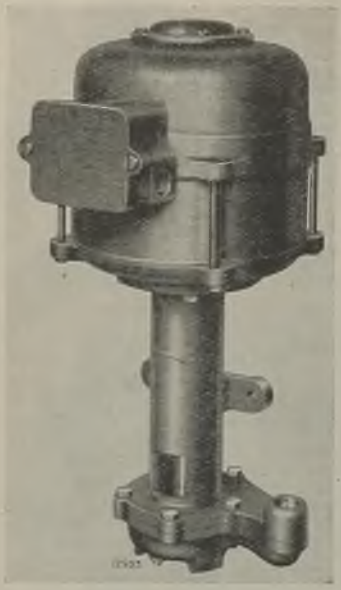

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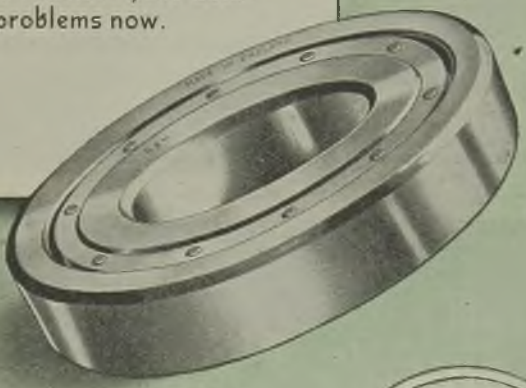

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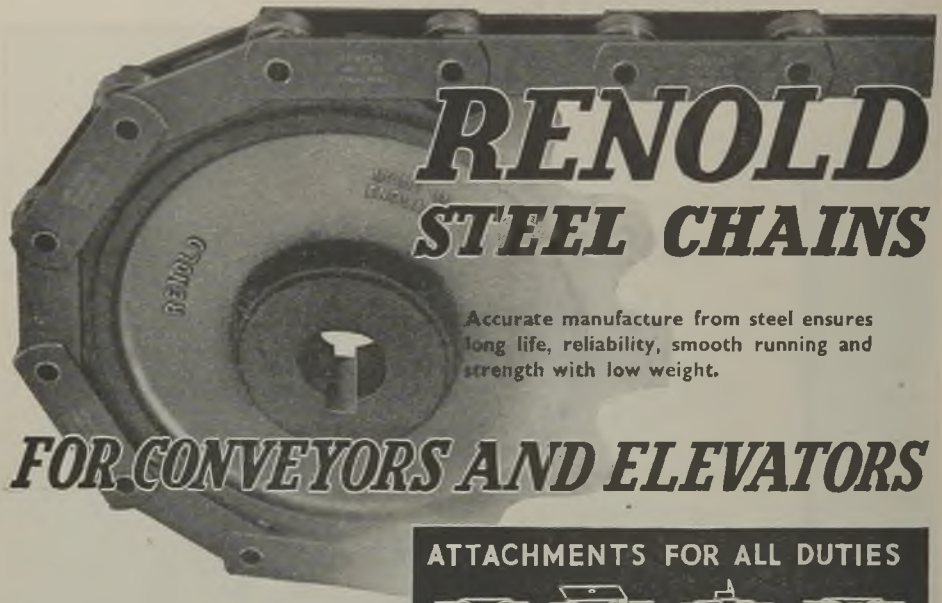

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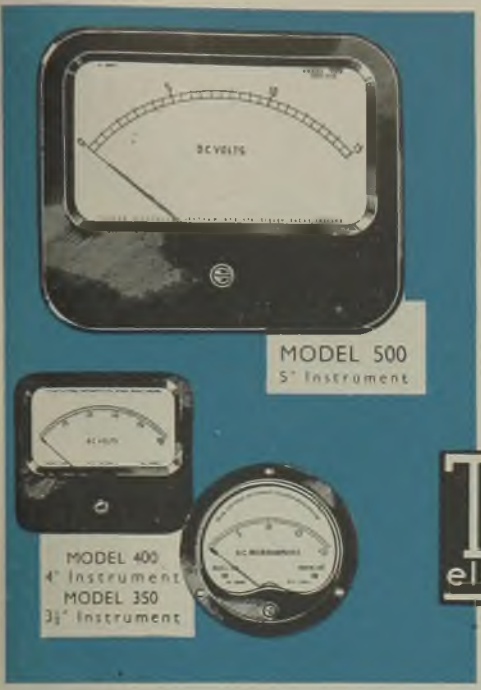

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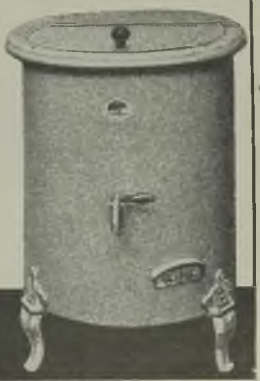

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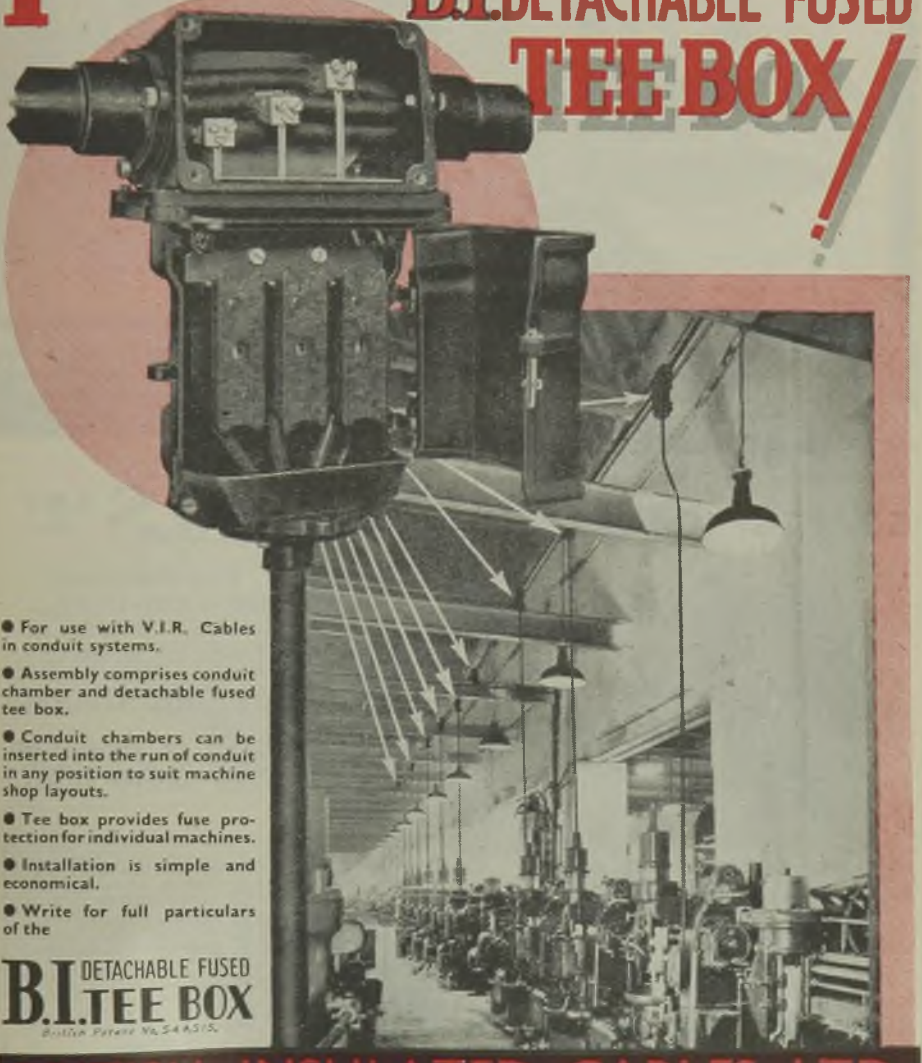

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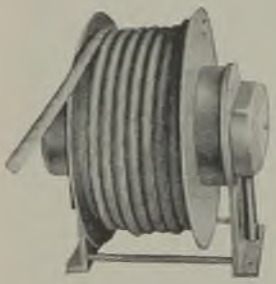

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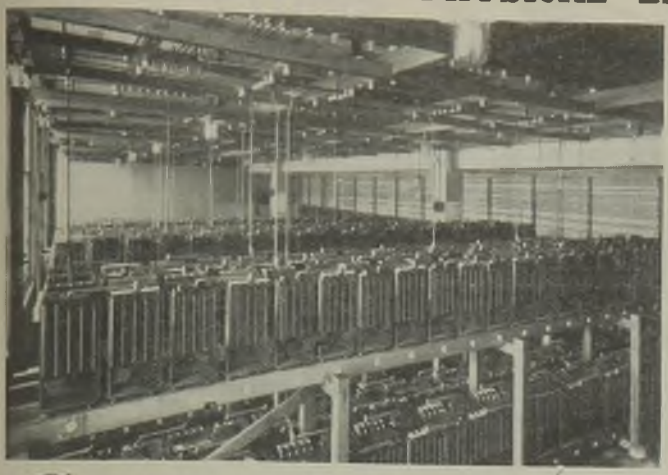

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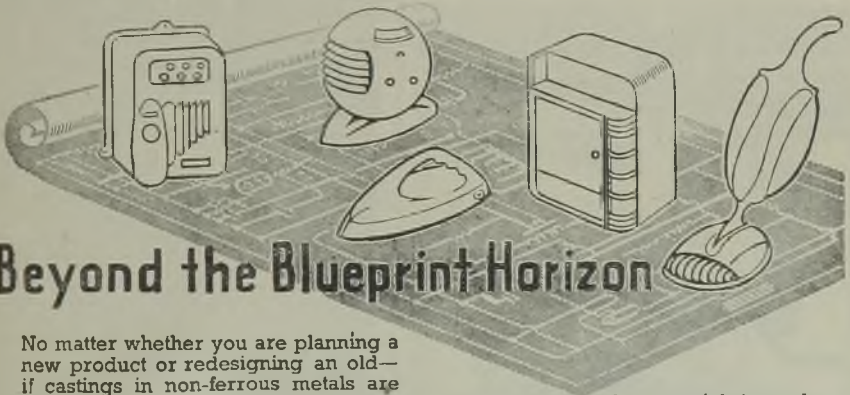

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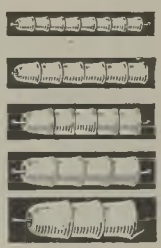

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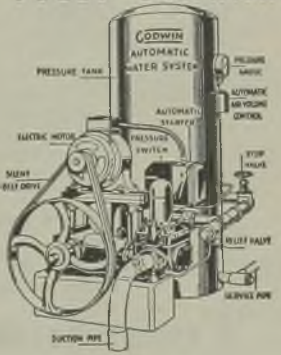

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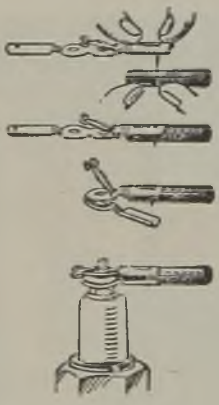

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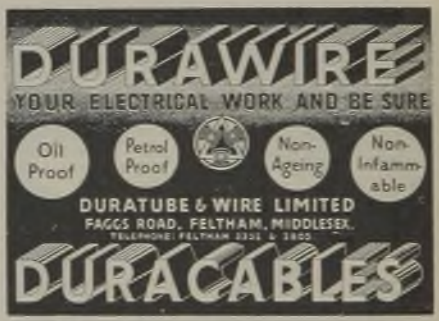

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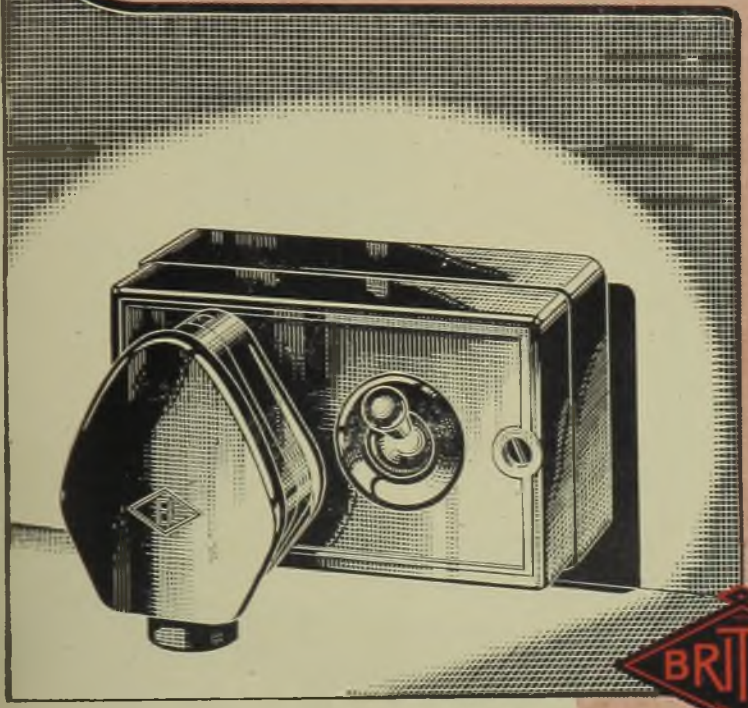


BRITMAC

The "Front-Entry" Rectangular pattern Surface Switchplug has become increasingly popular. The "BRITMAC" Range is very comprehensive, being available in 5-amp. and 15-amp. "Open," "Screened" and Interlocking patterns. Single and Double Pole. We also supply 2-amp. which are only available in "Open" type. Single Pole. Flush Mounting "Front-Entry" Switchplugs are also available. "BRITMAC" 3-pin Switchplugs are made to the only existing British Standard Specification, namely B.S.S. 546.

May we send you details of this Range of "BRITMAC" Front-Entry Switchplugs?

ELECTRICAL ACCESSORIES FOR ALL WAR-TIME INSTALLATIONS

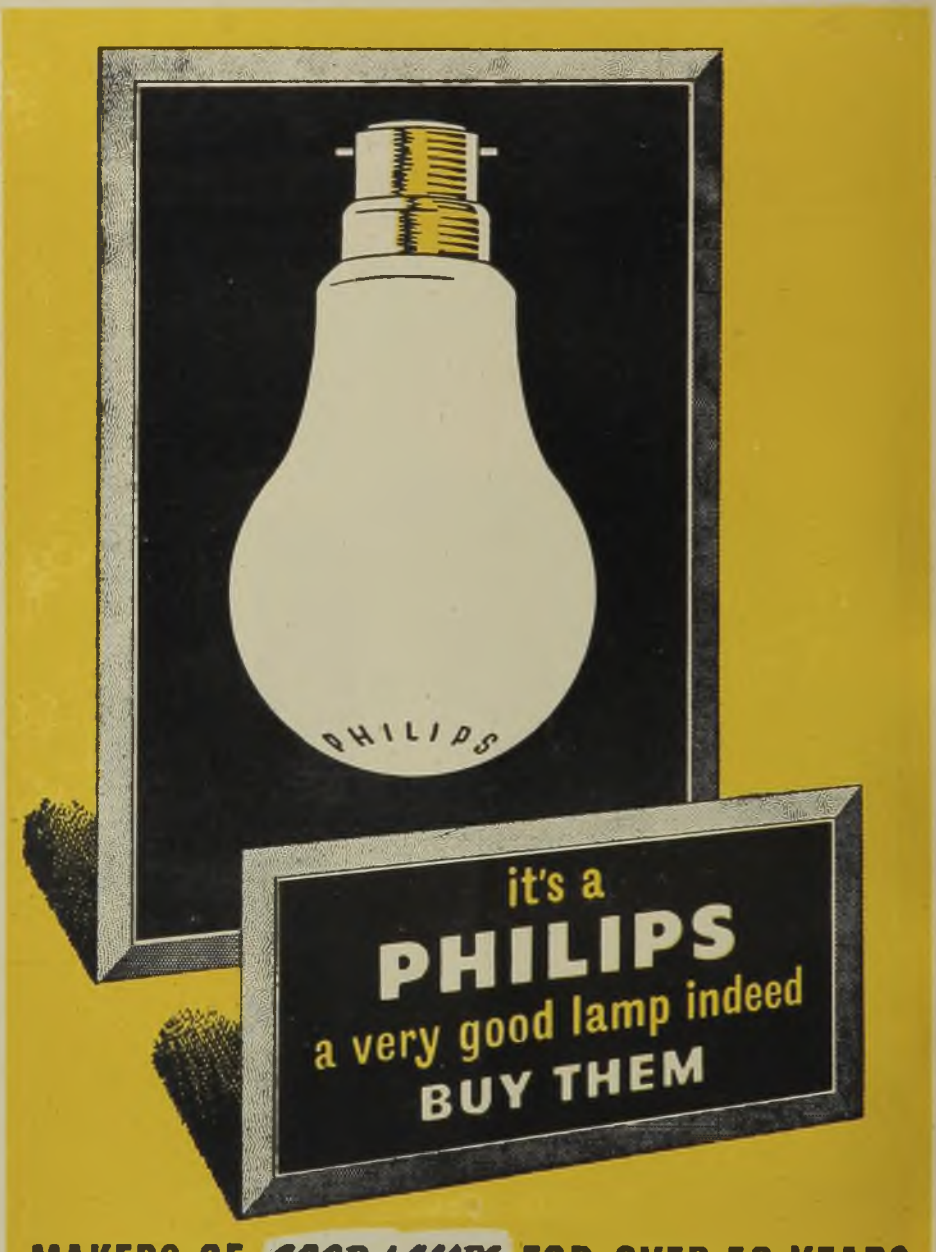
POINTS OF PERFECTION

C·H·PARSONS·LTD

Telephone: ACOCKS GREEN 1642 5 LINES

Britannia Works
Wharfdale Rd. Tyseley
BIRMINGHAM 11

Telegrams: HECTOMAR BIRMINGHAM

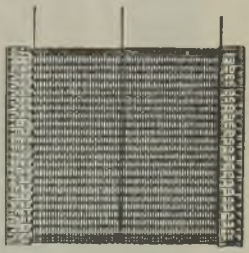

PHILIPS
it's a
PHILIPS
a very good lamp indeed
BUY THEM
MAKERS OF GOOD LAMPS FOR OVER 50 YEARS
PHILIPS LAMPS LTD · CENTURY HOUSE · SHAFTESBURY AVE · W.C.2

"PRANA" PRESSURE
Die Castings
BASIC METALS —
ALUMINIUM, ZINC, TIN AND LEAD

★ Write for Treatise on Die Castings
SPARKLETS LIMITED
Dept. 36, LONDON, N.18
FOUNDED 1896

ASBESTOS WOVEN
WIRE
RESISTANCE NETS

IN ADDITION TO A COMPREHENSIVE RANGE OF STANDARDISED SIZES, SPECIAL TYPES ARE MADE AT SHORT NOTICE



Send particulars of your requirements to our Technical Service Dept.

ALWAYS IN STOCK
IMMEDIATE DELIVERIES

THE CRESSALL MANUFACTURING CO. LTD
31-32 TOWER STREET ··· BIRMINGHAM 19
PHONE: ASTON CROSS 3463-4
GRAMS: OHMIC - BIRMINGHAM

INSULATION is the vital factor on which depends the efficiency of all electricity supply. Rely upon the knowledge and experience of specialisation.

SLIPKNOT Reg'd.
INSULATING TAPES

Indispensable to every Electrical Engineer

From all Electrical Wholesalers and Factors
Manufactured by:
ROTUNDA LIMITED

Copper
CLAMPING WASHERS

ALL SIZES

The HAMPTON WORKS
(STAMPINGS) LIMITED
PRESSWORK EXPERTS
TWYNING ROAD, STIRCHLEY, BIRMINGHAM
Tel.: King's Norton 2281 (2 lines). Grams: Radiagills, B'ham

OSRAM

FLUORESCENT LAMP

5 ft. 80 watt

The brilliant daylight effect of OSRAM Fluorescent lamps has done much to maintain and increase production in the war factories. There are situations, however, where a light of warmer tone than the existing "Daylight colour" is desired. *For these situations the "Warm-white" Fluorescent Lamp has been introduced.* With the exception of the change in colour, all other characteristics remain the same.

Low Surface Brightness reduces direct or reflected glare

Large area source means soft shadows

High efficiency means economy in current consumption

Cool Burning reduces discomfort due to heat

Quick starting, full light obtained almost instantaneously

Suitable for existing installations

G.E.C. Research and skilled manufacture have thus made available pleasing alternatives for almost any industrial need — and opened up a vista of unlimited promise for attractive and efficient lighting in other directions after the war. **An extensive range of G.E.C. Industrial fittings is available.**

CONSULT THE G.E.C. ON FLUORESCENT LIGHTING AND ALL FORMS OF ILLUMINATION

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

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First post on Monday,** at Dorset House, Stamford Street, London, S.E.1.

THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, minimum 2 lines 4/-, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number 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 LEEDS

THE Transport Committee of the Leeds Corporation invites tenders for the supply and erection of 750-kW Automatic Mercury Arc Rectifier Equipment, complete with H.T. and L.T., D.C. Switchgear.

Specification, with conditions of contract and form of tender, may be obtained upon application to the undersigned; each application to be accompanied by a deposit of ONE GUINEA, which deposit will be refunded upon receipt of a bona fide tender.

Sealed tenders, enclosed in a PLAIN ENVELOPE, endorsed on the outside "TRANSPORT—TENDER FOR RECTIFIER," to be delivered to the Town Clerk, Committee Department, Civic Hall, Leeds, 1, not later than 10 a.m. on Wednesday, 14th March, 1945, and must remain open for acceptance for six weeks thereafter.

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

W. VANE MORLAND,
M.I.Mech.E., M.I.A.E., M.Inst.T., F.R.S.A.,
General Manager and Chief Engineer.

1, Swinegate,
Leeds, 1.
24th February, 1945. 1494

COUNTY BOROUGH OF SOUTHEND-ON-SEA

Electricity Department

TENDERS are invited for the supply and delivery over a period of 18 months of 5,000 HOUSE SERVICE METERS. Specification, etc., from the undersigned.

Tenders to be delivered to the Town Clerk, Municipal Buildings, Southend-on-Sea, not later than March 31st, 1945.

A. C. JOHNSON,
Engineer and Manager.

Electricity Works,
London Rd., Southend-on-Sea. 1497

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 and 41 unless such woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

LONDON POWER COMPANY LTD.

APPLICATIONS are invited for the position of Control Room Engineer. Applicants must have had a sound technical training and experience in the control of Electric Supply Systems and the Parallel Operation of large turbo-alternators.

The salary will be in accordance with E.P.E.A. Schedule, Class J, Grade 9, at present amounting to £401 per annum.

The successful candidate will be required to pass a medical examination and to contribute to the Company's superannuation scheme.

Applications, stating age and full particulars of training and experience, to be addressed to:

Superintending Engineer,
London Power Co. Ltd.,
Acton Lane,
Harlesden, N.W.10. 1500

SALES Representative required for specialized range of Lighting Fittings. State age, experience and salary required to—Box 1519, c/o The Electrical Review.

CITY OF GLOUCESTER

Castle Meads Power Station

ENGINEER-in-Charge of Shift, Class G, Grade 8, required for 40-MW Plant. Must be accustomed to modern high-pressure and temperature equipment. State full particulars of age, training, experience, etc., and present employers' attitude with regard to release. Copies of not more than three recent testimonials should be given. The appointment is subject to the passing of a medical examination for superannuation purposes.

The housing situation in the district is extremely acute, and the likelihood of finding married quarters is remote. Lodging allowance on Ministry of Labour scale is payable for a limited period.

Closing date for application is March 17th, 1945.

EMIL BRAATHEN,
Chief Engineer and General Manager.

Gloucester Corporation Electricity Department,
Commercial Road,
Gloucester. 1521

DEMOBILISATION

MEN of definitely outstanding ability seeking permanent and progressive positions upon demobilisation from the armed Forces or from war industries are invited to record particulars of what they have to offer with a large and important electro-mechanical manufacturing group engaged in the development and production of electrical materials, equipment, apparatus, valves, plastics, wire and cable.

The policy of the group is to make promotions from within, but a few appointments for demobilised men of outstanding ability are available in the following fields:—

Research—electrical, mechanical, metallurgical.
Efficiency, time and motion study.
Production engineering—machine design, tool, jig and fixture design—shop-trained engineer draughtsmen.
Tool Room and Shop Supervision.
Factory and Plant Engineering.
Inspection.
Progress and Production Control.
Costing.
Employment and welfare of personnel.
Superlative craftsmen, e.g., toolmakers.
Young men of character suited for further training.

Men other than those of outstanding ability are advised not to reply to this advertisement.

Applications in the first instance should be made to Box 1491, c/o The Electrical Review.

SLONETRIC HOUSE

REQUIRE the following staff and offer good prospects: Male Clerical Assistant, with trade experience. Junior Female or Male Clerk, for general office routine.

SLOAN ELECTRICAL CO. LTD.
Wholesale Electrical Distributors,
Albany Rd.,
Leyton, E.10.
LEY. 5015/6/7.

1396

APPLICATIONS invited for position of Works Manager in transformer factory, North-West London. Applicants should have experience in manufacture of transformers of all types up to 500 kVA. Post becomes available upon lifting of the engagement order and will be permanent. Full particulars, giving details of experience and salary required, to—Box 1499, c/o The Electrical Review.

COUNTY BOROUGH OF BLACKPOOL

Appointment of Borough Electrical Engineer

APPLICATIONS are invited from persons experienced in the management and administration of an electricity undertaking for appointment as Borough Electrical Engineer of the Council.

The salary will be: First year, £1,490 per annum; second year, £1,620 per annum; third year and thereafter, £1,750 per annum, plus cost of living bonus.

The appointment will be subject (i) to the provisions of the Local Government Superannuation Act, 1937, (ii) to the person appointed satisfactorily passing a medical examination by a medical officer on behalf of the Council, and (iii) to the other terms and conditions relating to the appointment.

Application forms, together with terms and conditions of the appointment, may be obtained from this office, and must be returned to the undersigned, endorsed "Borough Electrical Engineer," not later than the 10th March, 1945.

Canvassing, directly or indirectly, will be deemed a disqualification.

TREVOR T. JONES,
Town Clerk.

Municipal Offices,
Town Hall St., Blackpool.
21st February, 1945. 1514

Associated Municipal Electrical Engineers
(Great Britain and Ireland) and
The Electrical Power Engineers' Association

NOTICE

BLACKPOOL CORPORATION

Appointment of Borough Electrical Engineer

ON account of the terms of the Corporation's advertisement of the above post, the Standing Joint Committee hereby cancels its previous notice and members are free to apply for the vacancy.

W. ARTHUR JONES, A.M.I.E.E.,
Secretary,
Standing Joint Committee,
A.M.E.E.—E.P.E.A. 1502

CHEMIST required for manufacture of and research into fluorescent material. Experience in this field, or in inorganic analysis of traces, an advantage. Excellent post-war prospects. Salary according to qualifications. Write—Box E.L.3, 105, Judd Street, London, W.C.1. 1507

DOMESTIC Ironmongery, Hardware and Electrical Buyer required. Applicants must be well versed in up-to-date household appliances and have a wide buying experience in the above departments. The position carries a substantial salary and prospects to a man who will be able to take advantage of post-war conditions. Apply—General Managers, Arding & Hobbs Ltd., Clapham Junction, S.W.11. 1513

EXPERIENCED Electrical Engineer, with technical and commercial training, required to deal with estimating and purchasing by firm of electrical engineers. Apply in confidence to—British Central Electrical Co. Ltd., 6/8, Rosebery Avenue, London, E.C.1. 1487

OVERSEAS Employment: Goverment of India. Urgent vacancies exist for 3 Supervisors (Production Engineers) for Telegraph Workshops at Calcutta, Jubbulpore and Bombay for manufacture of stores connected with telecommunication development. Qualifications: Degree or diploma in mechanical or electrical engineering, and preferably A.M.I.Mech.E. or A.M.I.E.E., 10 years' workshop experience, including 5 years in supervisory capacity. Preference given to candidates with expert knowledge and experience in (a) Toolmaking, (b) die-sinking for plastic moulding, or (c) instrument designing. Age limit 50 years. Appointment for 2 years, subject to 6 months' probation, terminable by 3 months' notice on either side. Pay between Rs. 800—Rs. 1400 per mensem, according to qualifications (Rupee = 1s. 6d. approximately). House rent and compensatory allowances admissible under certain conditions. Free passage to and from India. Applicants should write, quoting C.2484A, to the Ministry of Labour and National Service, Appointments Dept., Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for the necessary forms, which should be returned completed on or before 17th March, 1945. 1480

REPRESENTATIVES required by manufacturer to call upon export houses in London area, also upon manufacturers, mostly London area. State experience, age, full particulars of qualifications, remuneration desired.—Box 118, Parrs, Craven House, Kingsway, London, W.C.2. 1510

EXPERIMENTAL Physicist required, preferably with experience in vacuum and gas discharge work. Excellent post-war prospects. Salary according to qualifications. Write—Box E.F.7, 105, Judd St., London, W.C.1. 1508

MANAGER required for Electrical Department of large chemical and metallurgical works in London district, to superintend the installation and maintenance of all electrical equipment, including H.T. and L.T. distribution networks, and to assist in planning layouts. Experience in administration and the control of labour essential. Technical qualifications to engineering degree or A.M.I.E.E. standard. Applications, giving full details, to—Box 1515, c/o The Electrical Review.

REQUIRED for municipal power station in the West, Boiler Fireman, rate 25.67d. per hour, D.J.I.C. conditions of employment. Permanent, pensionable post for suitable man. The successful applicant, if not more than forty-five years of age, will be required to pass a medical examination for the purpose of contributing to the superannuation fund. Applicants must be used to modern H.P. boilers and chain-grate stokers. They should state clearly prospects of release as regards present employment. State age, whether married or single, and full address. The housing situation in the locality is extremely acute, and it may be necessary for the successful applicant to live either in lodgings or in hostel accommodation for a considerable period. Provisional arrangements for the payment of lodging allowances are in operation.—Box 1450, c/o The Electrical Review.

RESEARCH Engineer required immediately to organise and control laboratory and experimental department of progressive manufacturing company, situated in N.W. London area. The Company is concerned with the production and development of building and engineering specialities of high priority both at present and for post-war requirements. Applicants should have wide experience of mechanical and electrical engineering, knowledge of organic chemistry and metallurgy an advantage. An inventive ability would be an additional asset. Salary from £800 per annum according to qualifications. Applicants should write, quoting C.2462XA, to the Ministry of Labour and National Service, Appointments Dept. Central (T. and S.) Register, Room 5/17, Sardinia Street, Kingsway, London, W.C.2, for the necessary forms which should be returned completed on or before 12th March, 1945. 1437

SALES Manager for old-established firm in Midlands manufacturing and supplying arc welding electrodes, plant and accessories on a large scale. Applicants must be of good education, should possess sound technical knowledge of arc welding materials and applications, and must have considerable experience of indoor and outdoor sales management in the engineering industry. Age 30 to 40. Substantial salary with excellent present and post-war prospects. Apply, giving full particulars of education, training and experience, and stating age and salary required, to—Box 1483, c/o The Electrical Review.

SALES Representative required for illuminating engineering department of Thorn Electrical Industries Ltd. Experience in planning industrial lighting essential. Excellent post-war prospects. Write, with details of age, experience and salary required, to—Box E.L.2, c/o 105, Judd Street, London, W.C.1. 1490

SENIOR Time Study Engineers (Ref. No. QS.119) required by large North London light electrical manufacturers. Extensive experience of time study practice and modern manufacturing methods essential. Commencing salary £500-£600 per annum, according to experience. Time Study and Rate Fixing Trainees (Ref. No. QS.118) also required. Good education and some industrial experience necessary. Salary about £300 per annum, according to experience. All above posts are permanent, with sound post-war prospects. Applications, in writing (no interviews), stating date of birth, full details of qualifications and experience (including a list in chronological order of posts held) and quoting the appropriate reference number, should be addressed to the Ministry of Labour and National Service, Appointments Department (A.3A), Sardinia Street, Kingsway, W.C.2. 1509

TECHNICAL Copywriter with creative ability required on the staff of S. H. Benson Ltd., Kingsway Hall, London, W.C.2. Applicants must be able to write knowledgeably about electrical plant. Apply by letter to Production Director, stating age, experience and salary required. 1518

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.

LANARK County Council—Two Divisional Lighting Superintendents.

SITUATIONS WANTED

ADVERTISER desires change, either immediate or post-war; complete charge of Commercial Inside Sales Organisation. Advertiser is capable of controlling large office, warehouse and despatch departments, and is prepared to take up position in either London or provinces. Replies giving fullest details as to position and salary offered.—Box 6769, c/o The Electrical Review.

ADVERTISER, gent (34), requires secretarial position, varied experience electricity supply, diplomas, London or provinces.—Box 6795, c/o The Electrical Review.

ADVERTISER specialising in the introduction of high-class insulation materials to electrical engineering works and radio manufacturers would like to contact a progressive manufacturing concern who can use a live and well-connected gentleman in present and post-war activities. Main items are mica and productions therefrom, synthetic resin laminated boards, rods and tubes, etc. Write first to—I.N.S., Box 6775, c/o The Electrical Review.

A.M.I.E.E. requires post, 12 years mains assistant large municipality, 6 years' cable works experience, 1 year in senior executive post, three years supervising cable-laying contracts, London preferred.—Box 6764, c/o The Electrical Review.

ELECTRICAL Engineer, age 36, seeks change. 15 years' experience in design and operation high frequency furnaces, at present maintenance engineer at large factory. London or South preferred. Salary £700.—Box 6793, c/o The Electrical Review.

ELECTRICAL Engineer, age 36, travelled widely, seeks position with engineering firm with view to establishing agency abroad.—Box 6759, c/o The Electrical Review.

ELECTRICAL Engineer (28) desires post-war position with wide scope and good prospects. Twelve years' practical experience in all types of breakdown work, including maintenance and installation, also first-class armature winder.—Box 6747, c/o The Electrical Review.

ELECTRICAL Engineer (35), Inst.B.E., A.S.E.E., 21 years' experience installation, maintenance, etc., quotations, design, development of factory plant and equipment, desires change. Control staff 40 (mixed). Executive post with p.w. prospects. Salary commensurate with responsibility.—Box 6773, c/o The Electrical Review.

ELECTRICAL Engineer (36) seeks permanent progressive post, F.H.P. motors, motor-driven equipment, sound experience, inspection, test, winding, assembly.—Box 6790, c/o The Electrical Review.

ELECTRICAL Engineer (41), specialist in time study, bonus systems, methods, layout and equipment, desires post with progressive firm endeavouring to modernise factory methods and plant.—Box 6780, c/o The Electrical Review.

ELECTRICAL Installation and Maintenance Engineer, 20 years' sound practical experience, desires change, progressive post, home or colonies, (37), keen, competent. Can take charge.—Box 6786, c/o The Electrical Review.

ELECTRICAL Manager controlling large staff engaged on design, development and manufacture of small electrical equipment requires change to similar post, or position as Works or Technical Manager.—Box 6772, c/o The Electrical Review.

ELECTRICAL Wholesalers' Storekeeper or Manager, 35 years' experience, extensive knowledge all branches, material, office, correspondence, etc., desires change, with well-known firm, for fair wage. Not afraid of work or responsibility. South or South-West preferred. Please state approx. wages offered. Replies to—Box 6789, c/o The Electrical Review.

EX-R.E.M.E. officer (31), Grad. I.E.E., seeks executive post in London district, thorough apprenticeship and experience in complicated circuit designs, switchgear, F.H.P. and larger motors, preparation of technical reports, good organiser with initiative. Not less than £600 p.a. Box 6762, c/o The Electrical Review.

TECHNICAL Sales Engineer (50) wishes to represent electrical manufacturer in London and Southern Counties. Connection amongst Government depts., supply authorities and trade.—Box 6765, c/o The Electrical Review.

TELEPHONE and Telegraph Engineer, married, ex-officer (49), wide experience home, abroad, survey, constn., mtc., public and railway networks, installation, operating, mtc., internal plant, auto, C.B., railway train traffic control systems, administration above staffs, seeks appointment, home, abroad, railways or British communication company.—Box 1417, c/o The Electrical Review.

YOUNG Electrical Engineer, Grad. I.E.E., 1st class A.M.E.M.E., several years' experience at large colliery group, desires suitable position with manufacturers of mining apparatus.—Box 6792, c/o The Electrical Review.

FOR SALE

Traders buying and selling hereunder must observe the Restriction of Resale Order, S. R. & O. 1942 No. 958.

CITY OF SALFORD

Electricity Department

Time Switches for Disposal

OFFERS are invited by first post 14th March, 1945, for the following time switches:—

6 10-amp., 230-volt, electrically wound, suitable for A.C. and D.C.
7 10-amp., 230-volt, hand wound (7-day).
6 Electrically driven, 110-volt, 50-cycle, 30-minute period, suitable for the operation of Maximum Demand Attachments.
8 as above, but 440 volts.
2 .. .. 400 ..
1 .. .. 230 ..
6 .. .. hand wound (45-day).

The above may be inspected at any time during office hours on application to the City Electrical Engineer, Electricity Department, Frederick Road, Salford, 6.

W. W. TOMSON, Town Clerk.

1516

"G-POWER-UNITS"

We can supply at short notice:

(a) METER-TESTING UNITS.
(b) ELECTRIC-MAGNET-TEST UNITS.
(c) FREQUENCY CHANGERS.
(d) MOTOR GENERATING SETS.
(e) COMBINED ENGINE-DRIVEN SETS.
(f) SPECIAL VOLT GENERATORS AND MOTORS.
(g) VARIABLE-SPEED EQUIPMENT.
(h) SPECIAL STARTING AND SWITCHGEAR
(i) COMPLETE SWITCHBOARDS.
(j) SPECIAL RATIO TRANSFORMERS.

The Specialists for Unusual Plant.

THE ELECTROPLANT CO.
(Estab. 1912),
WEMBLEY, MIDDX. 1503

GEORGE COHEN, SONS & CO. LTD.

for

GUARANTEED ELECTRICAL PLANT.

MOTORS. GENERATORS.
SWITCHGEAR.
etc.

WOOD LANE, LONDON, W.12.
Telephone: Shepherds Bush 2070
and
STANNINGLEY, NEAR LEEDS.
Telephone: Pudsey 2241.
Established 1834.

27

A.C. Motors, 400/3/50, slip-ring, squir. cage, R.O., with starters, h.p. 12, 10, 7½, 5, and one tot. enc. induct. 3-h.p. Polishing Machine, just left work. Tufnol Panels, new, 1 doz., ¼" and 3/32".—F. Rushton, 19, Hay Lane, Kingsbury, N.W.9. 6787

REBUILT MOTORS AND GENERATORS

LONG deliveries can often be avoided by purchasing rebuilt secondhand plant. We can redesign or replace surplus plant of any size.

SEND US YOUR ENQUIRIES.

OVER 1,000 RATINGS ACTUALLY IN STOCK HERE

DYNAMO & MOTOR REPAIRS LTD.,
Wembley Park, Middlesex.
Telephone: Wembley 3121 (4 lines).

Also at Phœnix Works, Belgrave Terrace, Soho Road, Handsworth, Birmingham.
Telephone: Northern 0898.
2r

500-cu. ft. ROBEY vertical twin-cylinder, two-stage, water-cooled Air Compressor, 100 lbs. pressure, direct coupled to 100-h.p. BRUCE PEEBLES S.R. Motor, 400 volts, 3-phase, 50 cycles, 360 r.p.m., with starter, complete with auto unloader, intercooler and receiver.

350-cu. ft. REAVELL Quadruplex 4-cylinder, water-cooled Air Compressor, 120 lbs. pressure, belt drive, complete with auto unloader, air filter and receiver.

230-cu. ft. INGERSOLL-RAND horizontal, single cylinder, double acting Air Compressor, 100 lbs. pressure, complete with auto unloader, air receiver, belt drive

210-cu. ft. HOLLAND/SLM rotary two-stage, water-cooled Air Compressor, 100 lbs. pressure, complete with auto unloader, air receiver, bedplate and couplings for motor drive.

210-cu. ft. HOLLAND/SLM rotary, single-stage, water-cooled Compressor as above, 60 lbs. working pressure.

5-cu. ft. vertical, single-cylinder Air Compressor, for engine starting, 300 lbs. working pressure, driven by 3-h.p. CROMPTON PARKINSON motor, 400 volts, 3-phase, 50 cycles

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL
1447

WATER TUBE BOILERS IN STOCK

Two	25,000 lbs. evaporation,	175 lbs.	W.P.
Three	20,000 lbs. ..	175 lbs.	..
One	12,000 lbs. ..	200 lbs.	..
One	12,000 lbs. ..	160 lbs.	..
One	9/10,000 lbs. ..	200 lbs.	..

We install complete, including brickwork. Economisers, Pumps, Piping Valves, Generating Sets and Motors in stock. Please send us your enquiries; we can give immediate delivery.

BURFORD, TAYLOR & CO. LTD.,
Boiler Specialists, Middlesbrough.
Telephone: Middlesbrough 2622.
32

A.C. SLIP-RING MOTORS FOR DISPOSAL

Wound for 400/440-volts, 3-phase, 50-cycle Supply

ONE 140-h.p., 980-r.p.m. ball-bearing machine by LAURENCE SCOTT, with oil starting gear.

One 145-h.p., 485-r.p.m. three-bearing machine for belt drive by CROMPTON, with Ellison oil switchgear.

One 530-h.p., 600-r.p.m., 6,600-volts, 3-phase, 50-cycles auto-synchronous Motor by CROMPTON, with switch gear.

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL
1468

ARC WELDING MACHINES FROM STOCK

WE offer our latest type No. 2 Max-Arc Welder for immediate delivery, 15/250 amperes. Operates off any A.C. supply voltage. Send for details.

MAX-ARC WELDERS LTD.,
190, THORNTON ROAD, CROYDON.
THOrnton Heath 4276-8.
35

ELECTRIC MOTORS AND DYNAMOS

WE hold one of the largest stocks of New and Second-hand Motors. Secondhand machines are thoroughly overhauled. Inspection and tests can be made at our Works.

For Sale or Hire. Send your enquiries to:—

BRITANNIA MANUFACTURING CO. LTD.,
22-26, BRITANNIA WALK,
CITY ROAD, LONDON, N.1.

Telephone: 5512-3 Clerkenwell. 13

ECONOMISERS IN STOCK

TWO Green's Economisers, 208 tubes, 250 lbs. W.P.

Guaranteed re-insurable and first-class condition only, low prices. Quotations per return. Installations delivered and erected complete.

BURFORD, TAYLOR & CO. LTD.,
7, Commercial Street, Middlesbrough. Telephone 2622.
65

MAN POWER IS MULTIPLIED

by the installation of

MORGAN ELECTRIC LIFTING BLOCKS.

All capacities A.C. and D.C. Supply.
Delivery from 2-3 days.

MORGAN LIFTWAYS & POWERWAYS,
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Gul. 1147. 47

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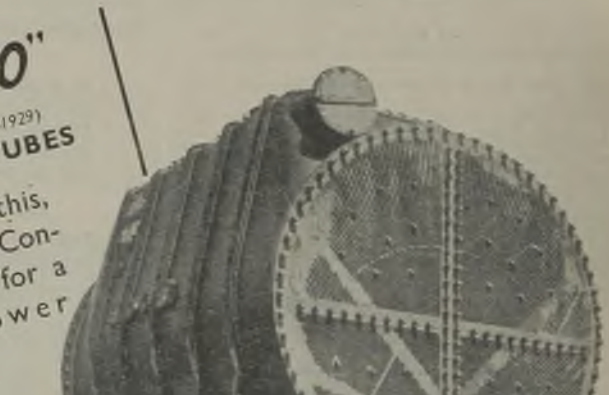

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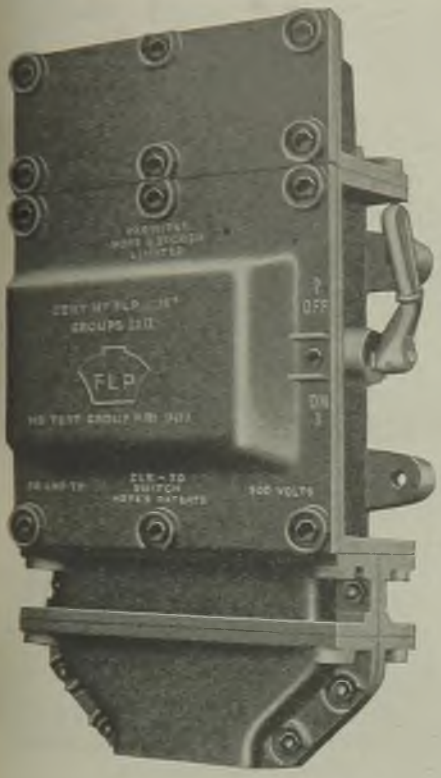

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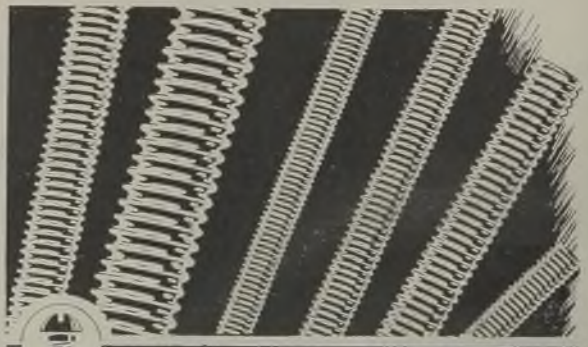

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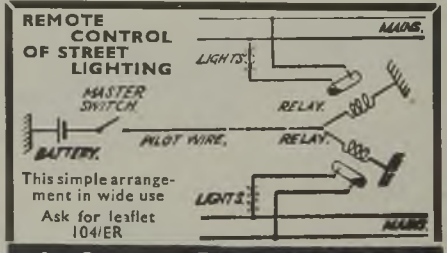

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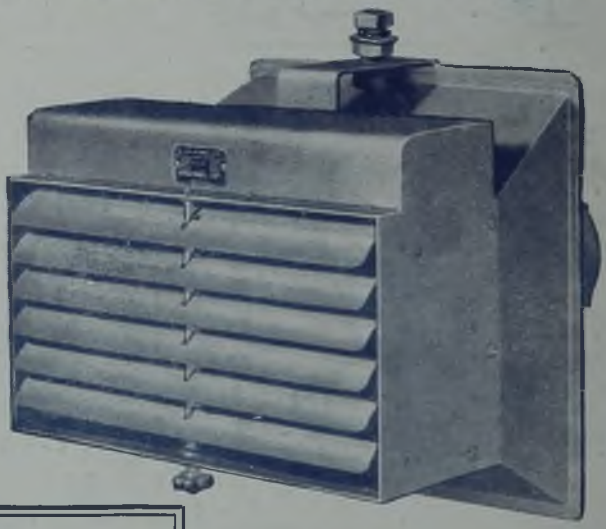

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