

2478/2a

THE

P.60/46/II

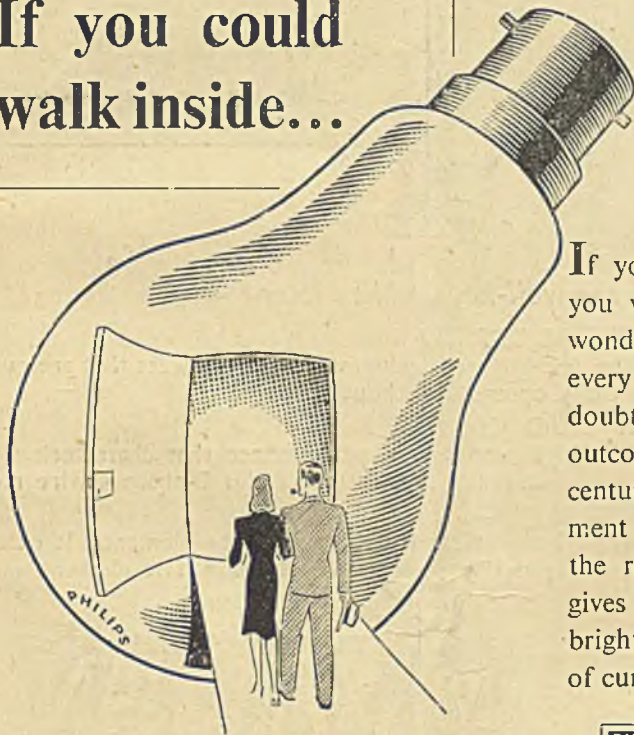
# ELECTRICIAN

202

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

R. 137 (1946) Nr. 24.

If you could walk inside...



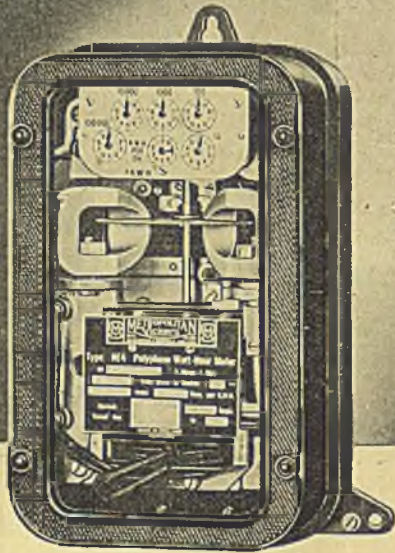
If you could walk inside, you would notice what a wonderful piece of work every Philips Lamp undoubtedly is. This is the outcome of over half a century of research, experiment and experience. And the result is a lamp that gives a maximum of clear, bright light for a minimum of current.

# PHILIPS



*Makers of Good Lamps for over 50 Years*

PHILIPS LAMPS LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2. (168D)



# Type NE 4 3 phase-4 wire Watt-hour METER

*A development of the well-known NE Meter*

- SIMPLE ADJUSTMENTS

The NE 4 Meter includes adjusting devices that are quickly and easily operated without special tools.

- FLAT LOAD CURVE

The high standard of performance that characterises two-element meters is also a feature of this 3-phase 4-wire meter.

- SPACE SAVING

Though the meter has three separate elements, it occupies no more panel space than the standard two-element meter.

*Write for leaflet No. 356/8-1.*



## METROPOLITAN Vickers

ELECTRICAL CO. LTD.  
TRAFFORD PARK ... MANCHESTER 17.

G/A301

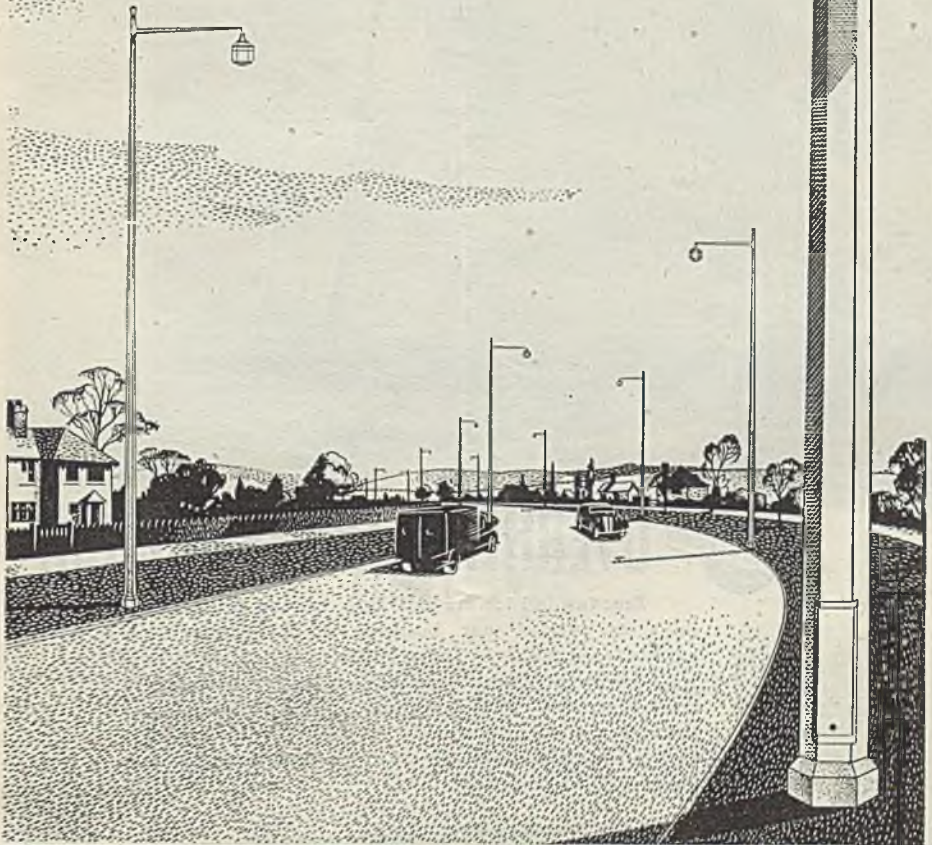
Switch to

# METROVICK

*Lighting*

when daylight fades

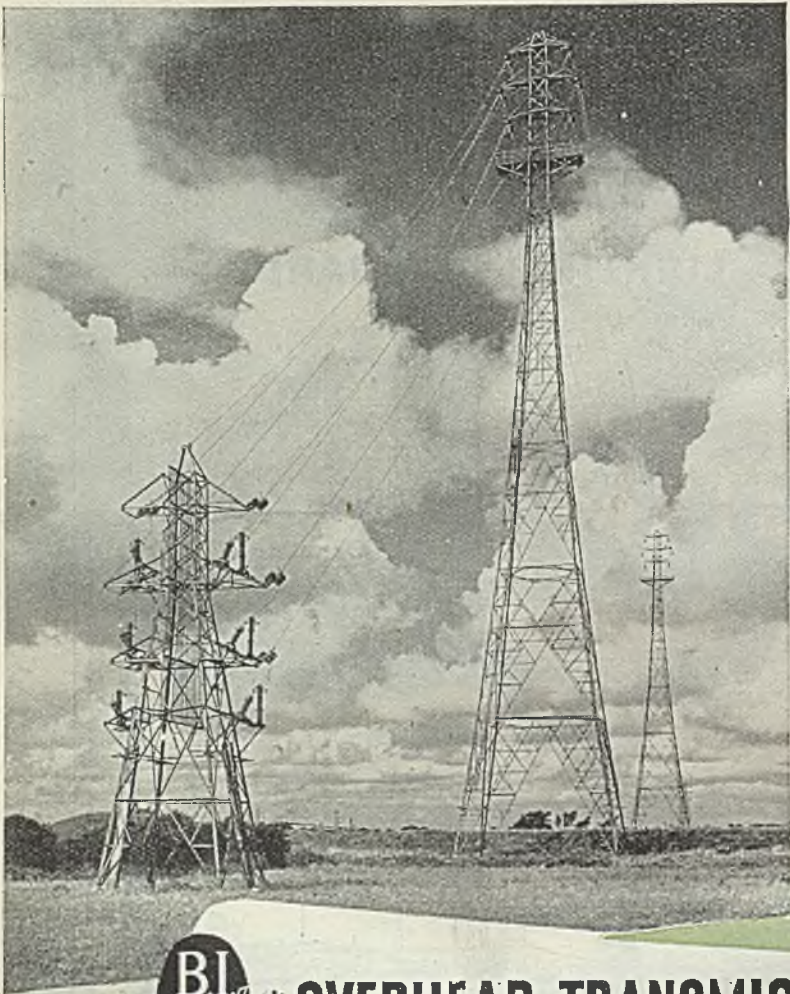
★ **ADASTRA** ★  
HEXAGONAL  
GALVANISED STEEL  
**LIGHTING STANDARDS**



**POLES LTD**

TYBURN RD. ERDINGTON  
BIRMINGHAM 24

*For full details send for Catalogue EN/240.*



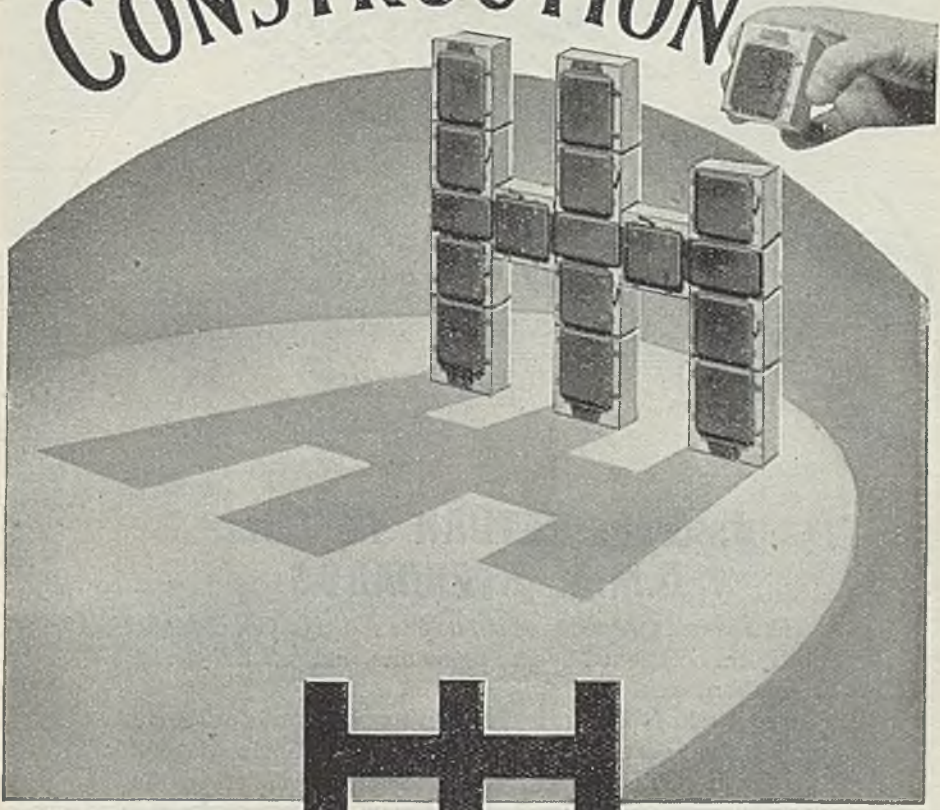
## OVERHEAD TRANSMISSION

Erecting tall towers and high voltage transmission lines is part of our business at B.I. Callender's. 1,650 miles of the Central Electricity Board's Grid System were constructed by us, including the highest towers for river crossings. One of our recent grid extension contracts for the Board was the 52 miles 132 kV primary, double circuit line, linking sub-stations at Bournemouth, Salisbury and Andover.

**BRITISH INSULATED CALLENDER'S CABLES LIMITED**

NORFOLK HOUSE, NORFOLK STREET, LONDON W.C.2

# UNIT CONSTRUCTION



## UNIT-TYPE METALGLAD DISTRIBUTION-GEAR

*Simple to erect and extend*

# REYROLLE

HEBBURN-ON-TYNE

ENGLAND

W.A.R. EMERGENCY GR

**C.M.A. (REGD.) CABLE**  
 Manufactured in accordance with the  
 Standards of the Cable Makers' Association  
 of Great Britain and Foreign Countries

Length \_\_\_\_\_  
 Size \_\_\_\_\_  
 Ref. No. **W.E.** \_\_\_\_\_  
 Certification Mark   
 Volt Grade \_\_\_\_\_

**C.M.A.**  
 Registered Trade Mark  
 Nos. 422, 709, 20-21.

**JOHNSON & PHILLIPS, LTD**  
**CHARLTON, LONDON, S.E.7.**  
 BRITISH MANUFACTURE

Please see that this Label and Seal are intact

ORDER NO. \_\_\_\_\_ PACKED BY \_\_\_\_\_

**Goodbye to W.E.!!**

## J. & P. RETURN TO FULL C.M.A. STANDARDS

This is one farewell at which no one will cry. Gone are the substitutes occasioned by war economies, and "W.E." can be happily forgotten.

Once again J. & P. are manufacturing cables and flexibles to conform to the exacting standards set by the Cable Makers' Association—standards recognised throughout the World as the surest guarantee of quality and craftsmanship offered to the rubber cable user.

There is still a gap between supply and demand, but if you can get J. & P. cables you will know you have the best. And we are sparing no efforts to hasten the day when you can order "off the shelf."

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

### JOHNSON & PHILLIPS LTD.

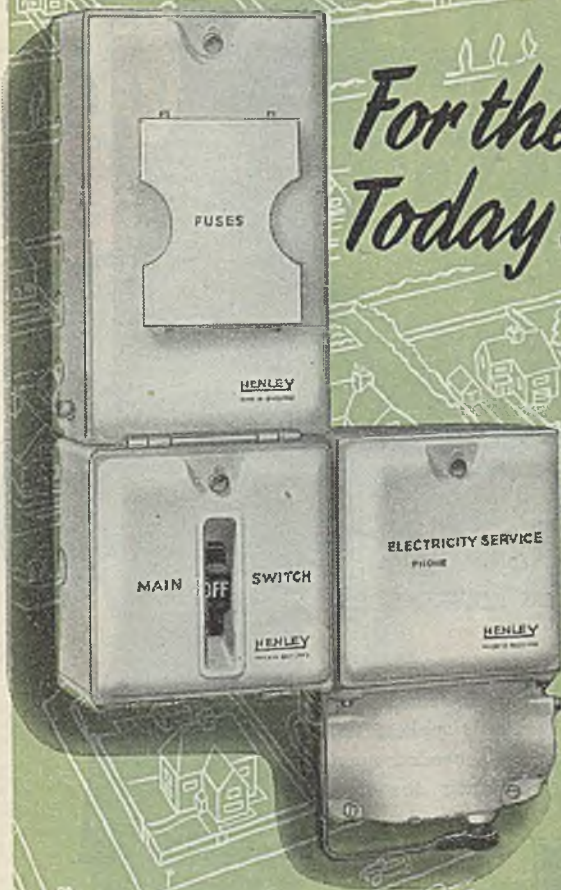
*Electrical Engineers and Cable Makers since 1875*

**CHARLTON — LONDON, S.E.7**



*The mark that means that "little more" in quality*

*For the Homes of  
Today & Tomorrow*



This modern unit provides a safe, neat and simple assembly superseding the often unsightly array of components employed in the past.

Complies with E.D.A. Specification No. 1627.

Write for details.

**HENLEY**  
**CONSUMER'S  
SERVICE UNIT**

**W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.**  
**51-53, HATTON GARDEN, LONDON, E.C.1**



THERE HE STANDS—symbol of authority in an orderly World — controlling — directing — obeyed because absolutely trustworthy and reliable.

What a fitting comparison with BIRCH RESISTANCES, *Arms of the Ohm's Law.*

Backed by many years of practical experience in which their reliability has been tested under all conditions, BIRCH RESISTANCES, in their various applications, stand up to their job and can always be depended upon to provide specified service because of their first-class workmanship.

# Birch

Registered Trade Mark

*Please call upon us to help you solve any Resistance problem.*

## Resistances

**ARMS OF THE OHM'S LAW**

May we quote you for any of the following :—

**RADIAL TYPE REGULATORS — SLIDING RESISTANCES — DIMMERS — ASBESTOS WOVEN RESISTANCE NETS AND GRIDS — HEATING ELEMENTS — RESISTANCES FOR SPECIAL REQUIREMENTS, ETC., ETC.**

**H. A. BIRCH & CO. LTD.,** Wilohm Works, Wood Street. WILLENHALL, STAFFS  
 Telegrams: "WILOHM," Willenhall. Telephone: Willenhall 494-495

G7

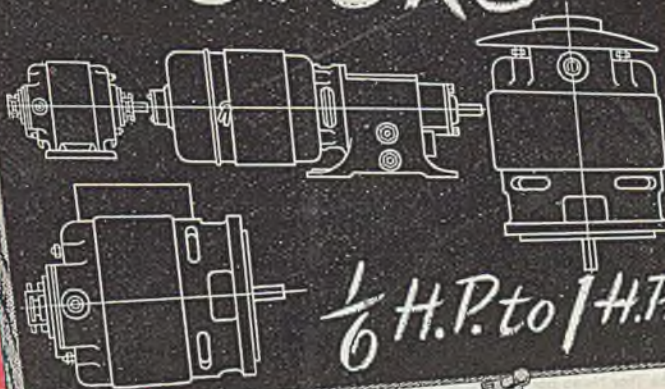
THE ELECTRICIAN

13 DECEMBER 1946





# FRACTIONAL HORSEPOWER MOTORS



$\frac{1}{6}$  H.P. to 1 H.P.

*The most popular  
in the country*

**OVER  
50 YEARS  
MANUFACTURING  
EXPERIENCE  
BEHIND THESE  
MOTORS**

**SINGLE-PHASE  
THREE-PHASE  
or  
D.C. MACHINES  
MECHANICALLY  
INTERCHANGEABLE  
ALTERNATIVE  
MOUNTINGS  
BALL or SLEEVE  
BEARINGS**

*(Flameproof Motors are available)*

# BTH

# RUGBY

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED, RUGBY, ENGLAND.

A 3658



# SMALL TOOLS DO BIG JOBS

*on Production, Construction and Maintenance*



DEMOLITION IS QUICK and sure with the Thor-Nado portable electric hammer.



MAKE HOLES FASTER with Thor electric drills. Capacities from 1/4" to 1 1/4". Speeds for any material.

Power-packed, yet light and easy to handle, Thor Portable Electric Tools save time and money on production, construction, repair and renovation work. Check the many tasks they'll do for you *faster*.

**INDEPENDENT PNEUMATIC TOOL CO., LTD.**

40 Broadway

London S.W. 1, England



FOR ALL TYPES OF GRINDING, wire brushing, buffing and polishing metal surfaces, Thor makes available three fast, powerful electric grinders in 4", 5" and 6" wheel capacities.

*Thor*

**PORTABLE ELECTRIC TOOLS  
FOR EVERY CONSTRUCTION JOB**

- Drills    • Hammers    • Grinders    • Sanders
- Polishers    • Screw Drivers    • Nut Setters
- Tappers    • Nibblers

*Thor*

**PORTABLE POWER  
TOOLS**

PNEUMATIC TOOLS • UNIVERSAL AND HIGH FREQUENCY ELECTRIC TOOLS • MINING AND CONTRACTORS TOOLS



**For new  
building projects**  
*specify*

# SIEMENS

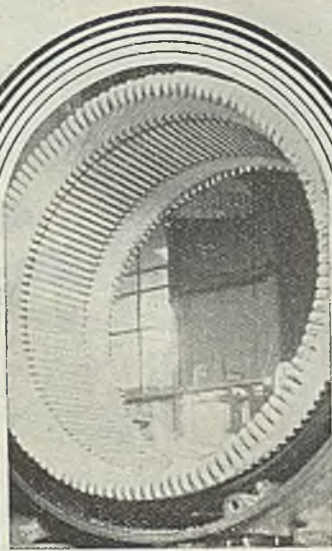
## RUBBER INSULATED CABLES



Registered Mark  
(No. 4211-9-1025)

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD., 38/39 Upper Thames St., London, E.C.4.  
Branches at Belfast, Birmingham, Bristol, Cardiff, Dublin, Glasgow,  
Leeds, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, Sheffield.

- Acru Electric Tool Manufacturing Co., Ltd., 1648  
 British Insulated Callenders' Cables, Ltd., 1622  
 Birch, H. A., & Co., Ltd., 1626  
 British Thomson-Houston Co., Ltd., 1627, 1639  
 Birmingham Products, Ltd., 1651  
 Bushing Co., Ltd. (The), 1646  
 Bryce, W. Andrew, & Co., Ltd., 1698  
 Burgess Products Co., Ltd., 1642  
 Castle Engineering Co., Ltd., 1696  
 City Electrical Co., 1653  
 Cryselco, Ltd., 1694  
 Collins Electrical, Ltd., 1630  
 Contactor Switchgear, Ltd., 1633  
 Davis & Timmins, Ltd., 1644  
 Donovan Electrical Co., Ltd., 1643  
 Dorman & Smith, 1638  
 D. S. Plugs, Ltd., 1646  
 Duratube & Wire, Ltd., 1652  
 Electro Methods, Ltd., 1650  
 Ericsson Telephones, Ltd., 1636  
 English Electric Co., Ltd., 1693  
 Fluorescent Spares, 1653  
 Fluxite, Ltd., 1657  
 Fox, C. J., & Sons, Ltd., 1696  
 Fry's Metal Foundries, Ltd., 1652  
 General Electric Co., Ltd., 1631  
 Glover, W. T., & Co., Ltd., 1635  
 Hampton Works, Ltd., 1654  
 Henley's W. T. Telegraph Works, Ltd., 1625, 1640  
 Hawes & Co. (London), Ltd., 1636  
 Iddon, Victor H., Ltd., 1647  
 Igranic Electric Co., Ltd., 1643  
 Independent Pneumatic Tool Co., Ltd., 1628  
 Isenthal & Co., Ltd., 1640  
 Johnson Clapham & Morris, Ltd., 1655  
 Johnson & Phillips, Ltd., 1624  
 Jones, Samuel, & Co., Ltd., 1648  
 Linread, Ltd., 1649  
 Londex, Ltd., 1650  
 L.P.S. Electrical Co., Ltd., 1632  
 Manor Electric Co., 1655  
 Measurement, Ltd., Cover iv  
 Metafiltration Co., Ltd., 1638  
 Metropolitan-Vickers Electrical Co., Ltd., Cover ii  
 Metway Electrical Industries Ltd., 1653  
 Microfuses, Ltd., 1651  
 Morgan, Laird & Co., Ltd., 1657  
 Nife Batteries, Ltd., 1658  
 Parmeko Ltd. of Leicester, 1634  
 Peace, Harold E., & Co., Ltd., 1656  
 Penney & Porter, Ltd., 1655  
 Philips Lamps Ltd., Cover i  
 Pinchin, Johnson & Co., Ltd., 1700  
 Poles Ltd., 1621  
 Pultra, Ltd., 1697  
 Riley, Robert, Ltd., 1645  
 Ripaults, Ltd., 1637  
 Rivlin, J., Ltd., 1650  
 Reyrolle, A., & Co., Ltd., 1623  
 Rockman Engineering Co. Ltd. 1656  
 Sankey, Joseph, & Sons, Ltd., 1698  
 Scholes, G. H., & Co., Ltd., 1645  
 Siemens Electric Lamps & Supplies, Ltd., 1629  
 Sunvic Controls, Ltd., 1695  
 Synchronatic Time Recording Co., Ltd., 1652  
 Telco, Ltd., 1654  
 Telephone Manufacturing Co., Ltd., 1697  
 Thames Wire & Cable Co., Cover iii  
 Universal Tools, Ltd., 1642  
 Watliff & Co., Ltd., 1699  
 Westerman, Frank, (Wholesale), Ltd., 1646  
 Wavmouth Gauges, Ltd., 1648  
 Wolf, S., & Co., Ltd., 1641  
 Zenith Electric Co., Ltd., 1644



Collins desire to place on record an Appreciation of the great work put in by Central Station and industrial Maintenance Engineers in their essential work of ensuring that the industrial machine runs flat out. Such staunch friends can rely at all times upon the co-operation of Britain's Premier Repair Service to keep them running.

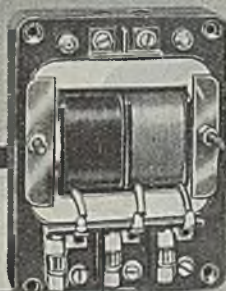
**COLLINS**  
 Collins Electrical Ltd.  
 Head Office  
 115 Clerkenwell Road London EC1  
 Holborn 0212-3-4  
 22 St. Albans Place Upper St. Islington N1  
 Canonbury 3227-8  
 9 & 11 Featherstone Rd. Southall  
 Southall 0168

CEL/15

sawell advertising

# G.E.C. INDICATORS

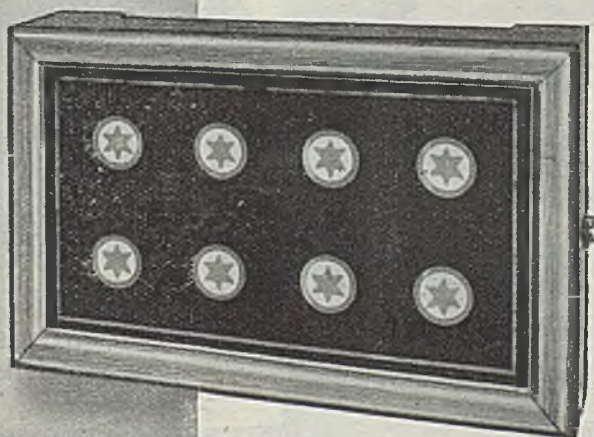
## BAKELITE BELLS·PUSHES AND TRANSFORMERS



Note the three fuses in the transformer, one to each pole on the secondary side, thus complying fully with I.E.E. Regulations No. 210.



Get into touch with your nearest G.E.C. Branch for all requirements in Bell installation material.



**REMEMBER**

THERE IS NO SUBSTITUTE FOR QUALITY  
IN EVERYTHING ELECTRICAL

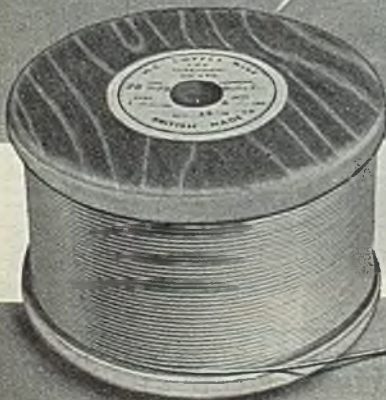
Advt. of The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

# LPS

*Insulated*  
**WIRES & CABLES**



INSTRUMENT WIRES • STRANDS & BRAIDS  
TELEPHONE & RADIO CORDS & CABLES  
RESISTANCE WIRES • P.V.C. TUBINGS



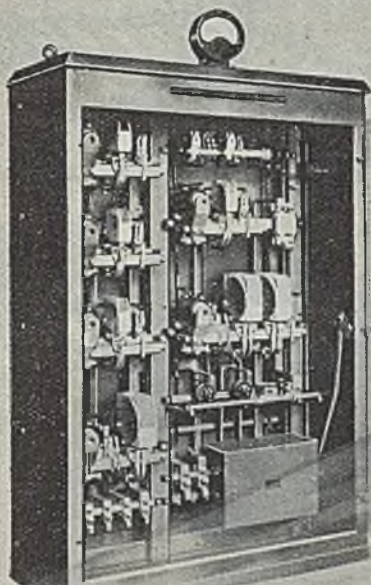
**L.P.S. ELECTRICAL CO. LTD**

ALPERTON • WEMBLEY • MIDDLESEX

TELEPHONE: PERIVALE 5621-2

TELEGRAMS: ENGINEYOR • PHONE • LONDON

# CONTACTOR SWITCHGEAR LTD. WOLVERHAMPTON



## **STANDARD AUTOMATIC STARTERS**

### **DIRECT CURRENT**

**DIRECT CURRENT  
STAR-DELTA  
DIRECT - ON  
STATOR-ROTOR**

Our standard range covers  
from 1 to 1000 H.P.

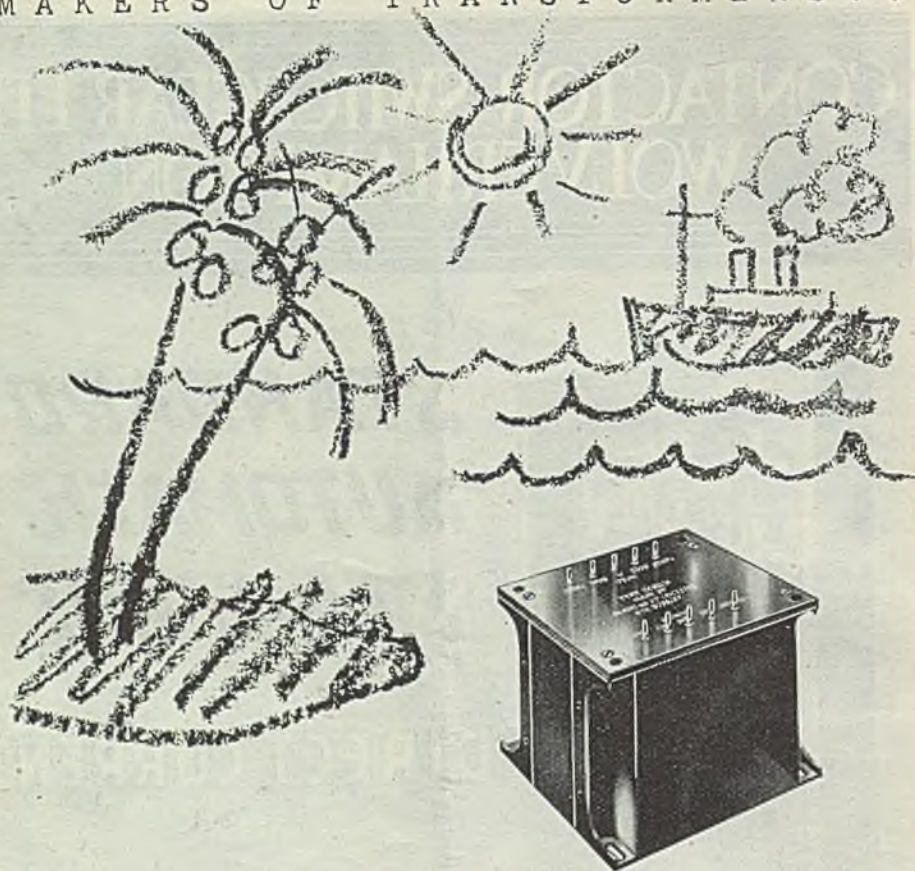


**RELIABLE**

**ADAPTABLE**

**ACCESSIBLE**

## MAKERS OF TRANSFORMERS . .



## TYPE 5080 TAKES A HOT SPOT IN THE S.PACIFIC .

If you have been exporting equipment to the Tropics you will know the immense difficulties in producing Transformers to operate efficiently under such conditions of heat and damp and you may give a sigh of relief when we tell you that those troubles are <sup>now</sup> a thing of the past. We are now producing Transformers vacuum impregnated with a specially developed compound which will withstand the most adverse tropical climates.

A typical member of our 5080 series is shown above, wound for outputs of 400-0-400V at 120m/a 6.3V at 4a and 5V at 3a.

\* P A R M E K O L T D . O F L E I C E S T E R .

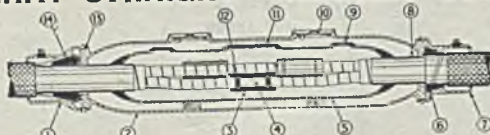




# FIVE POINTS OF AN EFFICIENT CABLE JOINT



## E.H.T. STRAIGHT THROUGH JOINT



### LEAD SLEEVE IN CAST-IRON PROTECTION BOX.

The illustration shows a wire armour clamp at one end and a steel tape armour clamp at the opposite end.

- |                             |                      |                    |  |
|-----------------------------|----------------------|--------------------|--|
| (1) S.W.A. or D.W.A. Clamp. | (5) Lead Sleeve.     | (9) Air Vent.      | (13) Yarn Packing.                     |
| (2) C.I. Protection Box.    | (6) Split Lead Cone. | (10) Filling Lid.  | (14) Split C.I. Cone with Lead Centre. |
| (3) Paper Sleeve.           | (7) S.T.A. Clamp.    | (11) Filling Lid.  |  |
| (4) Weak Back Ferrule.      | (8) Bonding Strip.   | (12) V.I.R. Rings. |  |

FOR PLAIN LEAD COVERED OR LEAD COVERED AND ARMoured CABLES



**W.T. GLOVER & CO. LTD**  
TRAFFORD PARK

MANCHESTER 17



ERICSSON TELEPHONES LTD.

56, KINGSWAY, LONDON, W.C.2

Tele:— NOL. 6338. Works Duxford, Herts.

A COMPREHENSIVE EXPORT SERVICE AVAILABLE TO MANUFACTURERS.

DOMESTIC  
APPLIANCES  
AND  
LIGHT ELECTRICAL  
EQUIPMENT

### HAWES & COMPANY (LONDON) LTD.

Imperial House - Dominion Street - London, E.C.2.

TELEPHONES (6 lines): MONarch 7128

SOUTH  
AND CENTRAL  
AMERICA

EUROPE

AFRICAN  
CONTINENT

MIDDLE  
EAST

INDIA  
AND THE  
FAR EAST

BRANCHES AND AGENTS THROUGHOUT THE WORLD.

# RIPAULTS

*fine range of:-*

**DOMESTIC  
CABLES AND  
FLEXIBLES** /

**cables**

Ripaults Ltd, Southbury Road, Enfield, Middlx.

## See the Saving with the Ring Circuit

The modern method with the domestic ring circuit incorporating the D.S. "one-size" fused plug and socket; any number of extra socket outlets can be added simply and cheaply.

**The NEW**

**DS**  
FUSED PLUG & SOCKET  
3 kw. 230 v

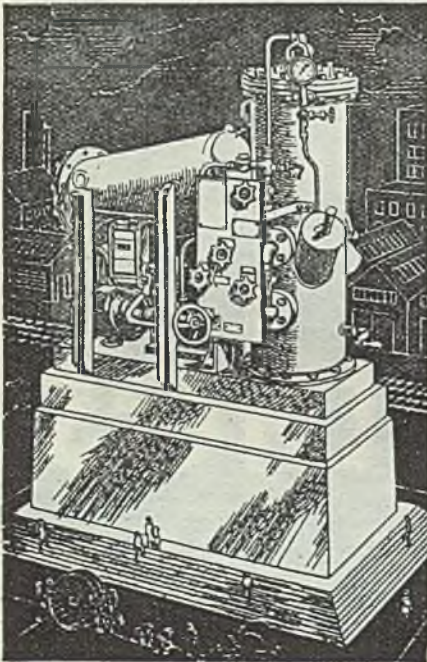
The old way with individual circuits employing BSS.546 2, 5 and 15A. unfused plugs. To add further socket outlets is expensive and complicates the wiring still further.

**The OLD**

**The DS Fused Plug made the Ring Circuit possible**

E11 46.

Announcement of Dorman & Smith Ltd.—Manchester—London—Glasgow



## A Monument to Efficiency

In a single passage through the Metafilter, transformer and heavily carbonized switch oils can be completely freed from all suspended impurities; and all traces of sludge and moisture removed—a monumental tribute to the efficiency of the Metafilter.

The Metafilter is economical and easy to operate; and can be used on switches and transformers while under load.

# Metafiltration

THE METAFILTRATION COMPANY LTD.  
BELGRAVE ROAD - HOUNSLOW, MIDDLESEX  
Telephone: Hounslow 1121/2/3.  
Telegrams: Metafilter, Hounslow

“Finally—gentlemen—  
the building will be lighted  
throughout by

**MAZDA**  
LAMPS in

**MAZDALUX FITTINGS”**



**LIGHTING ADVISORY  
SERVICE** All concerned with  
the installation or renewal of  
lighting are invited to communicate  
with our Lighting Advisory Service,  
Bridle Path, Watford. Phone 7701.



**The British Thomson-Houston Co. Ltd.**  
Crown House, Aldwych, London, W.C.2

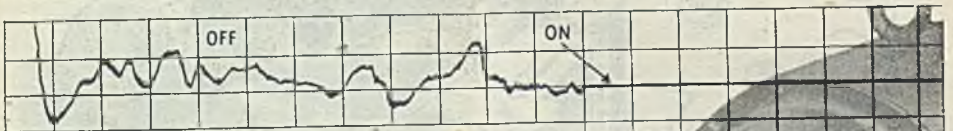




With the Solon there's no waste heat—the heating element is inside the copper bit itself. All the heat is at the point—where you want it. The terminals are at the other end; safely housed away from the heat and easy to get at. Every Solon is supplied complete with 6 ft. of Henley 3-core flexible. Made for the following standard voltages:—200/220, 230/250.

Made in England.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD. (Engineering Dept.)  
51-53, Hatton Garden, London, E.C.1.



Rapid Action

### VOLTAGE REGULATOR

- For A.C. and D.C. Generators, Booster Sets, Steam, Diesel or Hydro - Electric Generating Plant.
- Constant voltage maintained through wide variations of load, temperature and speed.
- Extremely rapid and accurate, can be installed on existing or new generators, are inexpensive in first cost, require little or no maintenance and they are absolutely reliable.
- They are easily fitted and we supply full information for installing.

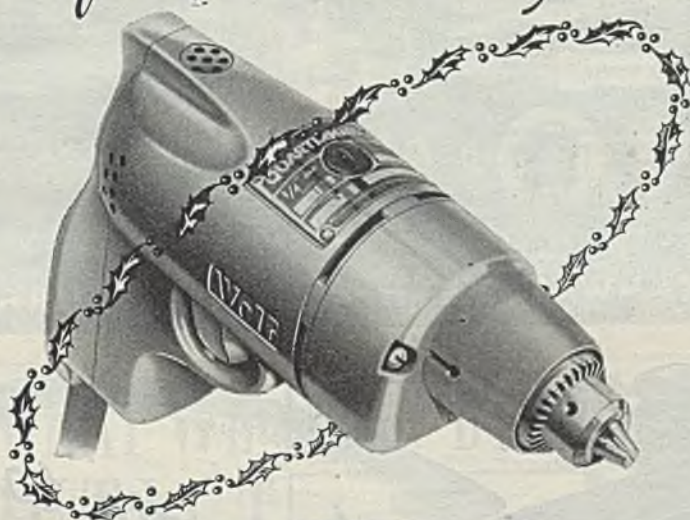


**ISENTHAL & CO. VOLTAGE REGULATOR**  
LTD. TYPE M.S.  
DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3

15 1

Telephone: Acorn 3904    Telegrams: Isenthal London

# Enrich every Season of the Production Year



*Greetings to  
all our friends  
throughout  
the World*



S. WOLF & CO. LTD.  
PIONEER WORKS  
HANGER LANE  
LONDON, W. 5.  
Telephone: PERivale 5631/4

BIRMINGHAM  
MANCHESTER  
LEEDS

47, Barker Street, Handsworth, Birmingham, 19.  
5, Blackfriars Street, Salford 3, Manchester.  
2, Park Square East, Leeds, 1.

Tel.: Northern 2954,5  
Tel.: Blackfriars 8426  
Tel.: Leeds 27981

# UNIVERSAL TOOLS LTD

PRESS TOOLS  
PRESSINGS  
MOULDS  
AND JIGS



TRAMWAY PATH · MITCHAM · SURREY



MKIII/BR.  
Length 2.070 ins.  
Depth 2.024 ins.  
Width 0.800 ins.

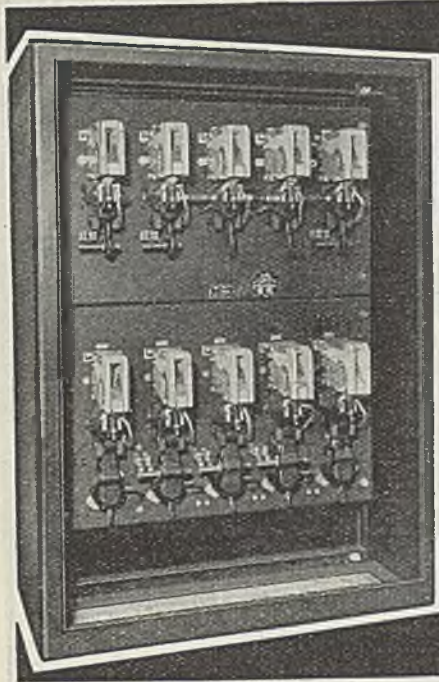
*Accurate to  
the N<sup>th</sup> Degree!*

The ideal small switch for practically all automatic switching applications. Precision built to fine limits and capable of positive snap-action operation up to 60 times a minute. May be installed in any position

Write for data sheet BP810 to :  
**BURGESS PRODUCTS  
COMPANY LIMITED**  
SAPCOTE, LEICESTERSHIRE

**BURGESS  
MICRO -  
SWITCHES**





# IGRANIC

## *Electric Control Gear*

Equip your electrically driven machines with the "right" control gear — IGRANIC, which will give positive protection to motor and machine and keep them working to secure maximum production.

*Illustration shows IGRANIC Contactor Panel for control of Travel motion of 6-ton Slab Charger for Steel Mill.*

**IGRANIC ELECTRIC CO LTD**  
**BEDFORD & LONDON**

# SEE WHAT WE MEAN BY SCRUTACT

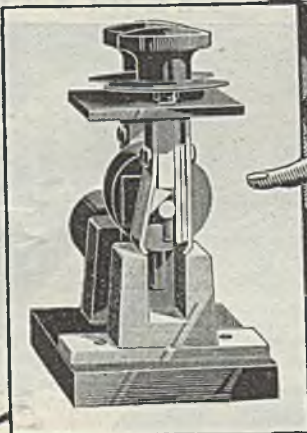
## ★ FUSEGEAR ★

Fusegear to be thoroughly efficient, demands—

- (1) strong, pressure-maintained contacts and
- (2) facility for instantaneously replaced cartridges—without tools.

Precisely. That's where "SCRUTACT" exactly fills the bill.

May we tell you more? Write us for a complete description.



# DONOVANS

THE DONOVAN ELECTRICAL CO LTD BIRMINGHAM, 9  
ELECTRICAL ENGINEERS AND STOCKHOLDERS.  
PHONE—ST ECHFORD 2277 (P.B.X.) GRAMS—DONOVAN, BIRMINGHAM

**ZENITH**

(Regd. Trade-Mark)

Improved Type

**CERAMIC  
EMBEDDED RESISTORS**of the highest quality, complying  
with all Government Specifications*Please allow us to send you a copy  
of our descriptive catalogue***THE ZENITH ELECTRIC CO. LTD.****Zenith Works, Villiers Road,  
Willesden Green, London, N.W.2**

Phone : WILlesden 4087-8-9

Grams : "Voltaohm, Phone, London"



38 G

**SCREWS · TERMINALS · PRESSWORK**

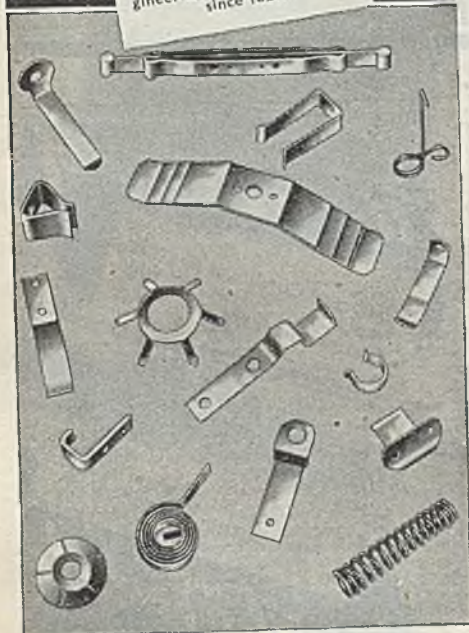
*If it's threaded  
— we make it!*

**DATIM**

**TURNED PARTS & INSERTS**

# Beryllium Copper Springs by **RILEY**

Specialists In Springs and  
Press Work for every known  
purpose In Electrical En-  
gineering. Technical leaders  
since 1821.



**ROBERT RILEY LTD. (Estd. 1821)**

Milkstone Spring Works, ROCHDALE.

Telephone :  
Rochdale 2237-2238.

Telegrams :  
"Rilospring" Rochdale.

# W Y L E X

**ELECTRICAL  
PRODUCTS**  
for  
**STRENGTH**

*'Wylex must be good'*

**GEORGE H. SCHOLLS  
and Co. Ltd.**

Wylex Works, Wythenshawe  
**MANCHESTER**



**COOKER**

**CONTROL - DS**

C O O K E R



C O N T R O L

**DS PLUG STYLE**

THE DS Cooker Control Unit is a compact yet efficient switch and plug unit. It includes a 30-A double-pole switch for the cooker and the famous DS Fused Plug and Socket for the kettle.

Conduit Holes are provided at top and bottom for cable entry but may be provided elsewhere to special requirements.

Announcement of D.S. Plugs Ltd., Manchester, London, Glasgow.

E 10

**immediate delivery!**

**TEXOLEX TUBES IN LAMINATED FABRIC OR PAPER BASE**

**THE BUSHING CO. LTD.**  
HEBBURN-ON-TYNE

**The Choice of**

Electrical Conduit is of great importance. That is why Contractors insist on

We are Birmingham's Sole Main Distributors to :-

**- the trade**

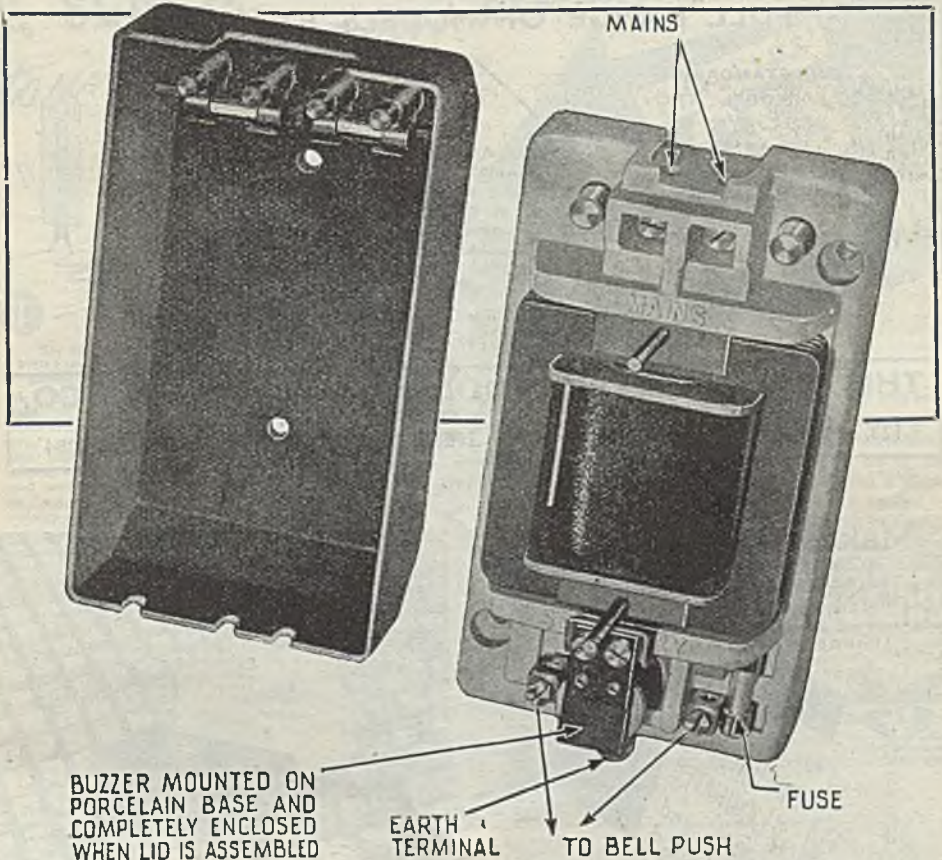
**FRANK WESTERMAN LTD.**  
Telephone: COLMORE 4252 (WHOLESALE) L.  
94 DALFEND, BIRMINGHAM 4

S. & U.

# Combined

# NETTLE

## TRANSFORMER AND BUZZER



BUZZER MOUNTED ON  
PORCELAIN BASE AND  
COMPLETELY ENCLOSED  
WHEN LID IS ASSEMBLED

Simplifies installation when Buzzer is required close to A.C. mains supply.

**SPECIFICATION.** The Primary and Secondary coils are separately wound and insulated from each other as in the case of the 1 amp Standard Transformer. The Secondary winding gives 6 volts and is connected directly to the Buzzer, obviating the necessity for internal wiring from Transformer to Buzzer. The only connections needed are from the Secondary terminals to the bell push. The Buzzer coil is wound on to a strong wooden bobbin which is completely insulated and all other parts are rigidly assembled. No adjustment on the Buzzer is required. This useful accessory can provide a warning signal, and lends itself to many industrial and domestic applications. For A.C. use only.

List No.

020 Secondary fused (Supplied as standard).

021 Primary fused and with Automatic Mains Cut-out.

# VICTOR V.H. IDDON *Ltd.*

HARPER ROAD  
WYTHENSHAW  
MANCHESTER

# FLUORESCENT STARTER SWITCHES

FULL RANGE OF MODELS EX STOCK



THE STANDARD  
MODEL  
S.B.C. TYPE  
AS  
AS  
ILLUSTRATED



THE P.S.1  
MODEL  
AS  
ILLUSTRATED

ALSO  
AVAILABLE  
P.S.2 MODEL  
FITTED WITH TERMINAL  
BOARD

P.S.3 FITTED WITH TERMINAL  
BOARD AND RADIO SUPPRESSOR  
ALSO

FLUORESCENT CHOKES EX STOCK

THE ACRU ELECTRIC TOOL MANUFACTURING CO.  
LIMITED

123, HYDE ROAD, ARDWICK, MANCHESTER, 12

Phone : ARDWICK 4284

Makers of Synthetic  
**RESIN PAPERS**  
(IMPREGNATED AND COATED)

for the  
MANUFACTURE  
of LAMINATED  
SHEETS and  
TUBES

**SAMUEL JONES & CO. LTD**  
16-17 NEW BRIDGE STREET, E.C.4  
PHONE: CENTRAL 6500

A few of the many thousand Waymouth Relays supplied for Britain's Aircraft. Illustration shows relay type RD double pole 24 volt 10 amp. Overall dimensions  $2\frac{1}{4}'' \times 2\frac{3}{4}'' \times 1\frac{1}{8}''$ . Weight 6 ozs.



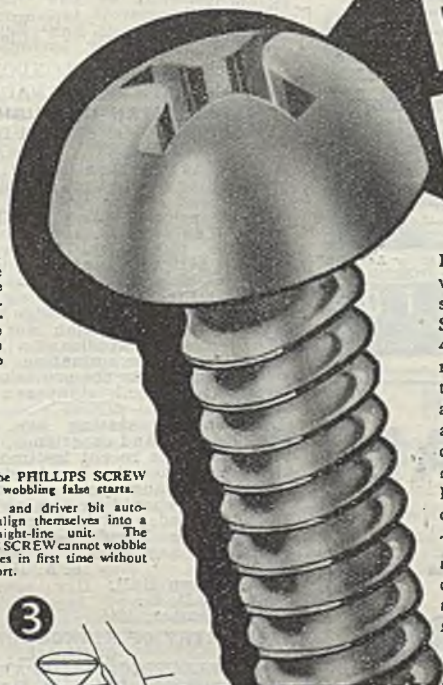
**WAYMOUTH**  
GAUGES & INSTRUMENTS  
LTD.

Electrical Relays and Switches : Aircraft Fuel  
Gauges : Electrical Indicators : Diaphragm  
Pressure Gauges and other instruments.

464-B, ALEXANDRA AVE., RAYNERS LANE, HARROW,  
MDDX.  
Telephone: PINNER 7193

Here is -  
A SCREW THAT "USES ITS HEAD"  
to increase your assembly output!

'PHILLIPS'  
**RECESS  
HEAD** screw



1 See how the PHILLIPS SCREW prevents Burring.

The PHILLIPS Recess-Head has 8 separate planes to take the torque thrust of the driver. This scientifically engineered recess gives the head nearly three times the strength of the ordinary slotted-head.



2 See how the PHILLIPS SCREW prevents wobbling false starts.

The screw and driver bit automatically align themselves into a single straight-line unit. The PHILLIPS SCREW cannot wobble over, it goes in first time without fuss or effort.



3 See how the PHILLIPS SCREW prevents the driver from slipping out.

THE PHILLIPS SCREW fits firmly and snugly on to the 4-winged bit - the driver cannot slip out to damage the work or injure the operator.

'PHILLIPS'  
**RECESS  
HEAD** screw

Here is the screw that makes quick and easy work out of the slow and laborious task of screw driving. The PHILLIPS Recess-Head SCREW fits firmly and snugly on to the 4-winged power driver bit to form a single rigid straight-line unit. Once it is applied to the job, the power driver screws it home quickly and cleanly, first time and every time. There are no false fumbling starts to chew the threads of the screw or the assembly. The driver bit cannot slip out of the PHILLIPS Engineered Recess to score the surrounding work surfaces, or injure the worker's hands.

Try PHILLIPS Recess-Head SCREWS on your assemblies, then watch production figures climb by as much as 50%, as you get better, neater work in less time. Notice, too, how you save on Overhead costs as you cut out spoilage and rejects.

SEND THIS COUPON FOR FULL DETAILS OF THE NEW PHILLIPS Recess-Head SCREWS.

To Linread Ltd., STERLING WORKS, 26/33, Cox Street, BIRMINGHAM, 3.

Please send me, without obligation, the illustrated catalogue giving full details of the Phillips Recess-Head screws.

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

It's a ADDRESS \_\_\_\_\_

**Linread**  
SPECIALISTS IN COLD FORGING

Product!

P.S. 11

# SOCKETS

**3 PIN, 5 AMP, SHUTTER**  
Available in good quantities

**COMPACT BALLAST UNITS**  
including strikers

**TENATHERAM SOIL HEATERS**

FULL LIST ON REQUEST

**J. RIVLIN**

16 17, BRUNSWICK STREET, LEEDS, 2

Telephone 21515



## BI-METAL

## BI-METAL

## FABRICATIONS

## BI-METAL

## THERMOSTATS

*Export Enquiries Especially Invited*

**ELECTRO METHODS LTD.**

112 BRENT ST., HENDON, N.W.4

Telephone: GLADstone 6611-2

## MISCELLANEOUS ADVERTISEMENTS

### TENDER

**METROPOLITAN WATER BOARD.**

**TENDERS FOR ALTERNATORS.**

THE METROPOLITAN WATER BOARD require the following new or second-hand alternators, 3 phase 400/440 volts, 60 cycles, 1 or 2 bearings, with or without switchgear for coupling directly or indirectly to diesel engines running at 600 r.p.m.:-

18 alternators approx. 200 K.W. output.

6 alternators approx. 300 K.W. output.

Further details may be obtained from the Mechanical Engineer at the Board's offices.

Particulars of plant available should be enclosed in sealed envelopes endorsed "Tender for alternators," and addressed to the undersigned at the Offices of the Board (Room 122).

C. W. STOKER,

Offices of the Board, Clerk of the Board.

New River Head,

Rosebery Avenue, LONDON, E.C.1.

### SITUATIONS VACANT

**METROPOLITAN BOROUGH OF POPLAR.**

**APPOINTMENT OF SENIOR DRAUGHTSMAN,**

**ELECTRICITY DEPARTMENT.**

APPLICATIONS are invited for the position of Senior Draughtsman, in the Electricity Department of the Council, at a salary in accordance with Class G, Grade 5, of the scales of salaries of the National Joint Board for the Electricity Supply Industry (at present £490 per annum inclusive).

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

The successful applicant will be required to pass a medical examination, and the appointment is subject to the provisions of the Poplar Borough Council (Superannuation) Acts, 1914-1937.

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

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

S. A. HAMILTON,

Poplar Town Hall,

Town Clerk.

BOW ROAD, E.3.

27th November, 1946.

**STEWARTRY OF KIRKCUDBRIGHT COUNTY COUNCIL.**

**ELECTRICITY DEPARTMENT.**

**Appointment of Junior Mains Assistant.**

APPLICATIONS are invited for the above Post from suitably qualified Engineers, who have had previous experience of Mains work, preferably in a Rural Electricity Undertaking. Duties will include the survey and profiling of 11 kV Overhead lines, maintenance of Sub-station and Switchgear, and generally acting as Assistant to the Mains Engineer.

Salary and Conditions of Appointment will be in accordance with the National Joint Board Schedule, the present salary being £316 per annum (Class D, Grade 9).

The appointment will be subject to the Local Government Superannuation (Scotland) Act, 1937, and the selected candidate will be required to pass a medical examination.

Applications, stating age, and giving full particulars of training and experience, together with copies of testimonials, to be forwarded to the undersigned not later than 4th JANUARY, 1947.

ROBT. C. MONTEATH,

County Offices,

County Clerk.

KIRKCUDBRIGHT.



**SITUATIONS VACANT****COUNTY BOROUGH OF BRIGHTON.  
ELECTRICITY DEPARTMENT.**

**Appointment of Junior Assistant in the Sales Department.**

**A**PPPLICATIONS are invited for the position of Junior (Male) Assistant for Showroom and Clerical Duties in the Sales Department.

Candidates, who must be under 25 years of age, must have been educated to matriculation standard and have had some experience with an electricity supply undertaking.

Salary will be in accordance with the General Division of the National Salary Scales (£215 per annum at 24 years of age) plus war bonus, at present £59 16s. per annum. Conditions of service will be those laid down by the National Joint Council Scheme of Conditions of Service.

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

Applications, which must be made on a prescribed form, to be obtained from Mr. H. Pryce-Jones, M.Eng., Engineer and Manager, Brighton Corporation Electricity Department, Electric House, Castle Square, Brighton, are to be delivered to him not later than Monday the 30th December, 1946.

Canvassing, either directly or indirectly, will disqualify.

Town Hall,  
BRIGHTON, 1.

J. G. DREW,  
Town Clerk.

**SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.  
INSTALLATION ENGINEER (ELECTRICAL CONTRACTING).**

**A**PPLOICATIONS are invited for the above position from applicants who have had a sound training and considerable practical experience in the electrical contracting industry. Applicants should be able to prepare estimates and specifications for all classes of electrical installation work, to supervise the carrying out of the work, and to control staff. Experience of development work in the domestic, commercial and industrial applications of electricity would be an advantage.

The salary will be in accordance with Class M, Grade 9A, of the National Joint Board Schedule, commencing at £478 per annum.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937. Applicants must preferably be not more than 40 years of age, or have had previous Local Authority service carrying transfer value within the meaning of the Act. The selected applicant would be required to pass a medical examination.

Applications on forms to be obtained from the undersigned are to be returned to me not later than Monday, 6th January, 1947, accompanied by copies of not more than three recent testimonials.

Canvassing or any communication to a member of the Council either directly or indirectly, is prohibited and is a disqualification.

JOHN R. STRUTHERS,  
General Manager.

Commercial Street,  
SHEFFIELD, 1.

**E**LECTRICAL Engineer with practical and general experience of installation, maintenance and fault-localising required for permanent employment in the specialised field of X-Ray engineering. Applicant must be willing to travel in the United Kingdom.—Apply by letter, stating age, experience, etc., to Victor X-Ray Corporation Ltd., 15/19, Cavendish Place, London, W.1.

**BIRMINGHAM PRODUCTS Ltd.,  
176-178, NEWHALL ST., BIRMINGHAM 3.**

**CAPSTAN AND REPETITION WORK IN ALL METALS FOR THE ELECTRICAL TRADE.**

ROLLED THREAD SCREWS, WOOD SCREWS, BOLTS AND NUTS, RIVETS, WASHERS, ETC.

**LARGE STOCKS CARRIED.**

'Grams :  
ROLTHRED, B'HAM.

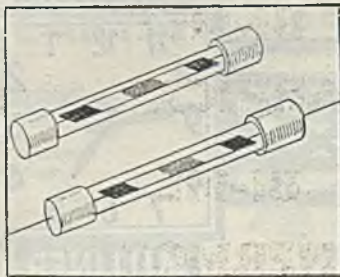
'Phone :  
CENTRAL 2681-2-3-4.

**Progressive wholesale Electrical House in West Riding of Yorkshire seeks first class products in Electrical goods. Sole distribution of guaranteed sales undertaken. Box J.R., "The Electrician," 154, Fleet Street, London, E.C.4.**

**HIGH ACCURACY  
CARTRIDGE MICROFUSES**

10mA.—1 Amp.

with Gold Film Fuse Link



Colour indication of blown fuses or Neon Indicators if preferred.

Pamphlet C.M.18 on request.

**MICROFUSES LTD**

KANCLEY BRIDGE ROAD,  
LOWER SYDENHAM, S.E.26

TEL. SYD. 5129

THE ELECTRICIAN

**Sole Manufacturers:**  
**DURATUBE & WIRE LTD.**  
**FELTHAM · MIDDSX**

**DURATUBE**  
**DURASTRIP**  
**DURASLEEVE**  
**DURATWINTAPE**  
**DURATHWINFLEX**  
**DURATHREEFCABLE**  
**DURATWINCABLE**  
**DURATWINFLAT**  
**DURATHREEFLAT**  
**DURAWIRE**  
**DURACABLE**

*Produced by  
 Friends...*

# FRY'S

**ALCHO-RE**  
**SOLDERING FLUX**  
*non-corrosive : for electrical work*

Write for sample

**FRY'S METAL FOUNDRIES LTD.,**  
 Tandem Works, Merton Abbey, London, S.W.19

**SYNCHROMATIC**  
**PUBLIC CLOCKS**  
 FOR A.C. OR D.C. SUPPLY



**MAXIMUM PUBLICITY**  
 AT  
**MINIMUM COST**

**SYNCHROMATIC**  
 TIME RECORDING CO. LTD.  
**LIVERPOOL, 6**

Grams : SYNTIME, Tel: ANFIELD 1934

**TIME INSTRUMENTS · ELECTRIC CLOCKS**

**SITUATIONS VACANT**

**DESIGNER** wanted, experienced in complete design of Three-Phase Motors up to 150 B.H.P. to take charge of production in small works. Yorkshire district.—Box L.T.A., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

**LONDON** Electrical Wholesalers require representative with car to cover London area and outskirts. Good commission paid with small car allowance.—Write Box L.T.D., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4, stating experience.

**JOHNSON & PHILLIPS LTD.**

Invite applications for the following positions at their Charlton Works :—

- (a) Draughtsmen (Senior and Junior) for
  1. Transformers up to 30,000 kVA.
  2. Switchgear up to 11 kV, 250 MVA.
- (b) Estimating Engineers for Transformers up to 30,000 kVA.
- (c) Designer Engineer (Junior) for Power Factor Correction Capacitors.
- (d) Estimating Engineer for Power Factor Correction Capacitors.

Applications, in writing, should state full details of education, training, experience, age and salary required, and be addressed to Employment and Welfare Manager, Johnson & Phillips Ltd., Victoria Works, Charlton, S.E.7.

**X-RAY APPARATUS**.—Watson and Sons (Electro-Medical) Ltd., have vacancies in London and Wembley for several technical men, preferably with some knowledge of X-ray apparatus, for administrative, development, design, drawing office, and sales work. Excellent opportunities for permanent progressive positions in a growing industry.—Write in confidence giving full particulars to Managing Director, Watson and Sons (Electro-Medical) Limited, Parker Street, Kingsway, W.C.2.

**SENIOR DRAUGHTSMAN** required, experienced in outdoor Contract work, overhead line steel and wood pole, underground cable installations and accessories.—Applications stating age, experience and salary required to Employment and Welfare Manager, Johnson and Phillips Ltd., Victoria Works, Charlton, S.E.7.

**FOR SALE**

**SINGLE** Flexible Co-Axial Cable (to Government Specification UNIRADIO 1) consisting of 1/056 Copper Inner Conductor, Solid Polythene Insulation, braided tinned copper outer conductor, sheathed in P.V.C. 45 in. 0/d.—Box L.T.B., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

**1**—B.T.H. 230/1/50 Alternator, 9 kVA, 1500 r.p.m.; 6—230/1/50 Extractor Fans by Verity, 18 in. dia., 700 r.p.m.; 1—B.T.H. M.G. Set, input 400/3/50, output 2.5 kW, 110 volts, D.C.; 1—Crompton Parkinson M.G. Set, input 440 volts D.C., output 12/16 volts, 30 amps. D.C.; 1—Newton M.G. Set, input 220 volts D.C., output 90 volts, 190 amps. D.C.; 1—David Brown Radicon Reducing Gear, output 4 H.P., input speed 1450 r.p.m. Reduction ratio 45:1; 1—Herbeard Rectifier, input 230/1/50, output to suit 25 Cells, 7.5 amps. charge current with Trickle Charging Device; 1—D.C. Welding Generator by Electromotors, 4.4 kW, 29/70 volts, 1200 r.p.m., with Exciter; 1—Crompton Parkinson M.G. Set, input 400/3/50, output 60 volts, 400 amps., with Direct Coupled Exciter.—Oldfield Engineering Company Limited, 96, East Ordsall Lane, Salford, 5.

**PLASTIC BOARD**, 1/8 in. to 1 in. thickness.—PURNESS (Builders' Merchants), LTD., 50, Victoria Street, Grimsby.

## FOR SALE

**A SUPERIOR** streamlined TOASTER in one piece die cast aluminium with attractive mirror finish. Price 39s. 6d. subject. Immediate delivery. Sample 31s. Cash with order.—Metropolitan Distribution, Ltd., Truro.

**ROTARY** Converter, complete with starter, by Mawdsley, input 440 volt D.C., output 85 kVA, 300 volt, 50 cycle, single-phase, 6 p.f. for spot welding.—Carter and James Ltd., Wenman Street, Balsall Heath, Birmingham.

**ONE** 36 h.p. D.C. Motor, 480 volts, 66 amps, 490 r.p.m. at full load. Inter-pole ventilated type with 12 in. by 14 in. pulley and slide rails, also one floor mounting type starting panel comprising starter, no volt and overload trips, circuit breaker, isolator, amp meter and push button control.—Lloyd's (Newport) Ltd., Brewers, Newport, Mon.

**FURTHER** supplies Second-hand 220 volt, D.C. MOTORS for disposal. Some in excellent condition.—Richards (Leicester), Ltd., Phoenix Iron Works, Leicester.

**MOTORS** a.c. 4-pole, induction 1/200 h.p. and 1/150 h.p., 230/50v /50Ω 1250 r.p.m. A. V. Allen, 1330, Stratford Road, Hall Green, Birmingham, 28.

**COMPARATIVELY** new 25 h.p. Brook's Squirrel Cage Motor, 750 r.p.m., 400 volts, 3-phase, 50 cycles. Best offers.—The Superheater Co. Ltd., Trafford Park, Manchester, 17.

**T. CLARKE AND CO. LTD.**, have the following for sale at their Hammersmith Stores: A.C. and D.C. Motors, Dynamos, Starters, Pulleys, 60/500 watt Industrial Reflectors, Cell Booster complete on trolley, T.P. Switches, 3/4 in. Screw Cutting Lathe, Bench Drills, etc. Please phone Riverside 2647 for appointment to view.

**FOR SALE**—Two 60 ft. lengths of 7/064 triple armoured CABLE. Best offers to Sewell and Richardson, Ellson Works, S.W.19. Liberty 4666.

**TRANSFORMER** for sale, "Welders" to BSS 171/1936 4 kVA 1 phase 50 Type AN. 400/230-0-90 Volts. Excellent condition. £50. Carriage Paid.—Apply J. Thorn and Sons, Ltd., Brampton Road, Bexleyheath, Kent. Bexleyheath 305.

**SECTIONAL** TIMBER BUILDINGS, completely reconditioned and equal to new. Sizes 6 ft. by 6 ft., 16 ft. by 8 ft., 20 ft. by 12 ft., 36 ft. by 17 ft., 52 ft. by 20 ft., 54 ft. by 18 ft., 54 ft. by 33 ft. No purchase licence required. Offered subject to being unsold. Further particulars and prices on application.—D. McMaster and Company, 33, Mount Bures Works, Bures, near Colchester, Essex. Telephone: Bures 351-352.

**MAY** we send our Engineers' Stethoscope on approval (without obligation)? Particulars on request.—Capac, Ltd., 2, Ullswater Road, London, S.W.13.

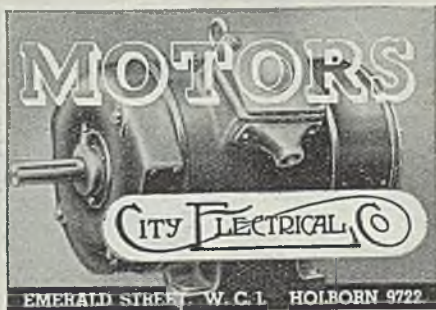
**ALL** Types of ELECTRICAL and CON-TRACTORS PLANT, Pumps, Boilers, Engines, etc., in stock.—G. E. WHITAKER, Wellington Mill, Bolton Road, Blackburn. Tel. 7232.

**MERCURY** SWITCHES, all types. For details of immediate delivery, apply Quicksilver Tube Mfg. Co., The Grays, High Street, Harlington, Middlesex.

**ONE** Philips SB.20 Spot Welding Machine. No reasonable offer refused.—The Superheater Co. Ltd., Trafford Park, Manchester, 17.

**DUMORE** type A.D. 3563 fractional h.p. MOTOR, 792 to one reduction gearing, perfect. 240 A.C., £10 10s.—Aici and Co., 30, Deansgate, Blackpool.

**RUBBER** STAMPS.—Every description. For office, shop and factory. With the usual pre-war cushion backed holders and polished handles.—W. L. Boughton, 53, Kenley Road, Merton, London, S.W.19.



BEMO

REPLACEMENT  
**FLUORESCENT**  
STARTER SWITCHES

(THERMAL TYPE)

For use with B.T.H., Reva and  
Metrovick Lighting Units  
Early Delivery

**FLUORESCENT**  
SPARES

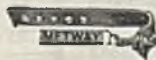
Dept. E/A, 53, GOODGE  
STREET, LONDON, W.1



**METWAY**  
PRODUCTS

Registered Trade Mark

ALL TYPES OF  
**EARTH CLIPS**

Adjustable  
CopperMETWAY  
Solid  
CopperMETWAY  
Tinned  
Copper

**PROMPT DELIVERY**

**METWAY ELECTRICAL INDUSTRIES LTD.**

KING STREET, BRIGHTON.

Phone: Brighton 44568X. Grams: 'Metway,' Phone, Brighton.

# Flat SOLDER TAGS



ALL  
SIZES

The HAMPTON WORKS  
(STAMPINGS) LIMITED  
PRESSWORK EXPERTS

1 WYNNINGS ROAD, STIRCHLEY, BIRMINGHAM.  
Tel.: KINGs Norton 2901 (3 lines). Grams: Radiagills B'h'm

# STUDDING? TELCO

TELCO LIMITED  
3 NEWMAN ST.  
LONDON, W.1  
MUSEUM 5701/4



© 93.43

THE ELECTRICIAN

## FOR SALE

1-240 H.P. L.D.M. SLIP RING MOTOR, 400 volts 3 phase 50 cycles 725 r.p.m. Complete with oil switch and liquid type rotor starter.—Oldfield Engineering Company Ltd., 96, East Ordsall Lane, Salford, 5.

WEE MEGGERS 500 V, £12 5s. 6d. Record 500 V test sets, £11. New. Carriage paid.—Robins' Electrics, 222, West End Lane, N.W.6. H.A.M. 0879.

"PIED PIPER" Electric MOUSE TRAPS, automatic, clean, safe. No "setting," just plug in! Type "O" (3 mouse capacity), with 6 ft. flex, 200/250 volts, 12s. 6d., post free.—The Robert Jolliffe Trust (Manufacturers), Aston Clinton, Bucks.

SEARCHLIGHTS (sale or hire). Carbon Rods, Ebonite, Fibre, Hightensite, Porcelain House-wiring and other Cleats, Reels and Knobs, Mirrors, Lenses, Lamp Lowering and Suspension Gear, T.R.S., lead and other Cables, Winches (hand), hundreds of thousands in use, etc.—London Electric Firm, Croydon.

LEATHER FINGER STALLS.—Made of Chrome Hide. Very strong and hard wearing. Length 3 in. Price 4s. per doz. Prompt delivery. Sample on application.—Willson Brothers, Industrial Clothing Manufacturers, Epsom, Surrey.

SACKS and Bags in excellent condition for all commodities, as low as 4d. each. Write: John Braydon, Ltd.,

230, Tottenham Court Road, W.1.  
Tel. No.: Museum 6972.

SUPERIOR Type Builders' Ladders now in production; also Steps, Trestles and Extension Ladders.—Phone: Shaftesbury Ladders, Ltd., 453, Katherine Road, E.7. Grangewood 3363/4.

ELECTRIC Convector Heaters.—Home and Export market supplied. Prompt deliveries from Weatherhead and Company (Glasgow) Ltd., Electro-Engineering Manufacturers and Distributors, 153, Oxford Street, Glasgow, O.5.

FIRES, fires, fires.—The Sedway 1 kw tubular bar reflector fire at 45s. retail is the finest value on the market; liberal trade discounts; factors willingly supplied; send for sample.—Sedway Electric, Ltd., 131, High Street, Wolstanton, Stoke-on-Trent.

ELECTRIC MOTORS, A.G. and D.C. We supply all types and sizes of Electrical Machinery—Slow Speed Reduction Gears can be supplied to customers' requirements with short deliveries. Send your enquiries to The Electro Power Co. Ltd. (formerly Be-Be, Eng.), 3, Retreat Close, Kenton, Middlesex. Tel.: WORDsworth 4923.

SLIP RING MOTORS, 400 volts 3 phase 50 cycles: 3—Crompton Parkinson, 90 H.P., 580 r.p.m. 3—E.E.C. 100 H.P., 720 r.p.m. The above complete with E.A.C. Pillar type Stator Rotor Control Units, Automatic type, floor mounting. Alternators 400 volts 3 phase 50 cycles: 1—Brush Revolving Field Alternator, 275 KW 600 r.p.m. Three Bearing type, complete with Switchboard. 1—As above, but 30 KW, 1500 r.p.m., complete with Switchboard.—Oldfield Engineering Company Limited, 96, East Ordsall Lane, Salford 5.

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

Alco at Phoenix Works, Belgrave Terrace,  
Soho Road, Handsworth, Birmingham.  
Telephone: Northern 0898.

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 1000 RATINGS ACTUALLY IN STOCK  
HERE.

13 DECEMBER, 1946

## FOR SALE

**VACUUM** Cleaner Spares and Accessories. Bags, bearings, belts, brushes, fans, switches, etc. Repairs, rewinding, rebristling. Sent for price list.—Reliance Vacuum Cleaner Service, 152-154, Broadway, Bexleyheath, Kent.

**A BARGAIN** IN CABLE and BELL WIRE.—Cable 1/052, V.R. 250 volt, Ref. 4101. Taped Cotton Braided and comp. Flameproof, Black (Craigpark), in 500 yd. coils or on non-returnable reels; 3/7s. 6d. per 500 yards. Waxed Bell Wire (1 red, 1 blue), 1/036. Twin Twisted, Tinned Copper, pure insulated, Cotton Runners, Cotton Lapped and Paraffined, in 100-yard coils (W. T. Glover), 9s. per 100 yards, 3/7s. 6d. for 500 yards. Terms net cash with order. Carriage extra. Any quantity supplied.—Wm. Hurlock, Jnr., Ltd., High Street, Thames Ditton, Surrey. Phone: Emberbrook 4011.

**A TLAS** lamps from stock, delivery in London, Surrey, Sussex and Kent; other lines include clocks, toasters, fires, irons, kettles, fans, fittings, chargers, speakers, etc.—Drubel Radio Distributors, Ltd., 39a, Stafford Road, Croydon, Croydon 1107.

**ELECTRIC** Lamps, Flashlights, Flashlight Bulbs, Portable Fires, Accessories. Prompt delivery.—Suplex Lamps, Ltd., 50, Gray's Inn Road, London, W.C.1.

**VACUUM CLEANER REWINDING SERVICE**, commutators and Bearings. Prompt delivery and full guarantee.—Thomas Anderson, 117, Bowes Street, Blyth, Northumberland. Phone: Blyth 405.

**JUNCTION** Electric Irons, superior design and quality, supplied with suitable stand. Also Junction Nickel plated Torch Cases. Supplied for home trade and export. Also large selection of household electrical appliances, Fires, Radiators, other electric Irons, Toasters, Table Lamps, Torch cases, Dry batteries, etc. Please write for full list.—Brooks & Bohm, Ltd., 90, Victoria Street, London, S.W.1. Tele.: Vic. 9550/1441.

**TINNED STEEL ARMATURE BINDING WIRE**—All even numbered sizes from 16 s.w.g.-23 s.w.g. supplied from stock on 7 lb., 14 lb. or 28 lb. reels.

**FREDERICK SMITH & CO. WIRE MANUFACTURERS LTD., CALEDONIA WORKS, HALIFAX.**

**VACUUM** Cleaners available in limited quantities, and all types of Repairs carried out for all makes of Vacuum Cleaners.—Crown Appliances Ltd., 90, Wellesley Road, Croydon, Cro. 6515.

**SWITCH** Blocks (round), well-finished hardwood, I.W. and W.E., 3 in. by ½ in., 45s. gross; 3½ in. by ½ in., 48s. gross, less 2½ per cent., carriage paid. Satisfaction guaranteed.—Elf Manufacturing Company, Dept. E., 9a, Sansome Place, Worcester.

**ELECTRIC** MOTORS.—1/3 h.p. 3000 r.p.m. D.C. 110 V. Also 220 V Stock Delivery. £6 15s. each.—John E. Steel, Clyde Mills, Bingley, Yorks.

## OPPORTUNITY

F  
O  
R  
S  
A  
L  
E

- 13½ K.W. Petter direct Coupling Lighting Set with Verity Dynamo.
- 230 volt, 18 H.P. Vertical Engine complete with starting bottle, tanks, voltage panel etc. (All in first class order, recently overhauled).
- Also, 55 new, enclosed type 110 volt Tungstone Batteries.

Nearest offer to £300

- Can be seen at Osmington Bay Chalet Centre, Nr. Weymouth, or phone Preston Dorset 2164.

## REWINDS

MOTORS, GENERATORS, TRANSFORMERS  
ALL SIZES WITH THE MINIMUM DELAY

FOR EFFICIENT SERVICE WIRE

"PORTER," LINCOLN

PENNEY & PORTER (1932) LTD.,  
LINCOLN

Grams: Porter.

Phone: 170677.

## MANOR ELECTRIC COMPANY

53, Victoria Street, London, S.W.1

Tel.: Abbey 1782

ELECTRICAL ENGINEERS

Manufacturers of

HOSPITAL FOOD TROLLEYS,  
IMPREGNATING OVENS, Etc.

Also Apparatus to Customers' own specifications

*Efficient  
Wholesale  
Service!*WIRING EQUIPMENT  
B.S.S. CONDUIT & FITTINGS  
C.M.A. CABLES & FLEXIBLES  
SW TCH & FUSE GEAR  
SANDERS, M.E.M., CRABTREE,  
BRITMAC, M.K., WYLEX, TENBY,  
ELMA LAMPS,  
APPLIANCES & FITTINGS  
FLUORESCENT LIGHTING  
WASHBOILERS

VAN DORN &amp; WOLF TOOLS.

Send enquiries and orders to.

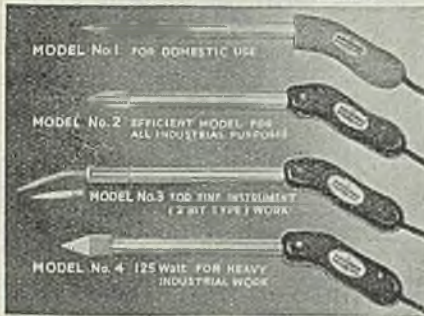
RD JOHNSON, CLAPHAM & MORRIS LTD.  
7-9, SWAN STREET, MANCHESTER, 4.

Phone: DEAnsgate 5491

HEAD OFFICE JACEM HOUSE, TRAFFORD PARK, M1c 17

# Rockman SOLDER GUNS

for all  
Industrial  
purposes



The Gun  
with the  
Guarantee

- Minimum Heat Loss
- Maximum Efficiency
- Perfect Balance — Effortless Operation
- Savings in Power and Labour

## Rockman

ENGINEERING CO. LTD.

16-18, Russell Street, MANCHESTER, 1

# YOU

should investigate  
the possibilities of the

## NEW 'AERO' TRANSFER

This new type of transfer gives a clear, permanent impression, is completely weather-proof and will stand up to the severest test.

*Your enquiries invited*



LUDGATE HILL, BIRMINGHAM 3

### FOR SALE

LADDERS, Trestles and Handcarts, from Ramsay and Sons (Forfar), Ltd., Forfar.

21 AND 5 kW 230 volt D.C. Petrol-driven GENERATING SETS, with Austin Petrol Engines.—Joseph Pugsley and Sons, Ltd., Lawrence Hill, Bristol, 5.

A.C./D.C. Motors and Switchgear can be supplied from stock or at short notice. Send your requirements to John Phillips and Co. Electric, 31, Fortune Green Road, N.W.6. Telephone: Hampstead 8132.

G R

By Order of the Minister of Supply.

WIVENHOE, ESSEX.

For SALE by AUCTION without reserve on January 7th, 8th and 9th, 1947, at 11 a.m. each day.

### MISCELLANEOUS GOVERNMENT STORES and EQUIPMENT.

About 360,000 yards of electric cable (various sizes), 30,000 feet of metallic steel, phosphor-bronze and copper tubing, galvanised bins, hot-water and other tanks, 870 gallons of good quality paints and varnishes, 27 portable forges, 63 engineer's vices, 45,000 fathoms of 2-in. and 3-in. wire rope, gas and other furnaces and ovens, drying cabinets, gas-producing plants, a vertical patent Mo-Pump, pigeon crates; **Two New 15-ton Ransomes' and Rapier Steam Shunting Cranes, 2.5 ton Overhead Cranes,** petrol and oil engines, Paint Spraying Equipment, nearly 250,000 feet of welding electrodes, 800 flameless heaters, 500 electric fans, electric drills, burnishing and milling machine, 600 windscreens motors, 16 **Trailer Mounted Water Purification Plants** with 8 h.p. Petter engine and equipment, assortment of engineers' tools, nearly 14,000 wood and steel containers, 20,000 feet of gravity conveyor.

At the Ministry of Supply Depot, Wivenhoe (adjoining L.N.E.R. Station), Essex.

On view December 31st, 1946, and January 1st 2nd, 3rd and 6th, 1947, inclusive, 9.30 a.m. to 3 p.m.

Admission by Catalogue only (6d. each), obtainable from the Auctioneers.

F. S. DANIELL AND SON,  
HEADGATE, COLCHESTER.

\*Phone 3336.

### REPAIRS

COOKERS.—We can give good deliveries of Sheet Metal Vitreous Enamelled Electric Cooker parts.—JOHN KING & SON (ENAMELLERS), LTD., PYRO WORKS, CHESTERFIELD. Phone: 5305.

### PATENT AGENTS

MEWBURN, ELLIS & CO.,

PATENTS, DESIGNS AND TRADE MARKS,

70 & 72, Chancery Lane, London, W.C.2.

Grams: "Patent, London." \*Phone: Holborn 0437 (2 lines)

And at—NEWCASTLE: 3, St. Nicholas Buildings.

A. E. HILL

Chartered Patent Agent,

27, Chancery Lane, London, W.C.2.

Chancery 8444

### AUCTIONEERS AND VALUERS

RICHARDS & PARTNERS,

Auctioneers and Valuers of  
PLANT AND MACHINERY AND  
INDUSTRIAL PROPERTY,

Granville House, Arundel Street,  
London, W.C.2

Telephone: TEMple Bar 7471.

## WANTED

A. C. Motors all sizes and voltages. Best prices offered.—John Phillips and Co. Electricians, 31, Fortune Green Road, W. Hampstead. Telephone: Hampstead 8132.

WANTED IMMEDIATELY.—Second-hand copy of the Blue Book of the Electrical and Engineering Trade Directory 1941, and of the Trader Year Book. Good price paid. Write, stating price expected.—Box No. L.T.C., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

LAMINATIONS.—Large types required in reasonable quantities. Ts and Us. Also 75's and 4A's.—Cornercroft, Fallibroome Road, Macclesfield.

SPOT electric welding plant urgently wanted.—Price and full particulars to James Scott and Son (Aberdeen), Ltd., 483, Union Street, Aberdeen.

REQUIRED for Export.—500 dozen SWITCHES, 5 amperes; 220 volts, Bakelite cover, brown on white base, or brown on brown. 20,000 yards 1/044 in. lead alloy, sheathed twin flat CABLE, conforming to C.M.A. specifications. Please communicate with E. S. Mashal, 86, Alie Street, E.1. Telephone number: Royal 4405/6.

URGENTLY required, quantities of 26, 27, 28, 29, 30 gauge enamelled copper wire.—Bevree, Ltd., 7, Jamaica Street, Bristol. 2.

VITREOUS base metal top push button switches required.—Runbaken Electrical Products, 71, Oxford Road, Manchester.

ENAMELLED wire wanted, 21, 21½, 23½, 24, 43 and 44 gauge. Good price paid, any quantity.—Runbaken Electrical Products, 71, Oxford Road, Manchester.

A. C. MOTORS, 1-100 h.p., 500-1,500 r.p.m. Any make fitted with ball and roller type bearings. Must be good machines, such as you yourselves would buy. Alternatively motors for rewinding will be considered.—Oldfield Engineering Co., Ltd., 96, East Ordsall Lane, Salford. 5.

WANTED.—ROTARY CONVERTORS, any size.—Universal, 221, City Road, London, E.C.1.

## AGENCIES

L. GOODMAN (RADIO), LTD., 9, Percy Street, W.1, are sole London agents for the "Mideo" Elongated FLUORESCENT CHOKE and Fluorescent Starter SWITCHES Museum 6216.

WELL-KNOWN and influential importing house having very good connections and a vast field of clientele desires sole representation of all electrical goods. Please contact Vyas Brothers, Post Box 2036, 33, Nanabhai Lane, Churchgate Street, BOMBAY.

## WORK WANTED

HARTLEPOOL Machine Shop for any small machinery castings in iron, orders of 50 thousand to one million wanted. Enquiries to—T. Moore, 61, Crathorne Crescent, Middlesbrough.

ARMATURE Winding: Vacuum Cleaners, etc., single or quantities.—Vac, 80, Cranbrook Road, Ilford.

FOR REWINDING ELECTRIC MOTORS. Fractional, up to 100 h.p. Transformers. Chokes, etc., contact Electrical Construction Company, Ltd., Seymour Wharf, Totnes, Devon. Phone: 3282.

BRISCOE PLATING CO. LTD., now have available capacity for silver and nickel plating and quantity production of electrical and household products in which we are specialists. Enquiries invited to 3-5, Maddox Street, London, W.1.



The "Fluxite Quine" at work  
"I'd just like to catch the big goose, who turned all these ball bearings loose, and also the kite who yelled 'Fetch the FLUXITE'"

I'm whacked to the wide—WHAT'S THE USE "

For all SOLDERING work—you need FLUXITE—the paste flux—with which even dirty metals are soldered and "tinned." For the jointing of lead—without solder and the "running" of white metal bearings—without "tinning" the bearing. It is suitable for ALL METALS—excepting ALUMINIUM—and can be used with safety on ELECTRICAL and other sensitive apparatus. With FLUXITE joints can be "wiped" successfully that are impossible by any other method. Used for over 30 years in Government works and by leading Engineers and Manufacturers. OF ALL IRONMONGERS in tins—10d., 1/6 and 3/.

The FLUXITE GUN puts FLUXITE where you want it by a simple pressure. Price 1/6 or filled 2/6.

# FLUXITE

## SIMPLIFIES ALL SOLDERING

Write for Leaflets on Case-Hardening Steel and Tempering Tools with FLUXITE, also on "Wiped" Joints. Price 1d. each  
FLUXITE LTD. (Dept. ERN), Bermondsey St., S.E.1

## YOUNG ELECTRICIANS! THIS WILL HELP YOU.

The new edition of our FIRST COURSE FOR ELECTRICIANS has been specially prepared to help the young man or woman entering the trade. It will pay you to get one quickly while stocks last.

"a reliable handbook for the apprentice"—Electrician

"a valuable aid to the student"—Electrical Trading

"surprising how much information the author has been able to impart"—

Electrical Review

From all booksellers 3/6,  
or 3/9 post free from

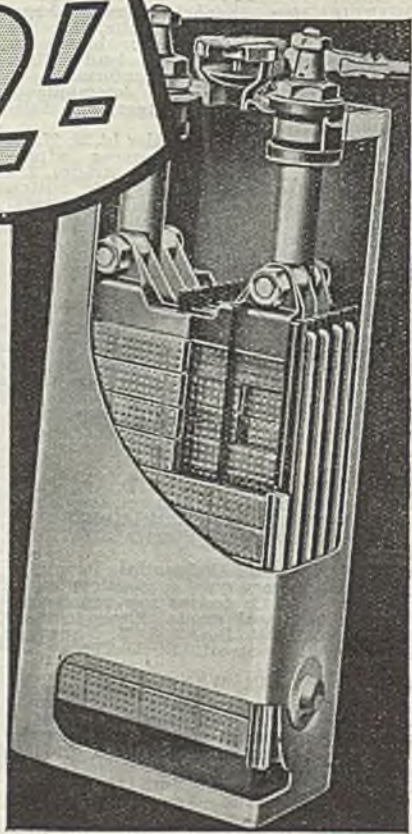
MORGAN LAIRD & CO., LTD.  
66, Gt. Russell St., London, W.C.1.

# 15,000 NIFE BATTERIES on duty 10 years

cost only **52!**

## for repairs!

This was the actual experience of a Railway Company operating NIFE Batteries under very severe conditions. Obviously, NIFE is no ordinary battery. It is an Alkaline cell of all-steel construction, practically indestructible, entirely free from corrosive fumes and immune from damage even by dead "shorting."



**Proof that there is**

# MORE LIFE in a NIFE

*Now available for all purposes except private radio and private cars.*

**NIFE BATTERIES LTD., Hunt End Works, Redditch, Worcs.**



# THE ELECTRICIAN

ESTABLISHED 1861

*Bouverie House - 154 Fleet Street - London EC 4*

*Telegrams: "BENBROTIC FLEET LONDON" Telephone: CENTRAL 3212 (12 lines)*

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

*Publisher and Manager: JOHN VESTEY*

*Number 3576*

*13 DECEMBER 1946*

*Vol CXXXVII No 24*

## CONTENTS

<i>Views on Current Affairs</i> .....	1659
<i>Sculcoates Power Station</i> .....	1662
<i>More About Silicones</i> .....	1666
<i>Inside of Electrical Machines</i> .....	1669
<i>Increasing Industrial Output</i> .....	1673
<i>Electrical Personalities</i> .....	1674
<i>Answers to Technical Questions</i> .....	1676
<i>Nationalisation and Finance</i> .....	1677
<i>In Parliament</i> .....	1678
<i>Power Station Auxiliary Services</i> .....	1679
<i>Equipment and Appliances</i> .....	1682
<i>Electricity Supply</i> .....	1683
<i>Conservation of Coal</i> .....	1684
<i>Electrical Inventions</i> .....	1685
<i>Industrial Information</i> .....	1686
<i>Contracts Open</i> .....	1690
<i>Company News: Metal Prices</i> .....	1691
<i>Commercial Information</i> .....	1692

## A Change of Front

WHEN last September Mr. E. SHINWELL described the power companies' fear of interrupted supplies this winter as "nonsense," we suggested that he was creating in the minds of the public a false sense of security, and that he might in January or February next regret having used that word so thoughtlessly in September. Subsequent happenings show that our appreciation of the position was not far wrong, for the gravity of the fuel position facing industry in December is such that the Minister is, by Statutory Order, restricting by 2½ per cent. all electricity consumption by industrial users in January, February and March next, with November last as the base period.

By this action of the Minister of Fuel, the industry of the country is called upon to serve two or more masters, in that cuts in consumption must be made on the one hand, and the output of goods increased on the other in answer to appeals by other Ministers for export and housing. It is seemingly impossible for industry to meet both calls. The necessity for bringing about a 2½ per cent. reduction over the next months will be accepted by the supply industry as being very real, while the prevalence of load-shedding over the last two or three weeks must by now have convinced industry generally, that unless something is done to stop it, the generating capacity of the country

### MIDLANDS OFFICE:

Daimler House, Paradise Street, Birmingham  
Telephone: Midlands 0784-5

### GLASGOW OFFICE:

116, Hope Street, Glasgow, C.2  
Telephone: Central 3970

*The offices of THE ELECTRICIAN are closed on Saturdays in accordance with the "Five-day Week" plan adopted by Benn Brothers, Ltd.*

SINGLE COPY (FRIDAY)	-	-	-	6d
ANNUAL SUBSCRIPTION	-	-	-	25s
OVERSEAS	-	-	-	30s

will soon be taxed even beyond the present demands made upon it. Such a condition is admittedly, extremely distasteful to both the supply industry and its consumers, but it has to be met, notwithstanding its unpleasantness, in order to avoid even greater restriction. The supply industry does not accept the position without criticism, however, for had Mr. SHINWELL listened to its pleading for caution, industrial consumers would have been warned earlier of the dangers now upon us, and, even assuming that alternative arrangements could not have been made, preparations for meeting the restrictions could have been put in hand some months ago.

### Fuel Cuts and Production

THE general feeling in industry with respect to the fuel position is that despite the fact that every possible step is being taken to minimise its effect upon production, some dislocation, accompanied by a reduction in efficiency, cannot be avoided. This opinion is based on the fact that despite the hope expressed by Mr. SHINWELL that further economies might be possible, most industrial concerns have reached the limit at present possible in pruning consumption, and they will therefore suffer the full effect of the statutory cut in supplies. It is appreciated that the scheme may be subject to revision should coal output improve, but in no sense would such revision alleviate the shortage of generating capacity. The position is that we have fallen between two stools, the legs of which were formed on the one part, by the war-time policy of the Executive Production Committee, and by post-war political disturbance on the other. If Ministers would accept that fact and evince a little more candour in time for preparations to be made to meet the altered conditions, they would provide less ground for the criticism of which they appear so sensitive.

### Education of Engineers

A MEETING which should attract a good many professional engineers is to be held on December 18, at which Prof. FORTESCUE will open a discussion on the subject of "The Education of Engineers." The meeting has been convened

by the Engineers' Guild which exists for the primary purpose of raising the status of the engineering profession in the eyes of the world, and it open to all who may be eligible for membership of the guild, and to any to whom the subject of the status of the engineering profession is of interest. The meeting is to be held at the Royal Society of Arts, at 6.30 p.m. and questions will be invited.

### The Hull Extension

THE starting up of the 30 MW extension at the Seuloates station of Hull Corporation focuses attention on the fact that but for the war, the 50th anniversary of the commencement of public supply in the area would have been celebrated in January, 1943, eight months before the latest extension was directed by the Central Board. In a way the occasion can be said to have been celebrated by the outstanding effort put into completing the new extension, for apart from the difficulties of the times and embargoes which had to be overcome, the scheduled date for commissioning the extension was advanced from 1948 to 1946. From the description given in this issue, it will be appreciated that the civil engineering work involved in the extension was in all respects a major operation, and necessitated the carrying out of many requirements unusual in their character. From a plant capacity of 300 kW in 1894 with a maximum demand of 160 kW, the undertaking has grown until to-day the figures stand at 124 000, including the new 30 MW set, and 90 495+. The original area of supply was 15 sq. miles but to-day 162 sq. miles are served, involving 94 962 consumers; a record of which the undertaking is justly proud.

### The E.L.M.A.

IT is customary at this time of the year for the E.L.M.A. Lighting Service Bureau to entertain the technical Press at an informal luncheon, during which indications are made of what the lamp-makers have in store for the immediate future, the trend of development, what their hopes may be, and so on. This year's luncheon was no exception to the rule and at the function last week—presided over by Mr. E. B. SAWYER, the acting manager of the Bureau—much was said in confi-

dence but still more was said which may be classed as current news. A common topic of conversation at these luncheons is the popularity of the illumination design courses, for each year the demand for attendance grows and grows, until this year the audience capacity of the theatre at the Bureau was by some expert means raised to the figure of 600. The popularity of the courses has not unnaturally spread to the provinces where for some time has been expressed the hope that the courses would be extended outside the London area; this hope now looks like being realised and when it is, the pressure at the London Bureau may in theory be relieved. The good services of that organisation known as N.I.E.L.S. during the war years is to give way to some similar body designed to meet peacetime needs of industry, while early in the New Year there will be made known something of a revolutionary nature with respect to fluorescent lighting. Speaking on the subject at the luncheon, Mr. W. J. JONES, director of the E.L.M.A., displayed an enthusiasm well justified and deserved; an enthusiasm, however, which we may not yet share with our readers.

### Documentary Films

NEW ground has been broken by the Film Producers' Guild in the making of two documentary films which are unusual, in that they have set out to cultivate the interest of the general public rather than that of selected audiences. These productions, which run for 35 minutes, will rank as second features in ordinary cinema programmes, and will be hired out at a nominal rental. With a focus on the future, the films are a form of propaganda that will be acceptable to most people, for their message is conveyed so subtly as to be unobtrusive. The more recent film, "A Place in the Sun," deals with the location of industry, and contrasts the unhealthy conditions of the overcrowded industrial areas, with the fuller, happier lives of the inhabitants of garden cities, or redeveloped centres, with open spaces and facilities for sport and recreation, where the factories and works are spacious, light and airy and the availability of electric power from the grid system has resulted

in the elimination of smoke and grime. The second film, "Can We Be Rich?" was referred to in THE ELECTRICIAN of November 22, and is concerned with the economics of production in relation to improved standards of living. Its message is that greater production and a higher standard of living can be achieved by increased mechanisation and electrification in industry, with hidden though none the less effective emphasis on the advantages of individual electric drive. Both are good films which all in the industry should see; both are films which the public will, it is felt, accept with pleasure and enthusiasm. The fact that they fall within the rental scheme of the ordinary entertainment field will ensure their being seen by wide audiences, and their electrical story will thus reach a public, perhaps hitherto untouched in this way.

### Swedish Hydro Developments

WHEN the international hydro-electric congress meets in Stockholm in June, 1948, Sweden will have a good deal of interest to show her guests, in that several large plants were completed during the war, while several more are under construction. New plants at Midskog, Jaarpströmmen and Gammelångo on the Indal river have been put into commission in the last few years, and among the works to be completed within the next five years or so, are Harspranget on the Lule river, Hjalta, Forsnoforsen and Nämforsen on the Angerman river and Hölleforsen on the Indal river. When ready in 1951, the Harspranget plant, of 255 000 kW, situated within the Arctic Circle, will be Sweden's biggest hydro-electric power station. In order to regulate the water supply to this plant a 2 000 ft. dam has been built at the well-lake of the Lule river, in the mountains of Lapland. By means of this structure, the Suorva dam, which has taken more than two decades to construct, the size of the lake has been increased to give at high water level an area of about 110 sq. miles, and a maximum storage capacity of 113 000 million cu. ft. Sweden has already this year been visited by several hydro-electric interests, among them a group of fourteen Dutch electrical engineers.

# Sculcoates Power Station

## 30 MW Extension Put Into Commission Last Week

*In an address at a luncheon following the starting-up of the 30 MW extension at the Sculcoates station of Kingston-upon-Hull Corporation on December 7, Mr. E. Shinwell, Minister of Fuel and Power, gave some further views on the reasons for the nationalisation of supply, and below will be found an abstract of his remarks.*

\* \* \*

*With regard to the extension, the original direction was for completion by the winter of 1948, but in March, 1944, this date was advanced by two years. In view of the conditions obtaining during the early part of the construction and the shortages which have prevailed since, those concerned with the erection of the new extension have done commendable work in keeping to so rigid a schedule.*

IT will be remembered that in THE ELECTRICIAN of January 18, last reference was made to the fact that in September, 1943, Kingston-upon-Hull Corporation received a direction from the Central Electricity Board to extend the Sculcoates station by 30 MW, including two 190 000 lb./hr. boilers and a 2½ million gal. cooling tower with all ancillaries—to be in operation by September, 1948; in March, 1944, this date was amended to the winter of 1946.

We are advised by Mr. D. Bellamy, general manager, that the reduction from five years to three of the time allowed for construction, entailed the most arduous and harassing labour in conflict with the restrictions of the period. However, the work was driven forward with varying success in different branches, so that by the end of 1945 the erection of one boiler was approximately 50 per cent. complete; all structural steelwork was on site, with the exception of some chimney support details; the switch-house construction was complete and as a crowning success to the effort put into the work, Mr. E. Shinwell, Minister of Fuel and Power, was able to open the extension on December 7.

At the ceremony Mr. Shinwell said that in spite of the ravages of war, the Hull

undertaking had shown great expansion over recent years. In 1922 the capacity of the generating station was just over 15 000 kW, and by 1945 it had grown to 94 000 kW. In the same period sales of electricity rose from 39 million units to nearly 230 million. The average price per unit for lighting, heating and cooking had been progressively reduced from 7.08d. to 1.10d. which compared favourably with the average price for the country of 1.56d., and the price of power units had fallen from 1.33d. in 1922 to .87d. in 1945.

At a luncheon following the ceremony, he said that he was not partial to nationalisation for its own sake alone. His attitude to any proposal for nationalisation was determined by the hard practical issues involved, and the prospects of social advance. In the matter of electricity he admitted freely the great developments which had been made by those now in control of the industry. Many undertakings were great examples of enterprise and progress.

“You may well ask me why, when a large measure of success has been achieved under the existing practice, we should seek to effect a change,” Mr. Shinwell con-

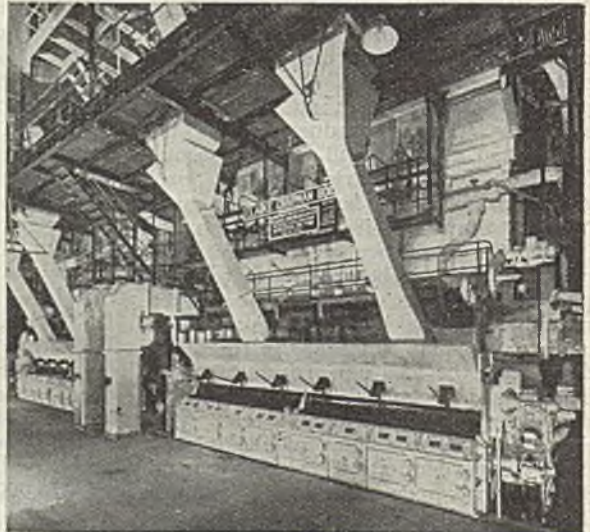
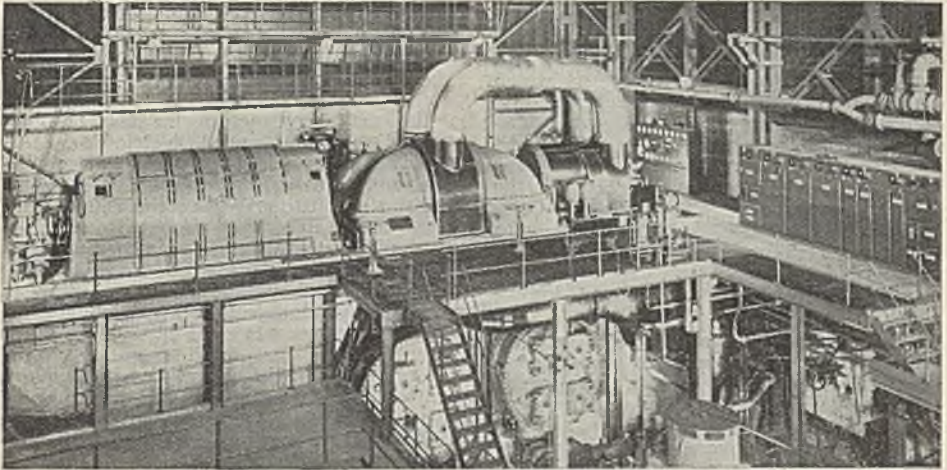


Photo: Turner and Drinkwater, Hull

One of the two 190 000 lbs./hr. Clarke, Chapman boilers



*Photo: Turner and Drinkwater, Hull.*

*The new 30 000 kW, G.E.C. turbo-alternator at the Sculcoates power station of Kingston-upon-Hull Corporation, which was put into commission on December 7*

tinued. "I judge the project solely by the criterion of the good of the people as a whole. It is for that reason—and for no other—that I advocate the nationalisation of the industry. While great things have been achieved in electrical development in many areas, I feel there is little doubt we have reached a stage at which the existing boundaries are retarding progress and the full play of enterprise, and I can see no way of securing orderly national development over the whole country apart from unified ownership and control."

One of the main purposes of nationalisation was rural electrification. In some areas much had been done in this direction and in the country as a whole 63 per cent. of rural premises were connected to a supply. Among farm holdings, however, only about 27 per cent. were connected, and even that figure was exaggerated, for of the number making full use of electricity, in over half the cases the supply was confined to the farmhouse proper.

He avoided any attempt to discriminate between municipal electricity undertakings and those in company ownership, for he realised that among those who opposed nationalisation were some whose honest conviction was that the present system offered the best means of developing the industry in the national interest. He asked them to re-examine the question with open minds, to envisage the matter in its broadest aspects and above all to do nothing which debarred them from, in due course, giving their active assistance in advancing the development of the indus-

try in any form of ownership whatsoever. All would be required in the task ahead.

The Lord Mayor, Ald. Isaac Robinson, chairman of the Electricity Committee, who presided, said that whenever nationalisation was decided upon, the Corporation would hand over to the Government an undertaking that was 100 per cent. efficient, thanks to the general manager, Mr. D. Bellamy, and the 1 100 employees.

Mr. V. A. Pask, personal assistant to the general manager of the Central Board, referred to the effort of the plant shortage, and said that so far as he could see it was likely to be about 1950 before there would be any easing of the position.

Mr. F. Lonsdale (director, General Electric Co., Ltd.) and Captain J. B. Woodson (director, Clarke, Chapman and Co., Ltd.) spoke on behalf of the main contractors, and Mr. Bellamy for the supply authority.

Sir Cyril Hurcomb, chairman of the Electricity Commissioners, also spoke, and after referring to the statistics abstracted in our last issue, said with regard to the future that two matters were of special interest, namely, tariffs and standardisation. The multiplicity of the former had long been a point of legitimate criticism, and indeed, before the war it was true to say that no undertaking's tariff was identical with that of any other, even if they were near neighbours. With the full backing of the Minister, the Commissioners appointed last summer a committee of the industry to review the position and, under the chairmanship of Sir John Dalton, the committee hoped to be in a position early

in the New Year to present an interim report. With regard to the standardisation of voltages, two months ago the Commissioners issued a new approved standard for low and medium voltages, which should be adopted for new supplies and would be obligatory for such supplies as from October 1 next year. As regards the change-over of existing supplies to the new standard, associations appropriate to the industry were co-operating with the Commission in drafting the conditions with which undertakings could reasonably be expected to comply, and a conclusion should be reached and made known shortly.

With regard to the extension at the station, the new boiler space was formerly occupied by  $2 \times 50\,000$  lb./hr. boilers. Old foundations had to be removed and new ones prepared. The steel columns supporting the bunkers of boilers put in in 1937 and 1942 were called upon in the new design to carry additional loads, and this entailed changing some columns. It will be appreciated that to do this without disturbing or interfering with the use of bunkers already supported by the columns was a complex operation. Steel columns later to be used elsewhere in the structure were made in advance and used temporarily to support the bunkers. The existing columns, capable of carrying 300 tons, were taken out and used again elsewhere in the structure, being replaced by new ones carrying the bunkers, and by extension upwards, also the fan floor. The new columns are loaded to about 1 000 tons and the whole of the operations were carried through by Heenan, Beddow and Sturmev, Ltd., of Manchester.

#### A CONSTRUCTIONAL PROBLEM

Chief obstacles in the turbine room so far as the extension was concerned were a 40 ft. deep low level drainage sump in heavy reinforced concrete and cable tracks across the area, carrying upwards of 40 cables, all of which had to be out of commission for a few days only, in some cases for a few hours. The cable difficulty was surmounted by building an underground tunnel in which the new cables were laid in racks, being finally jointed into the existing cables. The turbine room basement was then constructed.

An extension of the 22 kV switch house was built to house eight new switches including that of the new generator. A reactor switch house was built to house nine switches, the purpose of which was to sectionalise the existing 6 600 V bus, inserting three new and one existing current limiting reactors between the sections, in order to control the fault kVA on existing switchgear to a figure within

their designed limit of 500 000 kVA. Two 15 000 kVA inter-bus transformers were also transferred on the 6 600 V side to the reactor bus.

#### TURBINE PLANT

The main contractors for the turbine section were the General Electric Co., Ltd. The turbine was built at their Fraser and Chalmers' Works, Erith, and the alternator at the Witton Works; the condensing plant and heaters were designed and built by the Mirrlees Watson Co., Glasgow, acting as sub-contractors. The machine is a 30 000 kW, 2-cylinder tandem impulse turbine with double flow l.p. turbine and twin condensers. It runs at 3 000 r.p.m. Steam at 375 lbs./sq. in. and 800° F. enters the h.p. turbine through a main control valve followed by four governor valves. The latter are integral with the high pressure casing and symmetrically disposed in two pairs. One pair of valves passes steam enough for 80 per cent. full load, whereafter the second is opened to reach full load by admitting steam through a bye-pass to the 6th stage. It should be noted that steam enters the h.p. turbine at the end nearer the centre of the set. This is a special design to simplify problems arising from thermal expansion. The main casing is anchored axially by transverse keys under the north end of the l.p. turbine, approximately abreast of the main Michell thrust block. Thus, expansion of both casings and rotors springs from the same fixed point in space. Steam from the h.p. turbine passes through the two large cross-over pipes above the set, and enters the centre of the l.p. turbine. It flows both ways through six stages on either side to the twin condensers. There are 22 stages of expansion in the h.p. turbine.

The condensers take 1 250 000 gal. of cooling water per hour, and maintain a pressure of about 1.5 in. of mercury at the exhaust. The tubes are expanded into brass tube plates at each end of the shell and the equipment used for expansion was an electrically-driven automatic uniform expander controlled by a sensitive current limiting relay on the lines laid down by Messrs. Fisher and Coper, of the Detroit Edison Co., whose assistance in developing the tool is acknowledged by the Corporation. The push-out strength of the expansions is known to be very close to one ton, giving a factor of safety of four on the maximum thrust that a tube can exert on the tube plate.

A 47 h.p. motor-driven pump extracts the condensed steam and with the feed pump delivers it through a series of heaters back to the boilers. In its passage through the heaters, the water rises from about 80° F. to 300-315° F. The heat required

for this is extracted from the turbine at three separate points, the pressures at 80 per cent. load being 13.4, 36.4 and 105 lb. per sq. in. absolute. Approximately 20 per cent. of the steam fed to the turbine is thus condensed.

### THE ALTERNATOR

The generation voltage of the alternator is 22 000. The stator winding is insulated with moulded micanite and is of conventional construction. It is protected with Merz Price balanced protection, and cooling is effected by integral fans on each end of the shaft. In order to control the temperature rise in the rotor windings, air slots are provided between winding slots. The slots extend from the ends to the centre of the rotor, being covered by wedges at the periphery except near the centre. Rotor cooling air thus flows towards the centre, then out through slots in the stator iron. The purpose of this special arrangement is to hold the rotor copper temperature below a figure at which permanent shrinkage of the bars can occur along their length, so avoiding rotor coil distortion. The weight of the stator is 95 tons and of the rotor 21 tons.

The 2 × 190 000 lb./hr. boilers were supplied by Clarke, Chapman and Co., Ltd. The stop valve conditions are 400 p.s.i. and 825° F. Feed at approximately 250° F. enters the Green's economiser which raises the temperature to 355° F. before the water enters the rear top drum through a Copes' "Flowmatic" feed regulator. The arrangement of water tubes departs somewhat from the normal in three drum boilers, in order to accommodate a horizontal self-draining superheater as opposed to a pendent non-draining one. The object is to simplify washing out of any deposits carried over with steam into the superheater. To minimise the deposits a separate steam drum is superimposed. The dried steam passes through 14 distributing pipes to the superheater headers.

The superheater, supplied by the Superheater Co., Ltd., is all-welded, the headers being supplied with short steel pipes to which the elements are welded *in situ*.

The draught plant was supplied by Davidson, Ltd., of Belfast, and comprises twin forced and induced draught fans of 51 and 122 H.P. respectively, and two secondary air fans of 41 H.P.

The combustion equipment comprises two underfeed "L" type chain-grate stokers of International Combustion Co.'s manufacture. The combustion air at 300° F. is admitted below the return chain and passes through both go and return chains to the fire. The furnace is lined with Murray fin-type water tubes. Combustion control is effected by a Hagan

automatic installation, and an automatic installation of Clyde soot blowers of 18 blowers per boiler is installed, with one master controller per two boilers, either being switched on to the control bus by a special multi-switch selector. The electrical control gear was designed and built by Brookhirst Switchgear, Ltd., both for the soot blowers and for all chief auxiliary motors.

The nine wooden natural draught cooling towers erected from 1918 onwards have a nominal capacity of three million gal. per hour, and with the natural water flow of the Barmston Drain cater for an output of 95-100 MW. In order to cover the present extension and imminent obsolescence of the earlier wooden towers, the 2.5 million g.p.h. hyperbolic concrete tower was erected. It receives water from two outdoor 1.25 million g.p.h. pumps of Messrs. Sulzer's (Leeds) manufacture and the cooled water returns by an open flume to the existing cold water suction duct. The tower was designed by Mouchel and Partners, consulting engineers, and built by the Mitchell Construction Co., Ltd., of Peterborough, upon piling made and driven by Sangwin, Ltd., of Kingston-upon-Hull. It is expected to be in commission at the end of this month.

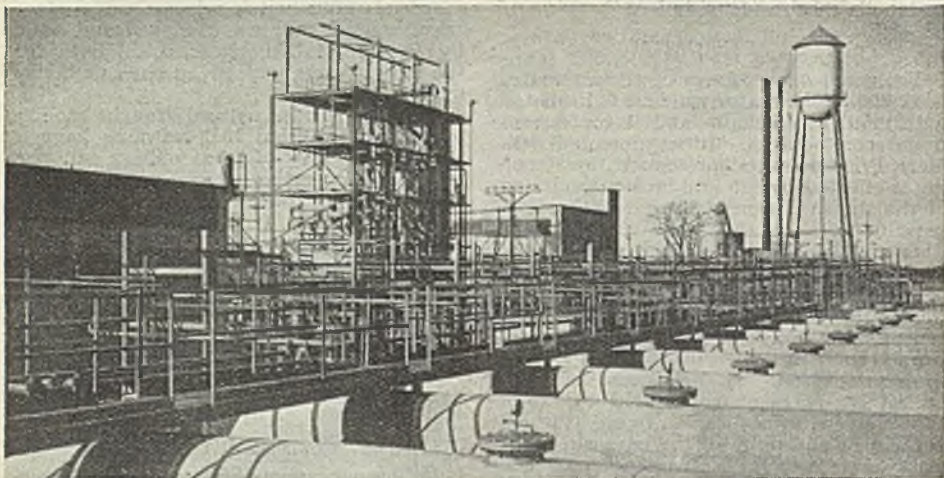
### ALL-WELDED CHIMNEY

The gases from the two new boilers, and in due course from one existing unit, discharge to a 300 ft. steel stack. This is an all-welded, self-supporting structure and is claimed to be the highest steel chimney in Britain.

The electrical and mechanical contractors included General Electric Co., Ltd., turbo-alternator; Clarke, Chapman and Co., Ltd., boiler plant; Aiton and Co., Ltd., pipework; Mitchell Engineering, Ltd., coal handling plant; John Thompson Conveyor Co., ash plant; A. Reyrolle and Co., Ltd., switchgear; Metropolitan-Vickers Electrical Co., Ltd., reactors and transformers; Sulzer Bros. (Leeds), Ltd., cooling tower pumps, cooling tower pump motors; J. Blakeborough and Sons, Ltd., sluice valves; G. and J. Weir, Ltd., feed pump; Permutit Co., Ltd., water softener; Mather and Platt, Ltd., fire protection (water); Foamite, Ltd., fire protection (CO.); Mirrlees, Watson Co., Ltd., condensing and feed heating plant; Geo. Kent, Ltd., instrument panels; Hopkinsons, Ltd., steam and feed valves; International Combustion, Ltd., stokers and furnace tubes; Davidson and Co., Ltd., draught plant and arrestors; E. Green and Son, Ltd., economisers; James Howden and Co. (Lond), Ltd., preheaters; Superheater Co., Ltd., superheaters; Aiton and Co., Ltd., P. and B. evaporator; Newall's Insulation Co., Ltd., heat insulation; J. Gordon and Co., Ltd., combustion control; Clyde Blowers, Ltd., soot blowers; E. N. Mackley and Co., drainage pumps; Brookhirst Switchgear, Ltd., auxiliary switchgear, soot blower controls; Goodyear Tyre and Rubber Co., Ltd., ash conveyor belting; Herbert Morris, Ltd., C.T. pump bay crane; Crompton Parkinson, Ltd., B.I. Callender's Cables, Ltd.; Pyrotex, Ltd., cable and wiring material.

# MORE ABOUT SILICONES

## THEIR CHARACTERISTICS AND POSSIBLE APPLICATIONS



*Silicone manufacture is largely a matter of pipes, stills and vats, as will be appreciated from this view of the Dow-Corning plant at Midland, Mich.*

THE recent announcement that a British distributor has begun the large-scale marketing of American-manufactured silicones will arouse new interest in these materials. The chemistry and more important properties of silicones have already been described at some length in this journal<sup>1</sup>, and the present article seeks, after a short introduction, to indicate some of the ways in which the silicones now available may assist the electrical engineer.

So far, the only plant in the world capable of bulk production of silicones is believed to be that of the Dow-Corning Corporation, at Midland, Mich. The manufacture of the materials from raw sand, modified by chemicals made from brine, coal and petroleum, is costly and complicated and is not, within the near future, likely to become cheap. Much fundamental research into silicone products has been carried out by the General Electric Co., of New York.

Silicones, as a group, owe their importance to their high water-resistance and temperature stability, which are common properties of the three main divisions—resins, liquids and rubbers. The reason for the high water-resistance can be partially understood by considering a silicone molecule as one in which the surfaces are hydrocarbon compounds and which, therefore, presents to water an exterior similar to that of paraffin or oil. The temperature stability can be accounted for by the fact that the bonding energy

of the silicon-oxygen link, which is the foundation of any silicone molecule, is very strong. Considerably more heat must be used to disrupt the bond than in the case of the carbon-to-carbon molecules in the hydrocarbon oils and resins.

Possibly the most important group of silicones, from the electrical engineering point of view, contains the resins and varnishes. These are produced as a liquid which polymerises to a solid when heated for one to three hours at temperatures of between 220° and 275°F., followed by a "cure" of several hours at 450° to 500°F. A recently developed varnish has normal baking times and temperatures.

This heating causes the long chain-like molecules to form side-bonds to adjoining molecules, and the substance becomes a brittle or flexible solid, depending upon its molecular constitution.

The resins are normally furnished in a toluene solution ready for application by conventional coating procedures. On evaporation of the solvent, the resin remains. In this form, they may be used as bonding agents for glass and asbestos cloth, or in the fabrication of heat-stable, waterproof laminates.

Silicone magnet wire enamel is of considerable use where space limitations preclude the use of glass served wire. The flex life of wire so treated, for example, is claimed to be over 30 times that of wire coated with organic enamels at 480°F. This ability to "run hot" makes possible



the reduction in size of motors and air-cooled transformers, and the indications are that equipment using silicone resins and varnishes will withstand continuous operation at 340°F. and intermittent operation at temperatures up to 390°F.

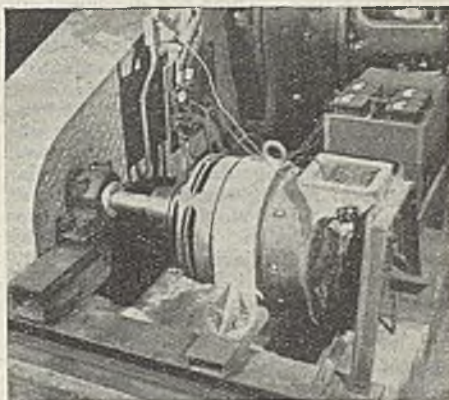
The Westinghouse Corporation, who are keenly interested in the electrical properties of silicones, have carried out exhaustive tests on silicone-insulated motors, some of which have now been running, under arduous conditions, for more than two years without failure. A d.c. traction motor, for example, was subjected to test cycles in which operation at 545°F. was alternated with thorough humidification. After 25 such cycles, totalling 350 hours at 545°F., the insulation lost its original high degree of moisture resistance, but even after 42 cycles, or 1 400 hours, it was still able to pass a severe humidification test. Several squirrel-cage induction motors have experienced similar heat and humidification cycles and are still running with no indication of insulation failure. Some of the illustrations on these pages, which are reproduced by courtesy of the "Westinghouse Engineer" and "Modern Industry," show the effects of high temperature silicone insulation.<sup>2</sup>

The dielectric strength of the resins is of the order of 1 500 V per mil on thin sections and the power factor at audio and normal radio frequencies is remarkably low—about 0.0001. The fact that, on flashover, no carbon track can form on the resins is partly responsible for the high temperatures at which motors can be run.

Summing up, the advantages of silicone resins and varnishes in motor and coil building are: (a) To prolong the life of equipment in locations which are hot, wet, or subject to severe corrosive action; (b) to give greater freedom from overload failures; (c) to permit increased horse-power output from a given machine.

The second important group is that of

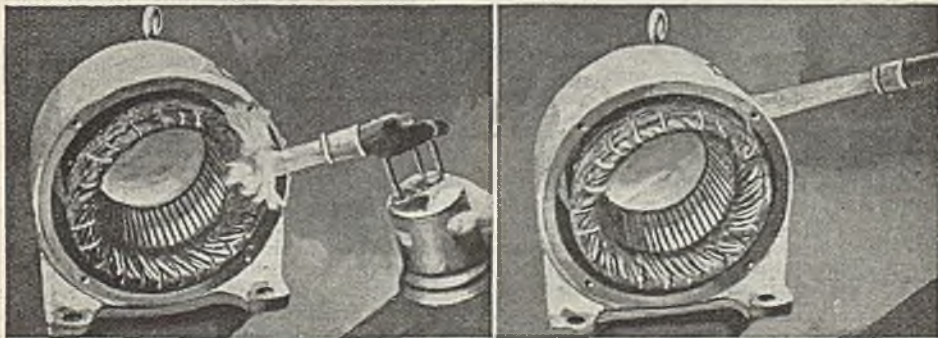
the silicone fluids. Long-chain molecules without cross-links to adjoining molecules form clear, water-white fluids with a viscosity range between that of water, at one



*A silicone-insulated traction motor, under test. It had withstood the equivalent of 400 years' operation under normal temperatures, at the time this photograph was taken*

extreme, and syrup at the other. The viscosity of a given fluid can be determined by control of the length of the molecule, which, in some forms, may be allowed to grow to lengths involving several thousand silicon-oxygen-silicon units. The freezing and boiling points of these fluids vary with the viscosity, but in all cases cover a wide range, and the viscosity is fairly insensitive to changes in working temperature.

By two modifications, the oils can be given additional valuable properties. The first modification involves the preparation of non-volatile silicone oils by removing the volatile fractions after equilibration. These oils, it is stated, are useful in high vacuum work, because of their low vapour



*When a blow-lamp flame is directed against silicone-insulated motor windings (left), the insulation flares up. Seven seconds later, when the lamp is turned away (right), the flames die out*

pressure; and they are also noteworthy for their resistance to combustion.

The second modification comprises the preparation of oils containing branched chain molecules. These oils are noted for their low pour points and their reluctance to crystallise or solidify. Neither of these modifications has any deleterious effect on the other properties of the oils<sup>3</sup>.

In the presence of air or oxygen, at temperatures as high as 300° F., silicone oils remain free from discolouration, acid formation, sludging, oxidation and similar phenomena, and in the absence of air or oxygen, the oil is stable at temperatures above 400° F. They are unaffected by contact with dilute acids and alkalis.

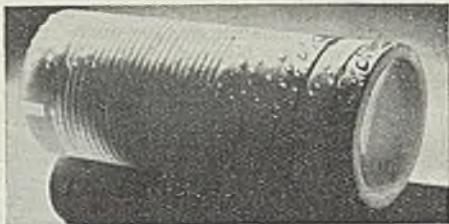
The liquid silicones have been used with success as hydraulic fluids, where temperatures are low, instrument lubricants and as damping fluids for dashpots and gauges. One of the most interesting applications, however, has been the treatment of insulators. When applied to a ceramic surface, the silicone oils provide a tenacious film that prevents the wetting of the surface. Moisture tends to stand out in droplets, instead of spreading in a film over the surface. This property has proved especially valuable in maintaining a high surface resistivity of insulators under moisture condensing conditions<sup>4</sup>.

Since the silicone fluids are not miscible with petroleum oils they are not normally used in conjunction with them. A notable exception, however, has been the use of very small amounts of the fluids in petroleum Diesel fuels containing detergents in order to reduce the tendency to foam.

The fluids have also been used as lubricants in the moulding of rubber and plastics products, and, since they retain useful lubricating properties up to 500° F., can be employed on bearings and moving parts, such as conveyor chains, which are subjected to high working temperatures. These oils, however, with one recently developed exception, make poor lubricants for iron and steel surfaces sliding on iron and steel. On some other combinations of metals, however, they are quite satisfactory. A range of bearing greases, both for high and low temperature lubrication, is also available.

Finally, there are the silicone rubbers. These are not yet a general substitute for natural or synthetic rubbers as regards tension, shear and abrasion, but their mutual properties of remaining flexible over a temperature range of -70° F. to 500° F. and their resistance to flash-over,

the effects of hard sunlight and many chemicals suggest a number of special uses. The rubber stocks can be handled in most respects like compounded rubber or synthetics. They can be moulded, extruded, friction-calendared, laminated or coated by adapting conventional processes and standard equipment, after which they are cured by heating. Some of the



*Ceramic coil-former treated with silicone fluid. Instead of forming a film, water stands out in droplets on the surface*

applications so far explored include the extrusion covering of conductors, embedding of transformers and coating wire-wound resistors and woven glass insulating tapes.

In constructing silicone molecules, the possible combinations of the several variables are virtually infinite. Several thousand silicones have already been made and studied to various degrees. Discussing the future of this branch of semi-organic chemistry, an American writer says: "Exploration of this vast field stands now at a point comparable with the charting of the American continents in Magellan's day. Only the outlines of some sections of this new chemical continent have been delineated."

The annual report of the National Institute for the Blind states that during the year ended March 31 last, 36 students of the School of Physiotherapy passed the examinations of the Chartered Society of Physiotherapy, and the electrical department of the school was re-equipped. Forty-four men and women, who completed their training at the School of Telephony, were successfully placed, and 38 trainees were admitted. A war-blinded stage dancer is now assembling electric fires, and a totally blinded man, deformed in both hands, is a first-class operative in the assembling of electric motors. Illustrations show blind workers making radio components for Philips Lamps, Ltd., and the Plessey Co., Ltd.; inspecting work by an audible comparator for the Sigma Instruments Co., Ltd.; and armature testing for Electrolux, Ltd.; and students administering treatment by ultra short-wave therapy and an infra-red tunnel bath

1. THE ELECTRICIAN, September 20, 1946.
2. "Westinghouse Engineer," September, 1945.
3. "General Electric Review," November, 1946.
4. Proc. Amer. I.R.E., July, 1945.

# INSIDE OF ELECTRICAL MACHINES

by R. H. ROBINSON, B.Eng., A.M.I.E.E.

**I**N the earlier articles of this series attention was paid to the testing and inspection of insulations. In this, Part XVII of the series,\* attention is devoted to the testing of these insulations when applied to windings. Since the tests are the same in principle throughout the whole range of machines, it is more advantageous to deal with them together rather than piecemeal. Details of resistance tests are also included.

**High Voltage Testing.**—The application of high voltage tests to windings during manufacture depends upon the voltages applied to them after the machines of which they form a part have had their temperature runs.

In B.S. 168—1936, "Electrical Performance of Industrial Motors and Generators," a table is given of the high voltage tests applicable to various windings after their temperature runs. This is reproduced in Table I and needs no amplification. The voltage is to be alternating at any frequency between 25 and 100 cycles/sec. In general a frequency of 50 cycles/sec. is employed in this country. The voltage is to be increased to the test voltage as rapidly as is consistent with its value being indicated by the measuring instrument, and maintained at the full value for one minute. It is applied between the windings and the frame of the machine with the core connected to the frame and to the windings not under test.

The specification stipulates that these voltages shall be applied only to a new and completed machine in normal working condition, and unless otherwise agreed, shall be carried out at the maker's works, preferably at the end of the temperature test of the machine.

A most important clause is to the effect that if a machine has passed the tests in Table I, and if for some reason it is desired to have an additional high-voltage test after erection on site, the additional test voltage shall be 75 per cent. of that given in the table.

If there are any weaknesses in the insulation it is important that they should be discovered in the early stages of manufacture, not after the expenditure of much labour in completing the machine. It is usual, therefore, to apply high-voltage tests at certain stages of the work, and to use voltages in excess of the final test.

Take for example an 11 kV stator winding, on which the final test will be 23 kV. After a number of coils have been inserted in the core they will be tested at 27 kV, each additional batch being similarly tested. After the wedges have been put in a 26 kV test will be given. When the end windings have been anchored a further test at 25 kV is given, and the completed winding, prior to handing over for the running test, will be tested at 24 kV.

Suitable tests are applied to practically all types of winding; for example, armatures which will have a final high voltage test of 2 000 V will be tested at 2 500 V at various stages of winding.

## Tests for Short-Circuits and Other Faults.

—Short-circuits may occur from a number of causes. Coils may be tight for getting into slots and the force employed to do so may result in damage to the insulation of their coverings.

Tensioning devices applied to wire or strip while it is being wound into coils may remove some of the covering. If strip coils are mica taped, there may be a few "bare spots" in the mica. These may not show up as absolute short circuits in the early stages of manufacture but may develop later, and suitable tests must be applied for discovering them.

Other faults for which tests must be made are open circuits, sometimes present in fine wire windings of various types, and reversed coils in armatures and stators.

**Armature and Rotor Faults.**—Armature and rotor coils of more than one turn may be tested for short circuits by lowering batches of them over one of the outer limbs of the apparatus illustrated in Fig. 3, and described later. This is not such a searching test as the transformer test on a wound armature or rotor since the conductors are not held in such intimate contact as when in their slots.

In coils of one turn per segment there are generally two or more conductors side by side in the slot. Each group, forming a half coil in the slot, may be taped together or be surrounded by micanite tubes moulded on the slot portions. In such cases a test is made between adjacent conductors with 230 V, a lamp being connected in one test lead for indicating a fault and to limit the current if there should be a short circuit. Since the voltage between conductors when in service seldom exceeds 20, this test provides an ample margin of safety for normal machines. If, however, the conductors are mica taped and required for arduous duty, such as in trac-

\* Parts I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, appeared in THE ELECTRICIAN of April 26, May 10, May 24, June 7, June 21, July 5, July 19, August 2, 16, 30, September 20, October 4, 18, November 1, 15, 29, respectively

tion motors, the test between them may be 1 000 or 1 500 V.

**Transformer or "Growler" Test.**—The most searching test for short-circuits is the transformer test, often known as the "growler" test because the mechanical vibration caused by the alternating flux sets up a noise similar to a growl.

The apparatus used for this test is depicted in Fig. 1. It consists of an electro-magnet built up with laminations, the coil being excited with alternating current preferably at 100 cycles/sec. Armatures for test are supported with their shaft horizontal and resting in vee blocks lined with leather. The growler is suspended by wire ropes over pulleys and counter-weighted so that it can be lowered on to the armature.

The alternating flux passing through that portion of the armature core embraced by the poles of the magnet will pass through all the coils in the slots which are in its path. An e.m.f. will be induced in those coils, and current will flow if a short circuit in a coil produces a closed circuit. Thus, if the coil shown in Fig. 1 is shorted, a current will flow in it and produce a magnetic field of its own. This will be concentrated in the teeth forming the sides of the slots containing the coil, and may be detected by the drag on a thin piece of iron moved over the core and in contact with it.

The test is made by moving a strip of iron over the surface of the armature in the

direction from a to b. If the coil shown is short-circuited a pronounced drag will be felt as the strip is drawn over the other slot in which it rests. After testing in this manner, the armature is rotated so that a fresh belt of coils comes under the electro-magnet, and the search with the strip is continued. It may be found necessary to switch off the current to permit of the armature being turned round. This test is also used for finding short-circuits in wound rotors. It is usually applied only to armatures or rotors having multi-turn coils. Coils for large armatures and rotors are tested more satisfactorily with the 230 V lamp test already described.

**"Drop Test" of Armatures.**—This test is frequently carried out immediately after the growler test. It is not so successful in finding short-circuits, but will show up faults which the other test will not detect. These are open-circuits and reversed coils.

A connection diagram for this test is shown in Fig. 2, where the ring represents the end view of a commutator. A large dry cell of 2 V is connected to two widely separated segments such as a and l. Two leads from a milliammeter are connected to the segments b and c and the position of the needle noted. They are next connected to c and d, d and e and so on. If the needle comes to rest at the same point the winding is satisfactory. If the needle does not move as contact is made to a pair of segments there is an

TABLE I

Item No.	Machine or Part	Test Voltage (R.M.S.)
1.	*Machines of Sizes 1 B.H.P., kW or kVA and above, but below 3 B.H.P., kW or kVA per 1 000 r.p.m.	1 000 V + twice the rated voltage.
2.	*Machines of Sizes 3 B.H.P., kW or kVA and above per 1 000 r.p.m.	1 000 V + twice the rated voltage with a minimum of 2 000 V.
3.	Field windings for synchronous generators when the excitation voltage does not exceed 750 V.	10 times the excitation voltage. Minimum, 2 000 V. Maximum, 3 500 V.
4.	Field windings for synchronous motors :—	
	(a) When intended to be started up with the field-windings short-circuited or connected across the exciter armature.	10 times the excitation voltage. Minimum, 2 000 V. Maximum, 3 500 V.
	(b) When intended to be started up with the field-windings separated by a field-dividing switch.	5 000 V.
	(c) When intended to be started up with the fields on open circuit and without a field-dividing switch.	5 000 V when the excitation voltage is less than 275 V. 8 000 V when the excitation voltage is equal to or exceeds 275 V.
	(d) When intended to be started up with a.c. windings idle.	As for Item 4 (a).
5.	Field-windings of synchronous induction motors intended for rheostatic starting.	1 000 V + twice the maximum voltage that could be induced between the terminals.
6.	Secondary (rotor) windings of induction motors not permanently short-circuited.	For non-reversing motors, 1 000 V + twice the maximum voltage which could be induced between the slip-rings. For reversing motors, 1 000 V + four times the voltage between the slip-rings at standstill on open circuit with full primary voltage applied to stator windings.
7.	(a) Exciters.	As for the field-windings they are intended to excite.
	(b) Exception.—Exciters of synchronous motors and synchronous induction motors, if connected to earth or disconnected from the rotor-field-windings during starting.	As for Item 3.
8.	Separately-excited field-windings of d.c. machines (including exciters).	1 000 V + twice the maximum voltage of the circuit for which they are excited, with a minimum of 2 000 V.

\* For two-phase windings having one terminal in common, the test values indicated in Table 2 shall be increased 40 per cent; the rated voltage shall be taken to be that of each separate phase.

open circuit. Should the needle move in the reverse direction a reversed coil is indicated. A movement short of the general resting point would indicate either a short-circuited coil or one with too few turns.

This follows from a consideration of Ohm's law. The same current is flowing through all the coils connected between a and l. If each coil is of the same resistance then the voltage drop across each pair of segments will be the same. If the voltage drop is less, then the resistance between those two segments is less.

When the drop in volts across each pair of segments has been checked as far as k, the battery connection is moved from a to, say, h, the other one being moved approximately the same distance. It is not necessary to keep the battery connections the same number of segments apart each time they are moved. If their distance apart is varied each time they are moved, the reading on the milliammeter will be different along each section. However, if the original set of readings finished at j and k, and this reading agreed with all those taken before, these two segments may be taken as the starting pair for the next section. Hence, provided the "drop" across succeeding pairs agrees with the new "drop" across j and k all those coils must be like j and k.

In carrying out this test the battery leads are generally pressed on the commutator by the thumb and fingers of one hand. The meter is connected to two suitable pieces of copper wire, insulated from each other and bound together. Their

the current passed into the winding by fixed brushes pressing on the commutator. This method of testing is not suitable for armatures having large section con-

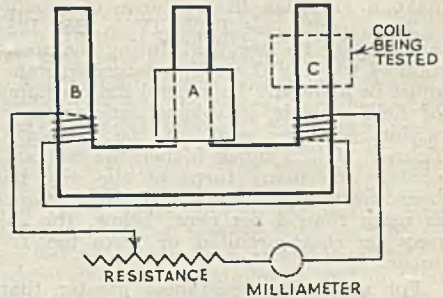


Fig. 3.—Transformer test for field coils

ductors. Their resistance is very low and the voltage drop too small. In such cases an instrument known as a ducer is employed. A heavy duty storage cell of two volts supplies the current which is applied to adjacent segments by special holders. These holders contain two sharp pointed steel rods which revolve as they are pressed on to the segments, and in doing so ensure that good contact is made. One point in each holder is used to carry the current to the segment and the other for measuring the potential. Thus the potential is measured across the same segments as are receiving current. The reading of the instrument is the actual resistance between the points of contact. It will measure resistances from 1 ohm down to 1 microhm.

**Testing of Fields Coils.**—Short-circuits in field coils are tested for by an apparatus of which the diagram is given in Fig. 3. A three-limbed electro-magnet is built up of laminations and excited by alternating current passing through the coil A on the middle limb. The coils B and C are connected so that the e.m.f.s. induced in them are in opposition and current does not circulate between them under normal conditions. The coil to be tested is placed over one of the outer limbs. This coil is not connected to any external circuit. If it is satisfactory its presence will not cause any movement of the needle of the milliammeter MA. A short-circuit in this coil will upset the balance of the flux in the limbs and cause a current to flow between B and C. The value of this current will vary, depending upon the number of turns short-circuited. It is, therefore, necessary to insert a large resistance in series with MA, and to arrange to cut some, or all, of it out as circumstances demand.

This method of testing is not applicable to coils having metal spools, since the spool

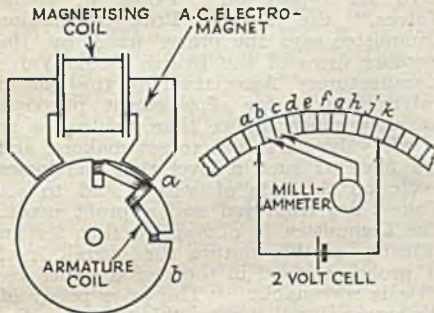


Fig. 1.  
Transformer test of  
armature

Fig. 2.  
Drop test of  
armature

ends are left bare and are pressed on to adjacent segments with the other hand. When large quantities of similar armatures are being manufactured, e.g., in a shop devoted to motors for domestic purposes, it is more convenient to rig up a fixture in which the armatures can be rotated and

would behave like a short-circuited turn and cause a deflection of the milliammeter needle.

The resistances of all field coils is checked. Since copper wire is permitted to have a variation in resistance of roughly  $\pm 3$  per cent. (see Table IV in BS. 128), and it may be stretched during the operation of winding the coil, a larger tolerance must be allowed. In general the resistance of field coils is considered satisfactory if within  $\pm 5$  per cent. of the calculated figure. If it is much higher the coil may contain too many turns or the wire has been stretched too much. If the resistance is more than 5 per cent. below, the coil may be short-circuited or have too few turns.

For measuring resistances greater than one ohm a Post Office Bridge is generally employed. Since this employs only a few volts the voltage drop per turn is very small and shorts will not be indicated unless they are across an appreciable number of turns. The transformer method illustrated in Fig. 3 is capable of finding shorts between two turns under favourable conditions. A ducter is used for measuring the resistance of heavy strip wound coils of very low resistance. This is accomplished by pressing a pair of points on each end of the coil.

**Tests of A.C. Stators.**—Stators are tested for short-circuits and other faults by inserting an unwound rotor in them and applying a suitable voltage, usually between two and three times the normal working voltage, to the winding. An ammeter is connected in the supply lead to each phase. The unwound rotor is merely rested on the bottom of the stator bore, it does not have to be rotated.

All three ammeters will indicate the same current if the winding is satisfactory. If not, the fault is found by a process of elimination in most cases.

In a star connected winding an open circuited phase is indicated by no current flowing in the ammeter connected in that phase. With a mesh connection three different currents are shown. Since other causes of failure may exhibit three different readings it is best to proceed with the elimination.

The most usual first step is to leave the voltage on for some time to ascertain if there is a short-circuited coil. Such a coil will heat up and may be felt by the hand, or if left on long enough, it will commence to smoke.

In the absence of a short-circuit, the connections of the phases are examined to see if one is reversed, and if satisfactory the resistance of each is measured. A difference in resistance may indicate a coil with too few turns, or in cases where the coils are wound with two or more

wires in parallel, one of the wires in a coil may be broken. In the former case the tape must be removed from the end winding and the turns counted. In the latter case each coil in the phase must be disconnected and its resistance checked.

If the resistance of each phase is alike, a reversed coil is probably present. It can only be located by untaping the connections and checking them.

In general, the three-ammeter test is applied only to stators wound with round wire. Machines having larger section copper are usually bigger and a suitable unwound rotor may not be available. Any faults in these machines are, therefore, not found until the running test. This is not a serious matter as faults in large machines are very rare.

The tests described in this article represent normal practice up to the present. Now, however, the cathode ray oscillograph is being adapted for the purpose. By suitable apparatus such an oscillograph will show all three faults—shorts, open circuits, and reversed coils—on a single trace on the screen, if they are present. It may be applied to armatures, rotors and stators, and possibly to field coils.

Note: The Sterling Varnish Co. point out with regard to the account of the radiant heat plant which appears in the last column of p. 1363 of *THE ELECTRICIAN*, of November 15, that the process described is known as the Zanderoll process, that it is patented in the U.S.A., and that patents are pending in this country.

*(To be continued)*

In its report on "Prices of Radio Valves," the Central Price Regulation Committee says the prices fixed by the member firms of the British Radio Valve Manufacturers' Association for the sale of valves bought for replacement purposes are very much higher than the prices at which valves are sold to set makers, and are fixed at such a level that the losses made on the sale of valves sold to set makers are recovered and a profit made. The Committee is of opinion that for an industry of this nature the overall level of profit obtained in the period under review is reasonable. "The price policy of the association," it says, "is that of a discriminating monopoly. If it were accepted that on general economic grounds it is desirable that each unit of goods should be sold at a price determined by the cost of production and if this were further accepted as a governing factor in price policy, then the practice of discriminatory prices followed in this trade is to be condemned. It must be recognised, however, that there are many other trades that have adopted this policy of discriminatory prices.

# Increasing Industrial Output

## Sir Claude Gibb on Need for Greater Efficiency

**A**N appeal for better production methods and a higher standard of craftsmanship, both of which were necessary if we were to maintain our position in export markets, was made by Sir Claude D. Gibb, F.R.S., on Thursday. The speaker, who is chairman and managing director of C. A. Parsons and Co., Ltd., was delivering his Presidential Address before the North-Eastern Section of the Institution of Production Engineers.

Recalling that the United Kingdom, which had spent 44 per cent. of its national income for direct war purposes, had made the largest proportional contribution, economically, to the war, Sir Claude said that, despite the American loan—which in any case covered only half the cost of repairing bomb damage in Great Britain—this country was in a mess.

### P.M.H. OUTPUT

Many reasons had been advanced to explain the fact that output per man-hour to-day was lower than it was pre-1939, but there was a tendency towards slackening off, not only amongst workers, but amongst managements. The production engineers, by clear thinking, blunt talking, and their example, could start an upward movement, and there was nothing more important for Great Britain and for the world than that we should quickly regain our industrial leadership.

"My company," Sir Claude continued, "have adequate export orders for electrical generating plant, but a recent example of competition is an indication of the shape of things to come. Tendering for a turbo-alternator to a European country which is a food exporter, my company's price of £123 000 was the lowest British price and lower than Swiss or Swedish tenders, but the order was placed with Czecho-Slovakia at £68 000. Can the Czecho-Slovak company cover their costs at that low price? I believe they can—their coal and steel costs were half ours pre-war and their workmen are highly skilled and industrious. I give that example," he added, "as a taste of the competition coming before long, when the present sellers' market ends."

After referring to the idea of interdependence of all units in the chain of production, and repeating the need for economy and efficiency, Sir Claude said that in the past few years we had demonstrated what poor showmen we were. The fundamental work on radar, atomic energy and the great war-time inventions like

Mulberry, Pluto and Fido had all come from British scientists and technicians, but had been insufficiently publicised.

Saying that it was customary for presidents to refer to the subjects in which they had a special interest, Sir Claude then mentioned recent developments in the design of turbines. The tendency to-day was towards higher steam temperatures, and the advance, during the last twenty years, from inlet temperatures of 750° F. to 950° F., had been made possible by improvements in metallurgy and in the development and greater use of alloy steels. The long-life gas turbine demanded a temperature of at least 1 150° F., and the indications were that a steel alloy could be used for such temperature conditions. The problem of the utilisation of atomic energy was also bound up with metallurgical solutions. New materials were required before atomic energy could have other than a very limited application.

There was not, however, any great likelihood of the costs of power generation being much further reduced, and one way to obtain lower costs of production was, therefore, by building machine tools and mechanisms which would produce more articles per hour per man employed than hitherto. Once the maximum production was achieved from a particular machine tool, then it was necessary to ensure that the operator worked the machine to its maximum capacity. The necessary incentive could only come from some form of output bonus, plus a restoration of the pride of craftsmanship.

### IMPORTANCE OF LIGHTING

A start could be made by giving the operator outstandingly bright, cheerful and clean conditions of employment. More attention to the standards of lighting, both natural and artificial, and the painting of workshops and machines would help. In his own factory, various colour schemes had been tried and workers had expressed their appreciation.

Concluding, Sir Claude said that when the sellers' market had faded into a delightful memory, Britain's export prospects would lie in the manufacture of capital and super-quality goods, because consumer goods of every-day quality would be manufactured in the countries to which we exported pre-war. We could prepare for the design and manufacture of these classes of goods only by higher standards of technical education, and more attention to craftsmanship training.

# Electrical Personalities

MR. MAURICE WADESON, deputy city electrical engineer, has been promoted by the Nottingham City Council, to the position of chief engineer and general manager of the electricity department.

MR. W. S. SAWTELL, general manager of the Scottish Southern Electric Supply Co., at Galashiels for the last 24 years, has been appointed general manager of the Fife Electric Power Co. He will be succeeded at Galashiels by Mr. G. H. Sankey, his chief assistant.

MR. HENRY E. GOODRICH, M.P. for North Hackney, has been elected chairman of the London and Home Counties J.E.A. Mr. Dudley Stuart, the former chairman, did not seek re-election as a member of the Authority, on which he had served for 21 years. Counc. W. H. Shaw, of Walthamstow, has been re-elected vice-chairman. Mr. Goodrich has evinced special interest in matters affecting the electricity supply industry, and served on the Electricity Committee of the Hackney Borough Council from 1926 to 1945. He was elected a member of the J.E.A. in 1937 as a representative of those Metropolitan Borough Councils who are authorised electricity undertakers. After serving on the Local Distribution, Finance, and General Purposes Committees for two years, he became vice-chairman of the General Purposes Committee, and in 1940 was made its chairman, holding office until his election as chairman of the Authority.

MR. G. A. WHITE has been appointed by the Wallasey Electricity Committee as installation superintendent.

MR. JOHN YATES, of Walsall, has been appointed by the Bolton Electricity Committee as mains engineer.

MR. S. J. RENDLE, senior control engineer, Yorkshire Electric Power Co., has been appointed by the Chesterfield Electricity Committee as shift charge engineer in the Corporation's undertaking.

MR. C. M. ISHERWOOD, temporary engineering assistant, Liverpool electricity supply department, has been appointed assistant high voltage engineer in a permanent capacity. Mr. W. Cook, control room engineer, Lister Drive station, now fills a similar position at the Clarence

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

Dock station; and Mr. H. L. Quayle, control room engineer, Clarence Dock station, has been appointed electrical maintenance engineer.

MR. ROBERT FYFE, who has been with the Grampian Electricity Supply Co., for the last seven years has been appointed electrical engineer at Oban. He



*Left to right (seated): MR. H. E. GOODRICH, chairman of the London and Home Counties J.E.A., and COUNC. W. H. SHAW, vice-chairman and (standing), MR. NORMAN ELLIOTT, general manager and chief engineer, and MR. A. L. BURNELL, clerk and finance officer of the Authority*

takes up his new post at the beginning of next year. Mr. Fyfe, who is 32 years of age, received his early training at the Dundee Technical College, and with Dundee Corporation as a student-apprentice.

MR. H. V. FIELD, principal of Constantine Technical College, Middlesbrough, and formerly head of the electrical engineering department of Rutherford College, Newcastle, has been appointed principal of Coventry Technical School.

MR. H. J. BOOTH has left the South Wales staff of Messrs. McLellan and Partners, to become assistant editor of the "Mining Electrical and Mechanical Engineer," the official journal of the A.M.E.M.E.

MR. B. FISHER, technical assistant to the chief electrical engineer, Tube Investment (Group Services), Ltd., Bir-



ningham, has been appointed power installations engineer in the Sheffield electricity department. Mr. T. Bryan, assistant engineer, with Messrs. McLellan and Partners, and Mr. A. Swift, acting installation engineer, Sheffield electricity department, have been appointed by the Sheffield Corporation as installation engineers.

MR. J. F. JONES, retired electrical engineer, of Woking, left £44 970 (net personalty, £42 425).

MR. GEOFFREY FALK and Mr. Walter Thurner, of Falk, Stadelmann and Co., Ltd., have now returned after visiting various manufacturing centres in the U.S.A. and Canada. They travelled to New York by the "Queen Elizabeth" on her first peace-time voyage.

MR. W. J. LLOYD, after 16 years' service with the Central Electricity Board, has resigned his appointment as chief draughtsman and is now in business under the name of Lloyd and Orr, Ltd., 313, Hook Rise, Surbiton, engineering and architectural draughtsmen and photographers.

DR. H. BUCKINGHAM, head of the electrical engineering department of Barnsley Technical College, has been appointed head of the department of electrical engineering at Bradford Technical College in succession to Mr. W. H. N. James, who is retiring.

MR. F. A. DAVENPORT, factories development engineer at Fort Dunlop, has been appointed deputy chief engineer at Dunlop's Speke factory where he helped to instal the plant, as he did at the company's Calcutta factory. The plant at the Speke premises was described in "THE ELECTRICIAN" of September 27.

DR. J. F. CROWLEY, consulting engineer, has been to Italy for a fortnight's lecture tour for the British Council, visiting Rome, Milan and Turin, and speaking on: "Production, Distribution and Utilisation of Electricity in Great Britain," "Electricity as a Factor in the Improvement of Social Amenities," and "Modern Developments in Engineering Construction."

MISS GWEN OVERTON, 16 years-old soprano, clerk in the filing department of E. K. Cole, Ltd., Southend-on-Sea, who has been appearing with Harry Davidson and his orchestra, and Harry Roy's Tiger Ragamuffins, and other well-known artistes, was "on the air" for the first time in the B.B.C. "Radioddities" feature on Sunday, Nov. 24, as a "claimant to fame."

MR. T. V. LIRONI, deputy borough electrical engineer, Birkenhead, speaking at the re-union dinner arranged by the Corporation Electricity Supply Troops' Comforts Fund, referred to the proposed

nationalisation of the supply industry, and said the efforts of the electricity department would influence, to a great degree, the economic state of Merseyside in the years to come. Mr. R. J. Harris, secretary and treasurer of the Comforts Fund, was presented with an electric clock and a cigarette case in appreciation of his work. It was stated that about 800 parcels and postal orders were despatched during the War to members of the department in the Forces.

MR. GORDON D. JOHNSTONE, secretary of the West Gloucestershire Power Co., Ltd., has been promoted general manager of the company as from January 1. He joined the company as chief accountant in 1939, and at the beginning of 1942 was appointed secretary. Mr. Harry S. Ellis, who has been general manager and chief engineer for more than 23 years, is retiring. Other changes include the appointment of Mr. W. Hill, chief assistant engineer, as chief engineer, and of Mr. V. C. Bastin, assistant secretary, as secretary.

THE HON. ERIC BUTLER-HENDERSON has joined the boards of the County of London Electric Supply Co., Ltd., and the South London Electric Supply Corporation, Ltd., and Sir Robert Renwick, has joined the board of the London Electric Supply Corporation, Ltd., with the purpose of furthering the mutual arrangements which have existed for some years in the development of electricity supplies in the large adjacent areas south of the Thames. Mr. Butler-Henderson is chairman of the London Electric Supply Corporation and Sir Robert Renwick is chairman of both the County of London Supply Company and the South London Corporation.

## Obituary

MR. JAMES P. SIMPSON, electrical engineer under the South Hetton Coal Co., Ltd., at Murton colliery for 40 years, aged 65 years.

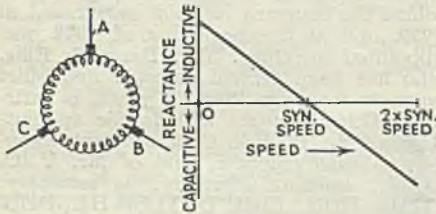
MR. QUENTIN ARBUCKLE, mains superintendent with the Bradford electricity department, on December 3, aged 63 years. Mr. Ar buckle gained his early experience with Crompton Parkinson, Ltd., and the Doncaster electricity department. He entered the service of the Bradford Corporation in July, 1905, as a draughtsman in the electricity department, and subsequently held the posts of mains assistant and mains engineer. In 1941 he was promoted to the position of mains superintendent. During his long service he was closely associated with the development of the city's transmission and distribution systems. He took an active part in the planning and development of the new 33 kV system and the primary sub-stations connected therewith.

# Answers to Technical Questions

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

## How does the Leblanc exciter operate to improve the power factor of an induction motor?

The Leblanc exciter consists of an armature carrying a double-layer winding connected to a commutator, the whole being exactly similar to the armature of



Figs. 1 and 2, illustrating the Leblanc exciter, and variation of reactance with speed

an ordinary d.c. machine. The armature is driven by a suitable motor, and on the commutator there are (for a 2-pole machine) three brushes spaced at  $120^\circ$  instead of two at  $180^\circ$  as would be the case for a d.c. machine. There need be no magnet frame or stator.

Suppose now that the armature is stationary and a three-phase alternating voltage at a frequency of  $f$  cycles per sec. is applied to the three brushes. The winding will form an ordinary mesh-connected circuit as shown in Fig. 1 and three-phase currents will flow in it. These currents will set up, in the usual way, a rotating magnetic field moving at a speed of  $n=f/p$  revs. per sec.,  $p$  being the number of pole pairs.

Since the field is moving and the conductors are stationary, the field is cutting the conductors and setting up in them an e.m.f.; and the current in the winding is a magnetising current since it has nothing else to do except set up the magnetic field and the e.m.f. induced by the field will be lagging  $90^\circ$  behind this current. The voltage applied to the armature will, of course, be opposite to this back e.m.f. so that the armature behaves as an ordinary 3-phase inductive reactance with the current in the windings lagging  $90^\circ$  behind the voltage applied between the brushes. The winding will, of course, also have some resistance so that the angle of lag will not, in practice, be quite  $90^\circ$ .

Suppose now that the armature is driven in the same direction as the field and at the same speed ( $n=f/p$  r.p.s.). If the current is assumed to be of the same magnitude as before, the rotating field will not be affected since the group of conductors between, say, brushes A and B will be carrying precisely the same current at any instant as it would if the armature were stationary, although, of course, the actual conductors which form the group are continually changing. Since, now, the conductors are rotating at the same speed as the field they are not cutting it and no e.m.f. is induced in them. The armature is therefore behaving as though it were a simple three-phase resistor having no reactance.

At any intermediate speed less than the synchronous speed (speed of the field) the e.m.f. will be proportional to the difference between the synchronous speed and the actual speed, i.e., the apparent reactance of the armature will decrease from the standstill value when it is stationary to zero when running at synchronous speed as shown in Fig. 2.

If the armature is now driven faster than synchronous speed, i.e. faster than the rotating field, the direction in which the conductors cut the flux will be reversed and the e.m.f. will therefore be reversed. The armature will thus behave

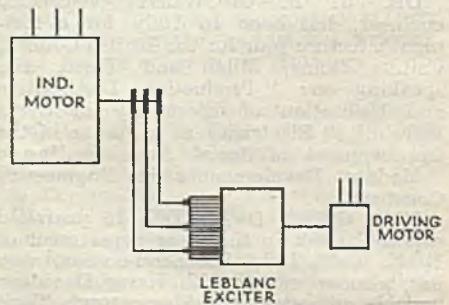


Fig. 3.—Connections for Leblanc exciter

as though its reactance were negative, i.e., as if it were a three-phase bank of condensers, the apparent capacitive reactance being as shown in Fig. 2.

By connecting the armature in the rotor circuit of an induction motor as shown in Fig. 3 and driving it above the synchronous

speed corresponding to the frequency of the rotor currents it thus behaves as a bank of condensers and causes the rotor current to lead on the rotor e.m.f. This leading current is reflected into the stator of the induction motor in the usual way and improves the power factor.

This simple arrangement operates quite

satisfactorily in small sizes, and can be used for improving the power factor of small induction motors up to, say, 100 to 200 H.P.—for motors above this size more satisfactory operation and better control of power factor is obtained if the exciter is fitted with a stator carrying suitable windings.

E. O. T.

## Nationalisation and Finance

A DETAILED survey of the problems which will face local authorities with the nationalisation of their electricity undertakings is made in a memorandum prepared by Mr. W. Appleyard, borough treasurer, Bolton, for members of the Town Council. Copies have also been sent to the town's two M.P.s.

He lists direct financial losses Bolton would suffer as, loss of rights to use trading profits in relief of rates; loss of benefit of income tax set-off and loss of contributions to central establishment charges and other overhead expenses; while other matters requiring special financial consideration whatever basis of compensation is adopted are, the disposition of the Reserve Fund and Revenue Surplus; adjustment in respect of superannuation liabilities, and valuation of the nationalised undertakings for local rating purposes.

Mr. Appleyard reveals that since the establishment of the Bolton undertaking in 1894 a total of £256 817 has been transferred from the profits in aid of rates. Mr. Appleyard's estimate for 1946 of the amount of income tax set-off utilised in rate aid is £43 967, while the amount of income tax set-off arising from the electricity undertaking alone is £10 395. It follows that the cessation of a substantial part of the credits arising from the severance of trading undertakings would result in a serious loss to municipal authorities.

On the subject of loss of contributions to central establishment charges, Mr. Appleyard points out that trading undertakings make an agreed contribution to these which includes the cost of the general and particular services of the Town Clerk's and Borough Treasurer's departments, and of other common services such as office accommodation and use of committee rooms.

He suggests that it might be appropriate for a sum to be included in the compensation payment which would ease the burden during the period necessary for the local authority to adjust its central administrative machinery to the new conditions.

Summing up, he says that if local authorities are compensated on the basis of the full market value of the undertaking

it might be reasonable that they should meet the direct losses he refers to, the loss of rate aid and the loss of the benefit of tax set-off. Mr. Appleyard adds, however, that if outstanding debit is to be regarded as the price of transfer it appears that a separate equitable financial adjustment should be provided in respect of each of the direct losses mentioned, and also of the disposition of the Reserve Fund and Reserve Surplus and of the matter of superannuation liabilities.

In any circumstances, he submits, a satisfactory protective provision in favour of local authorities should be made in connection with the future assessments of the undertakings for rating and similar purposes.

### Birmingham I.E.S.

AT a meeting of the Birmingham Centre of the Illuminating Engineering Society on November 22, Mr. George A. Jones of the Kodak Research Laboratories, spoke on "Lighting For Photography." By means of a step wedge diagram, the lecturer illustrated that exposure was not the simple product of lumens and time that it at first appeared, and to double the amount of light and halve the exposure time, did not necessarily produce the same result, as contrast would be affected. Even the type of current used for the artificial light source had an appreciable effect on the negative. In this connection he pointed out that a.c., and gas-discharge lamps, with their more pronounced stroboscopic effect tended to cause flatter results than tungsten filament lamps, or lamps used on d.c. Whilst dealing with arc lamps, Mr. Jones illustrated and discussed the high intensity flash discharge tube, which, by means of condenser arrangement, a specially coiled lamp column, and a suitable stroboton circuit, gave a single brilliant flash for a very brief period of time. Mr. Jones also dealt with infra-red and ultra-violet lighting for photography, and a number of slides showing examples illustrated his remarks.

# In Parliament

## Some Electrical Questions Asked and Answered

**Lead Mining.**—In the course of a written answer, Mr. Shinwell said that the Committee of Inquiry which he had set up to consider the possibilities and means of developing certain minerals in the national interest, had consideration of the lead mines at Wanlockhead within their terms of reference.

**District Heating.**—The Minister of Health was asked by Mr. Janner whether, in view of the expense and delay involved by the present procedure under which local authorities who wished to take effective action with regard to smoke abatement and the provision of district heating schemes had individually to seek powers for that purpose, he would consider legislation at an early date giving general powers to the appropriate local authorities in these matters. Mr. Bevan replied that these matters were now being examined with a view to the introduction, when opportunity permitted, of any necessary legislation.

**Airfield Radar, Prestwick.**—Mr. Lindgren, Parliamentary Secretary, Ministry of Civil Aviation, stated that the "blind approach" systems in operation at Prestwick Airport were as follows: (a) Standard beam approach on two runways; (b) blind approach beacon system on two runways; (c) ground controlled approach, which was operated by the R.A.F.; (d) S.C.S. 51, an American blind approach equipment on one runway. These installations constituted a comprehensive system which, equally with that being installed at London Airport, was consonant with the needs of an international airport.

**Neasden Boiler Conversion.**—Mr. Errol asked the Minister of Transport for what reasons he approved the conversion of the L.P.T.B.'s Neasden power station to fuel-oil burning; and by how much would the operating costs be increased. Mr. Barnes replied that the conversion of certain boilers at Neasden power station from pulverised fuel to oil fuel was being carried out by the L.P.T.B., and was not a matter for which his approval was necessary. The conversion would reduce the serious dust nuisance to residents in the vicinity. The estimated additional operating cost would be approximately £45 000 per annum on the basis of existing prices for coal and oil fuels. It was contemplated as a permanent measure.

**Fuel Quality.**—The Minister of Fuel and Power was asked by Major P. Roberts if he was aware that the C.E.B., in September, 1946, issued a notification to

the public to the effect that an occasional reduction of the electricity load was caused by regular loss of about 300 000 kW, due to inferior quality fuel being delivered to power stations feeding the grid; and what action he was taking to improve the quality of fuel and overcome this difficulty. Mr. Shinwell replied that owing to the great increase in the consumption of electricity, and, in consequence, in the requirements of coal by electricity undertakings, it was inevitable that some of the fuel supplied should be of poorer quality than formerly. Every possible step was being taken to improve the preparation of coal, but, apart from this, no immediate improvement in the quality of deliveries to electricity undertakings could be looked for.

**Reports from Germany.**—Mr. Leslie asked the President of the Board of Trade how many reports on German scientific and industrial developments prepared by British and American investigators had so far been released to British industry; how many more remained to be published; and what steps his department was taking to acquaint industry with this fund of information and to assist industrial concerns, particularly those with limited research facilities, to find material of value to them. Mr. Marquand replied that to date 1 390 reports had been published, 572 of them prepared by British teams, 278 by American teams and 540 by combined British and American teams. He expected that the total, including those already mentioned, would be near the 2 500 mark. In addition to placing the reports on sale at H.M. Stationery Office, free distribution of all reports were made to universities, the principal public libraries and chambers of commerce. Trade and research associations and learned professional institutions also received a token free distribution of reports of direct interest to them. Arrangements had been made with H.M. Stationery Office to produce both a classified list of reports and a subjects index. In addition to these works of reference, an information bureau and reference library had been created at the secretariat of the B.I.O.S. The existence of the information service, which had a nucleus technical staff and access both to the reports and the original German documents, should greatly assist a firm with limited research facilities and no connection with a trade association to find the material of interest to it.

# Power Station Auxiliary Services

## The Design of Supply and Distribution Systems

SIX officers of the Royal Dutch Forces, who are on a mission to this country, were invited to the meeting of the I.E.E. on December 5, and were welcomed by the president, Mr. V. Z. de Ferranti.

Lt.-Colonel Kok (Royal Netherlands Army), expressing appreciation of the welcome that had been given to his colleagues and himself, said that before the war Holland had a considerable trade with Germany. That was not now possible and it was necessary to look for contacts in this country and, perhaps, also in America in order to get electrical equipment, especially signalling equipment. He expressed the hope that the institution would give the mission all the help they needed in securing such equipment.

\* \* \*

A paper by Dr. W. Szwander on "Power Supply for Generating Station Auxiliary Services," was read and discussed.

The object of the paper was to analyse the factors governing the design of power supply and distribution systems for generating station auxiliary services. Considerations were limited to methods having practical application when designing modern stations, stated the author, and, though there were difficulties preventing the achievement of any high degree of standardisation of the auxiliary systems, a number of generally accepted trends could be found. With the commonly adopted use of electric drives for all auxiliary services, the necessary degree of service reliability could be achieved by a suitable design of the auxiliary distribution system, mainly by application of the principle of divided auxiliaries, and by the use of proper sources of auxiliary power supply. In respect of that last point, the common practice in this country was to use unit transformers or shaft generators. A number of typical schemes were represented diagrammatically in the paper to illustrate various possible alternatives.

MR. F. C. WINFIELD (Messrs. Merz and McLellan) agreed with the author that the steam driving of auxiliaries was really dead and that where it was used to-day it was by way of emergency standby. For nearly 50 years, he said, he had used the unit transformer arrangement and it had not given us much trouble. It was cheaper, inherently more reliable, and simpler, but he would not join issue with anybody who decided to come down on the side of the unit generator. He thought duplication could be overdone. Indeed, it was possible to do more harm by duplicating than by sticking to a straightforward non-duplicate

system. With reference to electric drive, the squirrel cage motor was the most robust, the simplest and cheapest motor for constant speed drive. The need for variable-speed motors arose in the case of boilers and fans. For that purpose the constant-speed fan was inefficient and clumsy. Dealing with boiler control, he said that in the old days it was necessary to run about all over the place to keep things in order. The next stage was to bring the controls together, and this gave more efficient operation and made it easier for the fireman to do his job better. That led to group control, or the unified control system, viz., the Ward-Leonard system, which would give a much better efficiency of the boiler. Automatic control seemed to be better for fluctuating loads, but in this country we really had not fluctuating loads, except during one or two periods of the day when shutting down and starting up, but he did not think the additional cost, the additional maintenance and additional unreliability of automatic gear could be reasonably justified with the sort of load they had.

MR. C. W. MARSHALL (C.E.B.) thought there was a great tendency to exaggerate the difficulties of power supply to station auxiliaries, and said that if one looked at an outdoor sub-station it would be realised that a very high degree of reliability could be obtained under conditions compared with which power station services were easy in the extreme. Therefore, he strongly suggested that more attention should be given to simplifying and avoiding duplication of auxiliaries. His first question was where exactly was duplication justified at all? He was very anxious to get information with regard to the shaft alternator, which was more costly, less efficient, less reliable and more cumbersome than the unit transformer. Admittedly it had the advantage of being shielded from voltage disturbances to a certain extent, but with the continually increasing effectiveness of fault clearance, he would like to be convinced. At the moment, he saw no justification for shaft alternators. In advocating the cutting out of duplication, he said there must be some means of measurement, but almost the only one was the better measurement of auxiliary power in order to ascertain whether things were changing. As to the power required for auxiliaries such as the governor and oil circulation, he did not think there was any less efficient method of providing a few watts than by having

a big clumsy worm gear on the end of the shaft of the turbine. He hoped some day to see a few watts tapped off, and a servo motor on the electrical supply doing the job, thereby cleaning up the steam end.

MR. H. PRYCE-JONES (electrical engineer and manager, Brighton electricity department), said that whilst realising the importance of high reliability, he was an apostle of simplicity and therefore, he added, "A 'Unit' system without duplication and sub-division of the essential auxiliary motors," was attractive to him on those grounds. Super-reliability could be purchased at too high a cost in capital, maintenance and complexity. The unit transformer on each turbo-alternator should deal with all the auxiliaries of the turbine and allied boilers with probably one house transformer to each half of the station, capable of dealing with the complete auxiliaries of one turbine and allied boilers, plus the capacity of half the non-essential services. That should provide a sufficiently high measure of standby to the essential auxiliary supply. A further safeguard, but also an additional complication and source of possible failure, would be the provision of some automatic device whereby in the event of the failure of a unit transformer, the essential auxiliaries could be changed over quickly and smoothly to the house transformer. He considered that provided sufficient thought was given to certain points in the initial design of a station, a house set, or house alternator driven by the main set, did not appear to be essential. The primary object of a house set driven from the main alternator was to be able to carry on despite severe temporary drops in voltage due to external line faults, or to reduction in voltage or frequency due to temporary over-loading of plant. The first would appear to be met by motors designed to run on 70 to 75 per cent. of normal voltage for, say, three minutes with normal frequency, and the second by providing motors designed to run at 90 per cent. normal frequency and, or, 90 per cent. normal voltage for, say, a period of 30 minutes.

One problem to be borne in mind was the possibility, due to complete shedding of load, of the main generating set tripping out on over-speed. Some form of anticipatory predictor device could possibly be designed which would immediately start to close the main stop valve before the mechanical overspeed trip operated. This feature was familiar to many boiler operators in the form of the power-operated relief valve, which was so designed as to open fully by mechanical means prior to the blow-off point of the spring-loaded safety valves. He believed that such a device had been tried on large turbines

on the Continent, and asked for information as to its success and possible application in this country.

MR. J. H. C. PETERS (English Electric Co., Ltd.) said the paper made no mention of the switchgear for controlling the supply. The author had rightly stressed the primary importance of reliability, overall efficiency and reduction of maintenance cost, and it was on those grounds that present day practice was to instal air-break switchgear to control the auxiliaries. Such switchgear was available for use on low tension systems and up to 3.3 kV, and this was one of the reasons why 3.3 kV was preferable to 6.6 kV for the high tension supply. With regard to short-circuit capacity, the maximum rating of a 3.3 kV breaker was 150 MVA, so that it was desirable to keep within that rating. A higher rating would require very much heavier switchgear.

MR. G. T. SHEARS (C.E.B.) said the Ward-Leonard system was fluid and readily adaptable for combustion control. He asked whether there were any power stations using Ward-Leonard equipment in conjunction with mercury-arc rectifiers, and suggested that that arrangement had considerable scope. He thought the hydraulic coupling was inefficient for constant torque drives, although there were few constant torque drives in power station machinery. Since the fuel situation was serious, economy in power station systems for supplying power to auxiliaries was very important. In the case of one statutory undertaking, about 750 000 tons of coal were used annually, and the works' power consumption was some 5½ per cent. of that; 5 per cent. was a usual figure. The station in question generated 1 200 million units.

MR. W. N. C. CLINCH (chief engineer and general manager, Northmet Power Co.) said that one of the main difficulties in regard to station auxiliary services was that it was very often forgotten that there was such a thing as a switchroom. There was the habit of putting switchgear near the motors, but there was no reason why the switchgear for station power purposes should not be placed in a proper switchroom. He shared the view that the house set was a bit of a nuisance. With regard to auxiliaries, we should bear in mind the facilities which were present to-day and which were not in themselves very complicated. For instance, in the event of a circulating pump shutting down, there was the advantage that the turbine could, as the result of the absolute back-pressure in the condenser falling, be in itself unloaded so that the condenser did not become a boiler. That was a simple contrivance and on several occa-

sions during the last war it served in an invaluable way to ensure that the plant was still available when things became a little more normal. With reference to what Mr. Pryce-Jones had said concerning safety valves, it was a pity they had to be used, but the use of electricity for assisting the safety valve so that it opened and shut positively was well worth while; he had tried it. He doubted whether some of the devices for controlling boiler auxiliaries, some of which were of fairly large H.P., were worth the bother entailed, in spite of what theory said. Supply engineers had to supply a national need, and in doing so they should concentrate more, perhaps, on eliminating gadgets than losses. Nothing should be done which made, or could make, the operation of a power station more difficult. He advocated a central control board with push-button control and the means of watching closely the control of all the auxiliaries in a simple manner, which such a scheme made possible.

MR. D. E. GAZE supported the idea of a separate switchroom with proper accommodation for the auxiliary switchgear, and thought the increased reliability would well justify the extra cost. Air-break switchgear had obvious merits for auxiliary services. He asked if any approximate estimate had been made of the allocation of failures to the various components of an auxiliary service, and also inquired as to the author's views with regard to motor protection. There were, he said, two schools of thought on that matter, one favouring the use of an unearthed system with no protective devices whatever, whilst the other wished to make use of the various protective devices that were available to protect against almost all kinds of faults, the view being that the more important the auxiliary the better should be the protection.

\* \* \*

Replying to the discussion, the author said that several speakers preferred the unit transformer to the shaft generator. He knew of cases where the two were very near to each other and the shaft generator was the cheaper alternative; he had not advocated either, and had tried to put forward an unbiassed view of the pros and cons of both. He agreed with Mr. Winfield respecting automatic control. As regards the shaft generator being cumbersome, that largely depended on the lay-out of the station. He also agreed that more attention should be given to the proper design of separate control rooms for auxiliaries. In reply to the comment that no mention had been made of switchgear for auxiliaries, he said the paper was limited to power supply for auxiliary services and in that respect the paper was really only one chapter of

a book on the subject of power station auxiliary systems as a whole. With regard to the last point made by Mr. Pryce-Jones, there was a long description of such a device at the St. Denis power station in Paris in the Bulletin de la Societe Francaise des Electriciens, in 1937. The idea was an electrically operated steam valve which closed when the electrically-measured load of the set dropped below a certain minimum, but how it actually worked in practice he did not know. As to the use of Ward-Leonard systems with mercury-arc rectifiers, he knew of one installation that was going into service shortly and a number of other installations were also in hand by the firm with which he was associated. In reply to Mr. Clinch, he said he would prefer to eliminate both losses and gadgets and not merely gadgets, as had been suggested. He added that in the last extension to the St. Denis power station they ran the auxiliaries from house transformers and obtained the highest possible efficiency. The discussion seemed to show that some designers preferred unit transformers and others shaft generators, but there had not been any difficulties with separately driven house sets, and there were a large number of cases where those were used, apart from practice on the Continent, where, before the war, they were frequently used. That was specially so in South Africa and, it might be mentioned, in some of the stations.

---

That the present Government is creating a new industrial aristocracy, the managerial class, was affirmed by Mr. Christopher Hollis, M.P., speaking at a luncheon gathering of the Society of Individualists and National League for Freedom in London, on November 28. Mr. Hollis claimed at least one thing must be said for the capitalist system. It raised the standards of life of the working class more than any other system known in history. Socialism had brought in a much different world than that epitomised by Keir Hardy when he founded the Labour Party 50 years ago. For one thing, there was now the increasing importance of the new intermediate class, the managerial class. When Labour was in power with a small majority 20 years ago, proposals were made for the nationalisation of the coal mines and their control by ten members appointed by the Government and ten members elected by the miners. When Labour actually got power by a large majority they introduced an entirely new Bill, in which, instead of control of the mines by the miners, Mr. Shinwell made plans for the creation of a new industrial aristocracy, the managerial class. And the managerial class meant bureaucratic control.

# Equipment and Appliances

## Mains Control Unit—Electronic pH Meter

**T**HE compact mains control unit, illustrated on this page, is a product of Hartley Electromotives, Ltd., and has been specially designed for rapid production in connection with housing schemes. The double - pole snap - acting isolating switch is automatically opened when the front panel is lowered for replacement of fuses, and is arranged so that it will remain open until the panel is re - closed or the front of the



*Hartley mains control unit, with servicing door open*

unit is removed for servicing purposes. Outlet holes are provided for three sizes of house cables, while the busbar on the mains side of the fuses has a removable link which permits lighting and power supplies to be metered separately. The fuses provided are one 30 A, for the electric cooker, five 15 A, for socket outlets, and two 5 A, for upper and lower floor lighting. The mounting screws are inserted through holes ready drilled in the back.

An interesting development in the packaging of cored solder wire is the production of the new size one carton of Ersin Multicore solder.

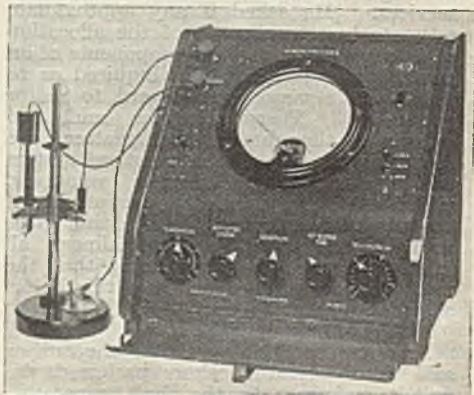


*New packaging for Multicore solder wire*

coming tangled. Windows at one side enable the user to determine when the contents are nearly exhausted. The alloys and gauges now available are identical

with those previously supplied on nominal 1 lb. reels. 60/40 high tin alloy is available in 14 and 18 s.w.g., in red cartons, while 40/60 alloy is available in 13 and 16 s.w.g., in green cartons. Multicore Solders, Ltd., state that these cartons are not sold as containing 1 lb. each of solder, but contain a specified length.

The direct electrical determination of pH, as a measure of the acidity or alkalinity of a solution or emulsion, consists in measuring the potential difference between suitable electrodes immersed in the solution under test. Modern technique uses a glass electrode with a thin membrane of high conductivity glass as a barrier between the test solution and a half cell of constant e.m.f. Such an electrode system has a high internal resistance and, in order to measure its generated e.m.f., a high resistance measuring device is required. The basis of the Muirhead pH meter illustrated on this page is an electrometer consisting of a pentode with



*Muirhead pH meter, connected to test electrodes*

a linear grid voltage/anode current characteristic, the anode current, as read on a backed-off meter, being proportional to negative changes in e.m.f. applied from the electrode system. The meter may, therefore, be calibrated directly in pH and may, on occasion, be used as a millivolt meter of variable sensitivity. A moving-coil microammeter is employed, and the controls include temperature and sensitivity adjustments. With a total power consumption of 9-10 W, the instrument is provided with a constant voltage transformer and valve for stabilisation.



# Electricity Supply

**Todmorden.**—A sub-station, costing £3 500, is to be built at Oak Avenue.

**Barrow in Furness.**—An estimate of £11 900, for rural developments, has been approved by the Electricity Committee.

**Ealing.**—Sanction to use surplus revenue for consumers' apparatus, at £9 500, and meters, at £4 500, has been obtained by the Electricity Committee.

**Morecambe.**—Extensions to the high-tension system, which will involve the provision of four sub-stations, will cost £13 854.

**Chesterfield.**—Extensions in the New Whittington area, estimated to cost £6 787, are to proceed, subject to the approval of the Electricity Commissioners.

**Seaham.**—The Urban Council has applied to the Electricity Commissioners for sanction to borrow £8 471 for mains and services, meters, plants, and buildings.

**Menai Straits.**—Mr. F. O. Harber has prepared a memorandum on a tidal scheme to utilise the waters of Menai Straits for the generation of electricity. It is suggested that the open ends of the straits should be utilised to form a double basin system, which would necessitate a dam at either end and one in the middle. It is estimated that such a project would provide about twelve times the amount of electrical energy at present required by the whole of the Bangor supply area.

**Accrington.**—Dealing with the electricity extension in his inaugural Mayoral speech, Coun. Leslie Ranson said that the year would mark the start of the largest project ever undertaken in the borough—the new electricity station at Huncoat, consisting of four generating units with a total capacity of 126 000 kW. The first section (two 31 500 kW units) should be in commission for the winter of 1950-51. The cost of the station would be about £5 000 000, borne by the C.E.B., and about six years would be required to carry out the work. By 20 votes to six, the Town Council has confirmed Messrs. Kennedy and Donkin as engineering consultants. This reverses the Council's previous decision to adopt a scheme prepared by the Borough Electrical Engineer, under which he would have undertaken sole responsibility, at a cost of £103 292, plus allowances to various officials and staff. The consulting engineers' fees will be about £200 000.

**Salford.**—Further powers in connection with its public utility undertakings are the objects of a Bill prepared by the Corporation. They are to include powers to charge for special readings of meters, the

recovery summarily of sums due for the sale, hire or fixing of apparatus and fittings, the cutting-off of supplies where charges are not wholly paid and amendment of the provisions relating to the payment of interest by the Corporation on sums deposited with it as security.

**Newport.**—Work is to begin on a £15 000 000 generating station at Newport, where a 550 acres site at the estuary of the river Usk has been earmarked. The station, which will have an ultimate capacity of 180 000 kW, is to be built in two sections, the first of which will cost £8 000 000. A third section may be started before the first two are completed. This station will augment the extensions now being carried out at the East Usk generating plant.

**Poplar.**—Reporting on the increasing number of overhead wires which are being erected in the borough in connection with the operation of wireless relay services, the General Purposes Committee states that the practice is reaching proportions not envisaged at the time of the passing of the Overground Wires Act (1933). It is particularly concerned at the unsightly appearance of the streets where relay services have been installed, as well as the possibility of danger resulting from the erection of a multitude of overhead wires, and expresses the need for legislation to enable local authorities to exercise a greater measure of control in connection with such installations. The matter has been referred to the Metropolitan Boroughs Standing Joint Committee, as it concerns other boroughs besides Poplar. The Electricity Committee reports that the change-over in the northern area will involve the provision of a 600 kW rectifier, with switchgear, at the static sub-station on the premises of Messrs. Clarke, Nicholls and Coombs, Ltd.

**Bolton.**—Reporting on the losses that may be sustained by the Corporation after the nationalisation of the electricity undertaking, the Borough Treasurer stated that between 1894 and 1946 £256 817 had been transferred in aid of rates by the electricity department. Since 1900, there had been only ten years in which no contribution had been made, and excepting 1943-44, there had been an annual contribution of £10 000 for each of the past 15 years. The removal of this contribution required to be offset by an adequate award of compensation. It was important, he said, that public utility undertakings taken into national ownership should continue to pay a quota of rates. The accounts show gross

profits for the year, after adjustments with the C.E.B. in respect of previous periods, of £80 325 (£74 603). After deducting debt charges and allocating £10 000 to rate aid, a balance for the year of £20 731 (£19 333) remained. Capital expenditure during the year amounted to £111 446, which, with the exception of £7 898 met from revenue, has been financed by new borrowings. Units purchased from the C.E.B. totalled 148 353 130, while the total of units sold was 132 556 555. The total average price obtained per unit was 1.03d., compared with 1.01d. in the previous year. The load factor was 35.30 per cent., and the units used for converting and loss in mains came to 15 796 575, or 10.65 per cent. of the quantity purchased.

**Carmarthenshire.**—Construction of a power station at Burry Port, Carmarthenshire, estimated to cost £12 000 000, is expected to start early in 1947. Trial borings are already being made. The station, which is designed for an ultimate capacity of 300 000 kW, is considered to be the key to industrial development planned for South-West Wales. The undertaking is to be built in three sections. The first section, which will cost £5 000 000, is scheduled to be ready for commercial operation towards the end of 1950. It is to be built in accordance with an agreement recently entered into by the Llanelly and District Electric Supply Co., Ltd., with the C.E.B. The site is approximately 220 acres. The directors of the new station company include

Mr. W. S. Morrison, M.P. (chairman), and Sir Duncan Watson. "The site is considered to be admirably suited for a large modern power station, being in close proximity to the local coalfields and having ample water and railway facilities," stated the company in an announcement.

**Alton.**—Objections to the erection of a grid line across the college grounds, made by the authorities of the Lord Wandsworth Agricultural College, Long Sutton, near Alton, were upheld at a recent inquiry held under the auspices of the Ministry of Fuel and Power. This decision has aroused strong opposition from local government bodies in the areas concerned. At a meeting of the Alton R.D.C., it was said that the only definite reason for the Ministry's decision to go against the considered opinions of the Hampshire C.C., the North-East Hampshire Joint Planning Committee and the R.D.C.s concerned, and also against the opinions of the C.E.B. and the Air Ministry, was that a rich foundation was prepared to put up a sum of £5 000 to flout the opinion of these bodies. The amended line for the grid would entail the use of materials and labour, all of which were in short supply. The Ministry states that the decision had been taken after the Minister had taken into account all the relevant considerations, including the willingness of the college to pay a sum not exceeding £5 000 towards any extra expense incurred in diverting the line. The Council has decided to bring the matter to the notice of Parliament.

## Conservation of Coal

A MEETING specially called to discuss the conservation of coal was held by the Midland Section of the Junior Institution of Engineers at the James Watt Memorial Institute, Birmingham, on December 4. Dr. R. D. Gifford, past-president, presided.

Mr. F. W. Lawton, chief engineer and manager of the Birmingham electric supply department, said that as the price of coal increased the importance of saving fuel had taken on a greater significance. The supply industry had done much in the way of conservation of coal by installing boiler equipment to use pulverised fuel and slack, and of recent years, open cast coal and fuel from pit mounds. Such fuels could only be burnt by the installation of suitable plant, which in itself was more costly than the ordinary type, and as the difference in price between high and low grade fuel to-day was almost negligible there was

little encouragement to go to the expense of installing such equipment. The industry, however, had done more than any other to use low grade fuel, and conservation of coal had been achieved with increased efficiency. There was water power and tidal power but, except in Scotland, enormous capital expenditure barred the way to development. Physicists and engineers were looking to atomic energy to release them from the necessity of burning coal for the purpose of producing electric power, but in the opinion of engineers engaged upon that development it would need ten to twenty years to make the cost of such energy comparable with coal.

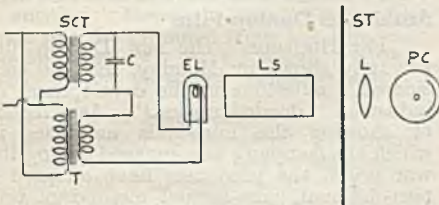
Dr. C. M. Walter, chief engineer of the industrial research laboratories of the Birmingham gas department, said, among other things, that coal would eventually be saved by the abolition of open fires and the complete electrification of the railways.

# Electrical Inventions

## Flickerless Light Source

Since the light from a filament lamp, excited from a normal a.c. source, flickers at twice the supply frequency, it is not, in general, suitable for such purposes as recording with photo-electric cells, etc.

The invention is intended to eliminate this flicker without the use of rectifiers and smoothing circuits. SCT is a saturated core transformer which produces, from a sinusoidal source, a waveform with flattened peaks. A second transformer T gives an e.m.f. of sinusoidal waveform which, combining with the output of the first transformer, produces a square or double-peaked resultant. The squareness



of the wave is further improved by the condenser C.

The advantage of the double-peaked waveform is that it compensates for an inevitable loss of squareness which will occur even with the circuit proposed by causing a rapid increase of energisation before and after the change of polarity. The lamp itself is of the normal exciter type, with a short thick filament, while the lens system is shown as an example of one application.

A. C. Lynch. Application date, December 13, 1943. No. 581 373.

## Surge Protecting Winding

A transformer, of the type normally used in conjunction with transmission lines, has a winding divided into a number of sections of a number of coil layers each. A wide, ribbon-like outer turn is positioned about the coil layers comprising the line-connected end section of the winding. The use of this outer turn greatly improves the voltage gradient through the remainder of the winding.

The specification describes several alternative constructions embodying this principle, which is said to be particularly suitable for minimizing the amplitude of surge voltages likely to occur in the case of core-type transformers, in which stacks of a relatively large number of individual coils are employed.

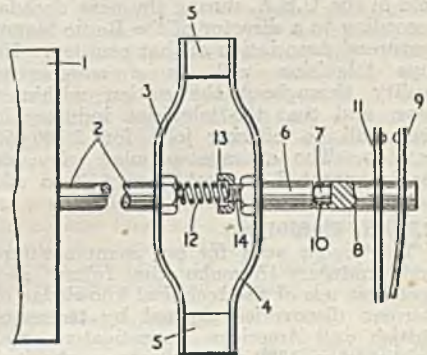
Westinghouse Electric International Co.,

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

New York. Convention date (U.S.A.) December 15, 1943. No. 581 112.

## Motor Speed Control

A centrifugal switch, the contacts of which are placed in series with the booster coil of a shunt-wound motor, is used to provide constant speed running. In the example illustrated, a spring strip 3 is secured to shaft 2 of a motor 1. A second strip 4 is secured to the strip 3 by means of bob-weights 5. The strips 3 and 4 are bowed away from each other at the centre, and a rod 6, rotating with 4, has a shouldered pivot 7 lying in a recess 10. The arrangement is completed with a movable contact 9 and a fixed contact 11. If the governor (3, 4, 5) exceeds a given speed, the bowing of the strips is reduced and the movable contact engages the fixed contact, thus completing the circuit



through the booster coil and reducing the speed of the motor. The contacts 9 and 11 part, and cut out the booster coil as soon as the motor speed has dropped below the predetermined level.

W. J. Scott and T. J. Davies (R.A.E., Farnborough). Application date, March 6, 1945. No. 581 832.

# Industrial Information

## Dutch Orders for British Firm

Despite competition from American firms, the General Electric Co., Ltd., through its agents, N.V. Technishe Handelmaatschappij "Helga," of Curacao, has secured orders for lighting schemes on two airfields which lie in the centre of the American zone of influence. The airfields, Hato and Dakota, are on Curacao and Aruba, respectively, two islands in the Netherlands West Indies. Air lines using this route include Pan American (Curacao only) and K.L.M.

## Frost-Free Refrigerator Windows

A glass screen giving perfect visibility at a temperature equivalent to 125° of frost has been evolved for experimental refrigerating plant by the Triplex Safety Glass Co., Ltd. It constitutes an adaptation of the principle used in aircraft during the war when misting was prevented by means of exhaustively dried air enclosed in hollow chambers.

## B.S.I. Year Book

The yearbook of the British Standards Institution for 1946, which has just been published, gives a subject index and a synopsis of each of the 1300 British standards now current. These standards have been prepared by representative committees of 44 different industries. Copies, price 2s., post free, can be obtained from the publications sales department at 28, Victoria Street, London, S.W.1.

## Television in the U.S.A.

Up to 25 000 000 television sets can be sold in the U.S.A. during the next decade, according to a director of the Radio Manufacturers' Association of that country. He says television will be a commercial reality throughout the nation within a year, and that the television industry in time will be offering jobs for 2 500 000 persons. The average popular television set is expected to cost from 250 to 400 dollars, plus tax.

## B.I.O.S. Exhibition

The urgent need for our manufacturers and producers to make the fullest and speediest use of the technical knowledge of German discoveries gleaned by teams of British and American investigators and published in 1390 reports, was emphasised by Sir Stafford Cripps, President of the Board of Trade, on Monday, December 9, when he opened the B.I.O.S. exhibition of German industrial information at the Board of Trade cinema, Millbank, London. His speech was recorded on one of the exhibits—the Magnetophon sound recording and reproducing equipment, most of the development of which took place in

Germany during the war. It was used for broadcasting purposes. It is noteworthy for the use of supersonic frequency alternating currents for erasing and biasing, the result of which has been considerably to lessen background noise; and the use, as a recording medium, of thin, light plastic tape impregnated with magnetic particles; this enables a 20-minute high quality recording to be made on a reel of tape 11 in. in diameter, less than  $\frac{1}{4}$  in. deep and weighing about 2 lbs. Other exhibits include the Mairhak strain gauge, an extremely sensitive instrument for measuring strains in any type of material. The exhibition, which will remain open until December 19, is limited to trade visitors and admission is by trade card. It will tour provincial centres during 1947.

## Ambitious Dunlop Film

"Far Horizons," the new Dunlop film privately shown on Monday, may be considered a milestone in the development of industrial "documentaries." As a means of showing the numerous activities in which the company was engaged during the war years, the producers have adopted a part-fictional, part-factual method of telling their story. The film opens with the declaration of war, and, with recourse to various official films and scenes taken in the studio and the Dunlop factories, describes some of the contributions which the company made to armament manufacture, for the fighting services and civil defence. Over 25 000 ft. of studio film, 65 000 taken in the 19 Dunlop war-time factories, and excerpts from more than 300 miles of war film, loaned by Government departments, were used in its production. Mr. Harold Warrender, in the part of an executive of the company, plays a leading rôle. The film will be shown in a number of provincial centres, and in London, in the early part of next year. As an example of one of the most ambitious productions yet made by an independent company, and as an interesting account of an important war effort, it will repay a visit.

## The P.E.R.A.

Born of the establishment by the Institution of Production Engineers of a research department, and the idea in 1945 of establishing a research association covering not only the institution but in addition, the Machine Tool Trades' Association, the Gauge and Tool Makers' Association and the National Federation of Engineers' Tool Manufacturers, there was incorporated in June last a body known as the Production Engineering Research Association of Great Britain. The association is recognised by the D.S.I.R., which department is willing

to give financial assistance on the basis of £15 000 p.a. for the first £15 000 p.a. subscribed by industry, and thereafter pound for pound up to a maximum of £35 000 from industry and £35 000 from the department, that is, a total annual income of £70 000. An inaugural meeting of the association in London on December 3, was attended by Mr. J. Wilmot, Minister of Supply, Sir William A. Stanier, F.R.S., Mr. H. Taylor, chairman of the association, and Dr. D. F. Galesway, director, short addresses by whom made it clear that the work of the association will cover the whole range of production engineering activities, and assist in the provision of technical data. Membership is open not only to the manufacturers of tools, machine tools, gauges, cutting fluids, etc., but also to the users of these equipments. An indication of the proposed activities is given in a booklet entitled "Research Plan," copies of which may be obtained from the Information Manager, Mr. A. V. Wood, Staveley Lodge, Melton Mowbray, Leicestershire.

#### **E.W.F. List of Members**

The Electrical Wholesalers' Federation has just published its "List of Members" for 1946. It is arranged in two sections, the first being in alphabetical order of names, and the second giving the members under the names of the cities and towns where they carry on business. Since its creation in 1914, the federation has, it is stated, strictly maintained the fundamental principle that its members must be accredited electrical wholesale distributors.

#### **Hydro-Electricity in Central Africa**

At a meeting of the Central African Council in London, on November 26, to 28, the Council recommended among other things the establishment of an Inter-Territorial Hydro-Electric Power Commission of two members, each from Southern and Northern Rhodesia with wide investigatory powers, including the power to engage consultants and specialists, with a view to studying the possibilities of Kariba and Kafue hydro-electric power projects and any other large sources of power available for joint development and to make recommendations on load development in participating territories, the extent of initial hydro-electric development desirable and the time by which it should be in operation. Other points to be considered by the Commission would be the selection of a site for initial development, transmission line details and routes, finance and costs, the form of control of the undertaking, subsequent investigations and development, irrigation possibilities, and having regard to the effects of the project on the African labour situation, the possibilities of economising in

man-power by mechanisation and modern labour-saving machinery.

#### **Wallasey's Electricity Jubilee**

The Wallasey Electricity Committee is arranging for the celebration on January 29 of the borough's electricity jubilee. A brochure giving the history of the undertaking is being prepared.

#### **Northmet N.A.L.G.O. Branch**

The first annual meeting of the Northmet branch of the National Association of Local Government Officers was held at Church House, Southgate, on November 27. Formed in March of this year, the branch has now over 1 000 members and is one of the largest of N.A.L.G.O. Over 90 per cent. of the clerical and sales staffs of the Northmet Power Co. and many of the technical staff are members. It was the first branch formed from the staff of a public utility company following the amendment of the N.A.L.G.O. constitution widening the scope of membership. Among the officers elected for the ensuing year were Mr. Clifford Baron (Northmet House), chairman; Mr. C. W. Dale (outside department), secretary; and Mr. L. H. Middleton (Wembley), treasurer.

#### **British Council's Electrical Courses**

The report of the British Council for the year 1945-46 states that in collaboration with the Students' Department, a two-weeks' summer course in advanced electrical engineering at Queen Mary College (University of London) was arranged for British Council and other students, the object being to present to foreign engineering students an adequate picture of British electrical engineering achievements. The scholarship programme for post-graduate students was considerably extended during the year, a total of 405 scholarships being offered as compared with 115 in 1944. Special awards were offered by the Council in conjunction with the Metropolitan-Vickers Electrical Co., Ltd., and the English Electric Co., Ltd. The scheme financed by the Council jointly with C. A. Parsons and Co., Ltd., and A. Reyrolle and Co., Ltd., for Turkish engineering apprentices was continued.

#### **Export Organisation**

Electrical equipment is included in £1 000 000 worth of orders just placed in Bristol and the West Country. It is hoped that £6 000 000 worth of orders will result each year by the setting up in Bristol of a branch of the import and export firm Societe Internationale Vasta. Pending the registration of the company in Bristol, Knee Bros. and Mark Whitwill and Son, Ltd., in co-operation with the Board of Trade and the Ministry of

Supply, will act as agents for Vasta. The object of the organisation in this country will be to overcome financial and other difficulties brought about by the import into Belgium of British goods destined for re-export. These goods will in future be exported from this country to the overseas markets direct.

### Southport Cookery Demonstrations

Since the opening of the demonstration theatre in the Southport electricity show-rooms in 1940, 470 cookery demonstrations, attended by more than 21 000 people, have been given.

### Thermovent Heaters

E. K. Cole, Ltd., announce that because of recent heavy demands and Board of Trade export obligations, no additional orders for Thermovent heaters for the home domestic market can be accepted until further notice. Every effort is being made by increases in production to meet demands. The Thermovent advisory service continues to operate.

### B.S. for Workshop Practice

A new edition of the B.S. Handbook No. 2, "British Standards for Workshop Practice," has just been issued by the British Standards Institution. In it are reproduced the essential technical data, diagrams and dimensions from forty British standards, applicable to engineering practice. Copies may be obtained from the British Standards Institution Publications Department, 28, Victoria Street, London, S.W.1, price 12s. 6d.

### Light Through the Ages

Under this title, a booklet, telling in basic English the story of artificial light from primitive methods to the fluorescent tube, has been issued by Thorn Electrical Industries, Ltd., for the entertainment and instruction of children. It is delightfully illustrated by Juppo, and has a general appeal. Its purpose is to emphasise the staying power of Atlas lamps.

### G.E.C. Service Depôt

The General Electric Co., Ltd., announce that as from December 30, the trade counter of its service depôt, in Greycoats Street, London, S.W.1, will be open as follows: Monday to Friday, from 8.30 a.m. to 5.30 p.m. The counter will be closed for lunch each day between 12.30 and 1.30 p.m. Saturdays, open from 8.30 a.m. to 12.30 p.m.

### Air-depolarised Primary Cells

B.S.S. No. 1335, 1946, issued by the British Standards Institution, prescribes the minimum rating of air-depolarised type primary cells on continuous discharge and gives the methods of test on which the

rating is based. A system of nomenclature is prescribed by which the type and size of cell are expressed by a sequence of two or three letters and a number. Details of the quality of materials to be used, and also dimensions of electrodes, containers, connecting wires and terminals are also given.

### New Electrical Factories

Crompton Parkinson, Ltd., have prepared plans for the building of four large factories for the manufacture of light electrical equipment at Wheatley Hills, Doncaster, which will eventually employ some 2 500 workers. The building of the first factory is due to start at an early date.

### Reports from Germany

Among further reports containing scientific and technical intelligence from German industry now available at the Stationery Office, are the following: B.I.O.S. 785, The German Mica Industry (5s. 6d.); F.I.A.T. 419, The Rohn Low Frequency Induction Furnace (1s. 6d.); F.I.A.T. 574, Flywheel Magnetos. R. Bosch G.m.b.H. Stuttgart (1s.).

### Electrical Apparatus in Mines

The Minister of Fuel and Power has issued lists of electrical apparatus for which certificates of flameproof enclosure have been granted by the Ministry during the six months ended September 30, 1946. At the request of the B.E.A.M.A., a few copies of these quarterly lists are on sale at 1s. 2½d. (post free), and may be obtained from The Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, S.W.1.

### Control of Building Components

The Ministry of Works has issued in pamphlet form (price 1d.), a statement dealing with the overall control of prices of building materials and components for the general market, in cases in which some further measure of control is deemed to be necessary beyond that provided under the Prices of Goods Act. It does not deal with points of contract procedure which arise in negotiation of purchases on direct or indirect Government account or in the negotiation of production agreements.

### The Engineers' Guild

The first issue of the journal of the Engineers' Guild contains a brief history of guild, which was founded in 1938 to promote and maintain the unity, public usefulness, honour and interests of the engineering profession; reports of the General Council and the Committee, and of the discussion meetings held on May 15 and October 9, this year. Dates and authors of papers for further discussion meetings have been fixed as follows: Wednesday.

December 18, Prof. C. L. Fortescue; Wednesday, February 12, 1947, Mr. Gower Pimm; and Wednesday, April 16, 1947, Mr. C. F. Bolton.

### Building Licensing

Notes for the guidance of applicants for civil building licences are given in a leaflet, "Building Licensing," which is being sent to all registered contractors by the Ministry of Works.

### Quiet Suction Cleaner

Electrolux, Ltd., announce that their model U.116 quiet suction cleaner—the lower priced of the two models they market—is available again in limited quantities, but at a slightly increased price occasioned by the prevalent rise in cost of material.

### E.A.W. Branch at Bangor

At a meeting at the Normal College on November 28, the Bangor E.A.W. branch achieved full status, having previously been a unit of North Wales Coast branch. The Mayor of Bangor was in the chair. Councillor Mrs. Chamberlayne, a member of the Electricity Committee, is chairman of the new branch, and the hon. secretary is Mrs. Skeats, wife of the Borough Treasurer. Those present included the borough electrical engineer, Mr. F. O. Harber and Mrs. Harber, and members of the E.A.W. North Wales and North Wales Coast centres.

### Fuel Economy

"Reports on Fuel Economy since 1939," published by the Central Office of the World Power Conference, 36, Kingsway, London (price 1s. 6d. net), is the contribution of the British National Committee of the World Power Conference to the series of reports on "Fuel Economy since 1939," and constitutes preparatory material for the Fuel Economy Conference of the World Power Conference, to be held at The Hague, from September 2 to 9, 1947. The report covers the history of the fuel efficiency campaign conducted by the Ministry of Fuel and Power during the war years. It deals with the restrictions controlling the supply position, the conditions which gave rise to the need for a campaign, its organisation, the publicity used and the results achieved.

### A.C.E.C. Review

The Ateliers de Constructions Electriques de Charleroi and the Forges et Ateliers de Constructions Electriques de Jeumont, Belgium, who have a London office at 56, Victoria Street, S.W.1, have resumed publication of their journal with an issue covering the half-year from January to July. In spite of difficulties caused by the German occupation this review of the company's activities continued to appear until 1942 when further publication was

forbidden on the pretext of scarcity of paper. So far as conditions and its available resources permitted, the organisation continued its work and prepared for the day of liberation. It has begun to renew overseas contacts and clients are assured of an up-to-date service.

### New Industrial Statistical Group

A North-Eastern group of the Industrial Applications Section of the Royal Statistical Society has been formed, centred on the Tyne and Wear areas, and including a Tees-side sub-group. Mr. J. Elliott, Leamington Glass Works, Leamington-on-Tyne, Northumberland, is hon. secretary of the new group; and Mr. J. T. Richardson, research department, Imperial Chemical Industries, Ltd., Billingham, Co. Durham, is hon. secretary of the sub-group.

### Change of Address

As and from January 1 the address of the Transmission Lines and Cables Construction Co., of Keighley, will be: Street Head, Newbiggin, near Aysgarth (Yorks.).

### New Branch Office

The Hoffmann Manufacturing Co., Ltd., announce that they have recently opened a new branch office at 59, Queen Square, Bristol, 1 (telephone: Bristol 20561), which will be under the control of a qualified ball and roller bearing engineer. An emergency stock of bearings will be carried.

### Trade Publications

A brochure dealing with the M.R.E. centering machine produced by Manchester Repetition Engineers, Ltd., Reynold Works, Chell Street, Longsight, Manchester. A new principle in centering has been adopted.

A booklet, entitled "Osram Fluorescent Lamps and G.E.C. Fittings," issued by the General Electric Co., Ltd., comprises 28 pages of information relating to 80 W and 20 W fluorescent lamps, and the auxiliary gear—starting switches, capacitors for power-factor correction and chokes—as well as details of more than thirty different types of lamp fittings.

Two new publications from Standard Telephones and Cables, Ltd., Connaught House, Aldwych, London, W.C.2. One introduces the "Simultaneous Twenty Continuous Load Telemeter," with electronic teleprinter impulsing, by which a single telephone circuit can be made to carry supervisory control and indication of switchgear, telephone conversations and switching, and twenty simultaneous continuous meter readings. The other leaflet gives particulars of a staff location system operating on the principle of light combinations.

# Contracts Open

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

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

**South Westmorland,** December 14.—Supply of centrifugal pumps and motors, with switchgear in duplicate, for R.D.C. Particulars from Engineer's Department, Council Offices, 30, Lowther Street, Kendal.

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

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

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

**Romford,** December 23.—Electrical installations in 144 three-bedroom and four-bedroom type permanent houses on the Gobions Estate. Specification from Borough Engineer and Surveyor, Town Hall, Romford; deposit, £2 2s.

**Forres,** December 23.—Electrical work on 32 houses at Fleurs Place, Forres, for Town Council. Particulars from Town Clerk, Forres; deposit, £3 3s.

**Brighton,** December 30.—Manufacture, delivery, setting to work of electrically driven booster pump, motor, control gear, etc., at Aldrington station, capable of normal output of 60 000 galls. per hour. Particulars from Waterworks Engineer, 12, Bond Street, Brighton, 1; deposit, £2 2s.

**Exeter,** December 30.—Supply, delivery and erection of two 12 000 kVA transformers. Specification from City Electrical Engineer, Electricity Offices, 46, North Street, Exeter.

**Leeds,** December 30.—Supply and delivery of electrically operated pumping

plant, with motors, switchgear, etc. Particulars from Sewerage Engineer's Office, Civic Hall, Leeds.

**Newport, Mon.,** December 31.—Electrical installations in 134 houses on Alway Farm estate. Specification from Borough Electrical Engineer, Electric House, Dock Street, Newport, Mon.; deposit, £1 1s.

**Shoreham-by-Sea,** January 4.—Taking down of existing street lamps and erection of new steel or concrete columns, complete with lanterns, sodium discharge lamps, etc., giving a mounting height to lamp of 25 ft. Specification from Surveyor's Office, 31, John Street, Shoreham-by-Sea; deposit, £3 3s.

**Keighley,** January 11.—Supply and delivery of street lighting posts and fittings for housing schemes at Bracken Bank and Woodhouse. Particulars from Town Clerk, Town Hall, Keighley.

**Hastings,** January 13.—Manufacture, supply and delivery of two 2 000 kVA Scott-connected transformers, and two switch kiosks. Specifications from Borough Electrical Engineer and Manager, 12 and 13, York Buildings, Hastings.

**Manchester,** January 13.—Supply, delivery and erection, over period of two years, with option to terminate at end of first year, of 6.6 kV sub-station switchgear. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2.

**Sheffield,** January 15.—Tenders for purchase and removal of redundant plant from Neepsend power station, including two turbo-alternators and ancillary plant, 12 500 kW; electric feed pumps; spare motors, etc. Details of plant available from General Manager, Commercial Street, Sheffield, 1.

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

**North of Scotland Hydro-Electric Board,** January 21.—Construction, completion and maintenance of the Pitlochry dam and power station, Tummel-Garry hydro-electric project. Particulars from the Engineers, Sir Alexander Gibb and Partners, 39, Northumberland Street, Edinburgh, 3, and Queen Anne's Lodge, London, S.W.1; deposit, £5.

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



# Company News

**VERA CRUZ ELECTRIC LIGHT, POWER AND TRACTION CO., LTD.**—Statement for 1945 shows operating revenues £78 359, operating exes., includg. taxes, £68 520; deficit at end yr. £89 201 (£95 873).

**BARCELONA TRACTION, LIGHT AND POWER CO., LTD.**—Net income for 1945 \$2 613 667, compared with \$2 810 892 for 1944. Owing to continuous restrictions on the transfer of funds from Spain net income was placed in suspense account. Gross income from subsidiary companies accrued, but not received, was \$4 083 634, against \$4 688 574.

**DECCA RECORD CO., LTD.**—Full accts. to Mar. 31 show blee. from trdg. acct., inclgd. divs. from sub. cos. and E.P.T. recov. £51 000, after managmt. exps., etc., £131 286 (£123 168), plus int. nil (£858), fees £399 (£491) and divs. from Decca Records, Inc. £1 188 (£1 781), mkg. £132 873 (£126 298). To dirs.' fees £1 304 (£1 550), maint. plant £13 588 (£11 883), deprecn. £7 447 (£8 251), int. £1 821 (nil), deb. trustees' remun. £200 (same), A.R.P. exp. £108 (£965), War Damage Act premis. nil (£255), lvg. £108 405 (£103 194). Deb. int. takes £12 927 (£14 054), inc. tax £40 822 (£42 357), prem. on redpn. debts. nil (£215), ptg. pref. div. at 16% £4 608 (same), final ord. div. 79½%, making 112½% (same); fwd. £37 352 (£27 025).

**ELECTRIC AND MUSICAL INDUSTRIES, LTD.**—Net prft. to June 30, £165 000 (£150 085). To pref. div. £14 835 (£15 525), ord. div. 6% and bonus 2% (same) £127 727 (£119 018), fwd. £291 340 (£268 902). Cons. accts. show trdg., etc., prft. £837 830 (£1 348 685). To pensions £74 088 (£64 790), dirs.' fees £5 705 (£4 349), patent rights nil (£50 000), tax £302 935 (£706 207), tax res. £259 291 (£337 637), lvg. net prft. £195 811 (£185 702), fwd. (after divs.) £437 399 (£384 150). Cons. blee. sheet shows stk. and work £2 623 248 (£4 485 101), debtors £2 201 357 (£1 400 016), Govt. secs. £1 000 (nil), tax certs. £1 413 525 (£778 300), cash £1 124 034 (£531 074); creditors and contings. £2 530 837 (£2 143 706), surplus and res. £737 399 (£684 150).

**ABERDARE CABLES, LTD.**—A South African company, Aberdare Cables of South Africa, has been formed to take over and develop business in the Union and closely related markets. The new company will act as agents for the English concern until its Port Elizabeth factory is erected and in production, which is expected to be about the end of next year. Steps are being taken to secure permission to deal in the whole of the share capital on

the London market. The company's announcement shows that the new firm is capitalised at £350 000, consisting of £100 000 5½% cumulative preference £1 shares and £250 000 ordinary 5s. shares. The English company subscribed at par for 226 000 ordinary shares and its shareholders for 163 500, and the balance of the capital was subscribed by other interests. In addition to cables, the South African company will manufacture other devices now produced by the English company's subsidiary, South Wales Switchgear, Ltd. At a later stage, other specialities will be manufactured.

**DICTOGRAPH TELEPHONES, LTD.**—Cons. trdg. prfts. to August 31 £48 927 (£49 324), plus int. £16 (£182). To dirs.' fees £500 (£1 146), inc.-tax and E.P.T. £25 034 (£28 543), pensions £2 895 (£2 887), war dmge. nil (£202), lvg. group cons. net prfts. £20 514 (£16 728), less prfts. retained on subsids. £2 115 (£798), lvg. parent co. net prft. £18 399 (£15 930). To genl. res. £5 000, benevolent fund £250, div. 11% (all same), fwd. £11 738 (£10 689). Cons. blee.-sheet shows net current assets £22 515 (£48 375).

## Metal Prices

	Monday, Price	December 9 Inc. Dec.
<b>Copper—</b>		
Best Selected (nom.)...per ton	£96 10 0	-- --
Electro Wire bars ... ..	£98 0 0	-- --
H.O. Wires, basis ... ..	£112 5 0	-- --
Sheet ... ..	£138 10 0	-- --
<b>Bronze Electrical quality</b>		
1% Tin—		
Wire (Telephone) basis per ton	£134 0 0	-- --
<b>Brass (60/40)—</b>		
Rod basis ... ..	10¾d.	-- --
Wire ... ..	1s. 3¾d.	-- --
<b>Iron and Steel—</b>		
Pig Iron (B. Coast Hematite No. 1) ...per ton	£8 19 0	-- --
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... ..	£33 0 0	-- --
Mild Steel Tape (Cable Armouring) basis 0.04 in.) ... ..	£21 15 0	-- --
<b>Lead Pig—</b>		
English ... ..	£56 10 0	-- --
Foreign and Colonial... ..	£55 0 0	-- --
<b>Tin—</b>		
Ingot (minimum of 99.8% purity) ... ..	£384 0 0	-- --
Wire, basis ... ..per lb. 4s. 10½d.		-- --
<b>Aluminium Ingots ...per ton</b>		
Spelter ... ..	£55 0 0	-- --
Mercury (spot) ... ..per bott.	£25 0 0	-- --

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

# Commercial Information

## Mortgages and Charges

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

**GENT, HURLEY AND ORRINGE, LTD.,** Leicester, electrical engineers.—Nov. 4, charge, to Leicester Temperance and General Permanent Building Society securing £3 000 and any other money (including any further advances), etc.; charged on workshops, battery charging station and cott. 8, 10, 14, 16 and 16a, York Road, Leicester. \*Nil. July 11, 1945.

## County Court Judgment

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

**RADIO ELECTRICAL REPAIR CENTRE** (sued as a firm), 141, Alfred Street, South,

Nottingham, repairers. £11 11s. 10d. October, 10.

## Order for Discharge

**BADER, Kaspar Erwin**, residing at 53, Canons Drive, Edgware, Middlesex, consulting engineer, described in the Receiving Order as Kaspar Bader, lately residing at 25, Selborne Gardens, Hendon, London, electrical equipment manufacturer, and lately carrying on business at Westmoreland Road, Hendon, London. Court.—High Court of Justice. Date of Order—October 24, 1946. The Court ordered that the bankrupt's discharge be suspended for nine months, and that he be discharged as from July 24, 1947, the ground given for the suspension being that the bankrupt had been guilty of misconduct in relation to his property and affairs.

## Order Annulled

**POOLE, William Stanley**, residing and carrying on business at High Street, Queensbury, near Halifax, in York, electrician. Court—Halifax, Receiving order, dated December 14, 1937, rescinded and order of adjudication dated December 14, 1937, annulled, November 1, 1946, on the ground that all debts have been paid in full.

# Coming Events

## Friday, December 13 (To-day)

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

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

**I.E.E., N. EASTERN STUDENTS' SECTION.**—Newcastle-on-Tyne. "Industrial Electronics," papers by Messrs. Finlay, Edgley and Richmond. 6.30 p.m.

## Saturday, December 14

**I.E.E., N. EASTERN STUDENTS' SECTION.**—Visit to Dartford Ironworks. 2.30 p.m. "Evening Gazette." 2.15 p.m.

**I.E.E., N. MIDLAND STUDENTS' SECTION.**—Leeds. Problems afternoon. 2.50 p.m.

**I.E.E., N. WESTERN STUDENTS' SECTION.**—Manchester. Visit to B.B.C. Studios, Piccadilly.

**ELECTRICAL ENGINEERING SOCIETY.**—London. Visit to Hither Green Telephone Exchange. 2.30 p.m.

## Monday, December 16

**I.E.E., N.E. CENTRE.**—Newcastle-on-Tyne. "Power Supply for Generating Station Auxiliary Services," W. Szwander. 6.15 p.m.

**I.E.E., N.W. STUDENTS' SECTION.**—Manchester. "Motion Study," H. G. McKenzie. 6.45 p.m.

**BIRMINGHAM ELECTRIC CLUB.**—"Lightning and the Engineer," Dr. T. E. Allibone. 6.30 p.m.

## Tuesday, December 17

**I.E.E., N.W. CENTRE.**—Manchester. "The Cathode-Ray Oscillograph as a Universal Test Instrument," discussion opened by E. C. Cherry. 6 p.m.

**ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.**—London. "Mercury Arc Rectifiers, with Particular Reference to the application of Variable Speed Control of D.C. Motors," F. T. Cowley. 6.15 p.m. (At the E.L.M.A. Lighting Service Bureau.)

## Wednesday, December 18

**I.E.E., LONDON STUDENTS' SECTION.**—Visit to Dartford Ironworks. 2.30 p.m.

**I.E.E., SCOTTISH CENTRE.**—Edinburgh. "Naval Fire-Control Radar," J. F. Coales, H. C. Calpine and D. S. Watson. 6 p.m.

**EDINBURGH ELECTRICAL SOCIETY.**—"Electrical Practice in Shipyards," T. S. Wood.

**ENGINEERS' GUILD.**—London. "The Education of Engineers," discussion to be opened by Prof. C. L. Fortescue. 6.30 p.m. (At the Royal Society of Arts.)

**INSTITUTE OF WELDING.**—Wolverhampton. "Resistance Welding Applied to Jettison Tank Manufacture," K. B. Gilbert.

## Thursday, December 19

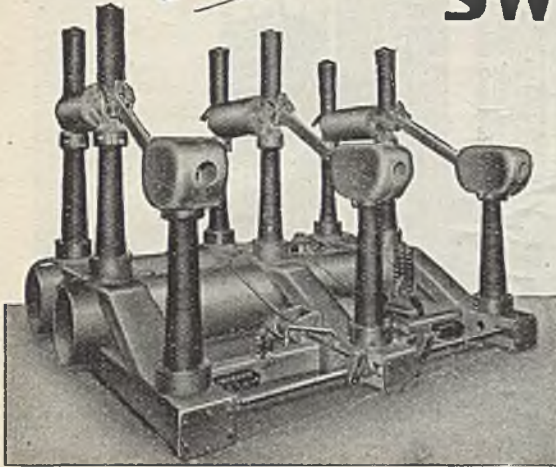
**EDINBURGH ELECTRICAL SOCIETY.**—Annual Whist Drive and Dance. 8.30 p.m. (At 75, Queen Street, Edinburgh.)

**I.E.E., London.** "The Future of Pulverised-Coal Firing in Great Britain," C. H. Sparks. 5.30 p.m.

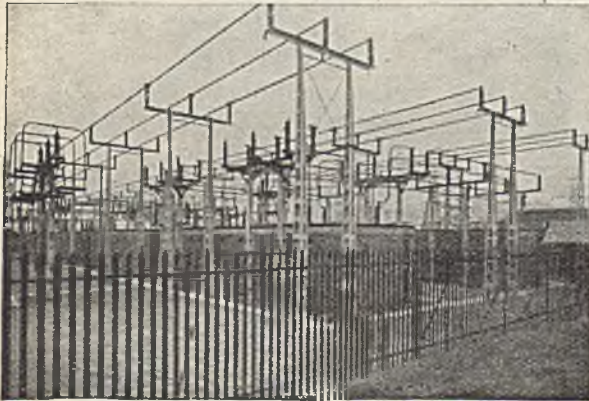
# 'ENGLISH ELECTRIC'

## AIR-BLAST

# SWITCHGEAR



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



Part of a 66 kV. outdoor substation, showing block-houses containing "English Electric" Air-Blast Circuit-Breakers

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

### Important features

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



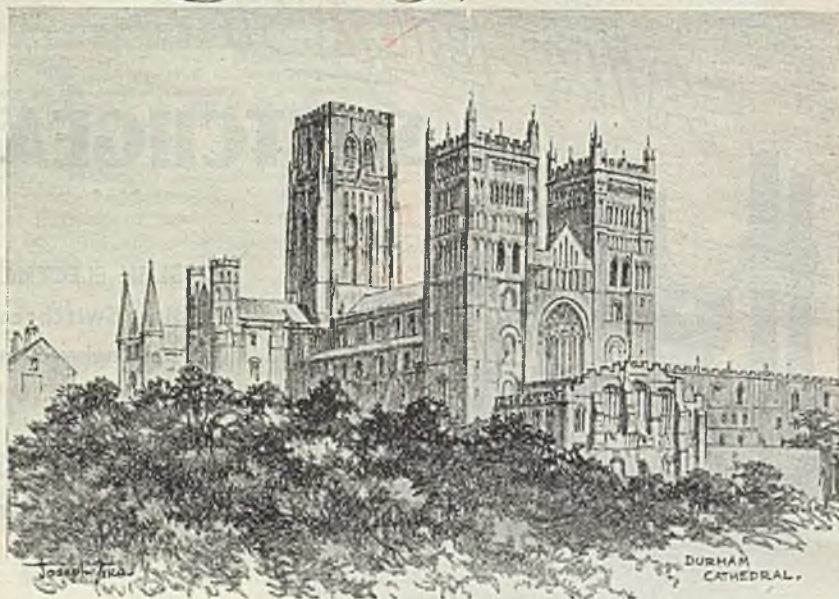
Publication SG/105B obtainable on request from Switchgear Dept. Stafford.

## THE ENGLISH ELECTRIC COMPANY LIMITED

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

WORKS: STAFFORD - PRESTON - RUGBY - BRADFORD - LIVERPOOL

# Landmarks of Britain



DURHAM CATHEDRAL

The nave is one of the finest specimens of Norman architecture in England—period 1090. St. Cuthbert's bones lie in the Feretory

## CRYSELCO

MADE IN ENGLAND



FIFTY YEARS OF  
QUALITY & SERVICE

### Branches

BIRMINGHAM	BURY ST EDMUNDS	LEEDS	LONDON
BRIGHTON	CARDIFF	LEICESTER	MANCHESTER
BRISTOL	GLASGOW	LIVERPOOL	NEWCASTLE



CRYSELCO LIMITED, KEMPSTON WORKS, BEDFORD.

**1,509,600  
CUSTOMERS!**

The estimated number of electric cookers in service indicates YOUR potential market for SIMMERSTATS!

The SIMMERSTAT (retail 21/-), fitted in place of the usual 3-heat or 4-heat hot-plate switch, MODERNISES any cooker, providing PERFECT SIMMERING control.

Every housewife that cooks by electricity is a potential customer. Write now for Trade Terms for immediate delivery to:

SUNVIC CONTROLS LTD.  
STANHOPE HOUSE, KEAN ST., LONDON, W.C.2

Phone: TEMple Bar 8202



*The* **SIMMERSTAT**

The  
*All-heat*  
HOTPLATE  
CONTROL



TAS/SC. 119

*All-over warmth* ENSURES SALES  
*all over Britain*

★ **AEROFIER** heats the whole room — not just one spot

With the AEROFIER Portable Space Heater *all* the room — floor to ceiling, wall to wall — gets evenly heated at once. Consisting of 2-kilowatt element and distributing fan, compactly built in, AEROFIER circulates warm air in winter, cooling air in summer — eliminating stuffiness. Of attractive design and colour choice, AEROFIER looks well in any part of room or business premises. Robustly constructed. Thorough insulation makes it burn-proof, scorch-proof. Here is a heater of unique sales appeal. Retail at £10. 10

Full details and Trade terms from sole concessionaires:  
 C. J. FOX & SONS LTD., 117 VICTORIA ST., LONDON S.W.1  
 Telephone: Victoria 0204



**AEROFIER** EVEN HEAT DISTRIBUTOR



THE  
**CASTLE**

ENGINEERING CO.,  
 (NOTTINGHAM) LTD.

HASLAM ST., CASTLE BOULEVARD,  
 NOTTINGHAM

\*PHONE: NOTTINGHAM 46068 (3 Lines)

\*GRAMS: CAPSTAN, NOTTINGHAM

ON AIR MINISTRY, ADMIRALTY AND  
 WAR OFFICE LISTS

**REPETITION WORK  
 IN ALL METALS**



# Proved by TIME..



No. 1110



No. 1402

Products of TELEPHONE  
MANUFACTURING CO., LTD.

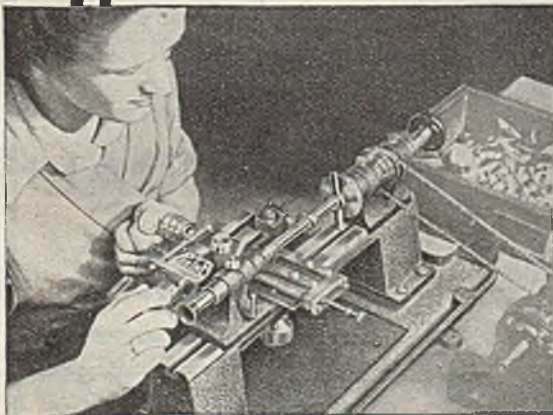
Marketed by T.M.C.-HARWELL (SALES) LTD., 233, SHAFTESBURY AVENUE, LONDON, W.C.2.  
Telephone: TEMple Bar 0055.

## TEMCO

SYNCHRONOUS ELECTRIC CLOCKS

The CURRENT way of telling  
the TIME

## It's possible to turn a hair on a PULTRA MICRO-LATHE



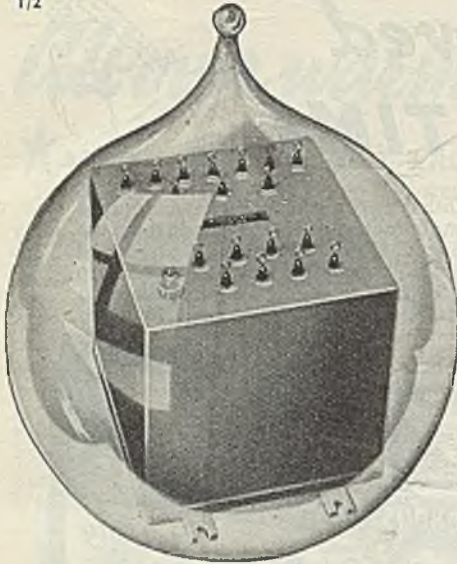
The ability to perform such a delicate operation is evidence of the efficiency and versatility of Pultra Lathes and their equipment.

They are ideal for all small work calling for maximum accuracy.

Write for Catalogue CA4.

**PTA**  
PULTRA  
MANCHESTER

**PULTRA LTD. 24, GRAVEL LANE, SALFORD 3, MANCHESTER**  
Phone: BLA. 9181.



HERMETICALLY  
*Sealed*

## TRANSFORMERS

(PATENT APPLIED FOR)

Robust construction, liberal internal specifications and specially developed hermetic sealing ensure efficient operation at constant load under extreme tropical conditions. Sealed against humidity, destruction by termites and other pests, these Transformers can now be supplied to meet your particular requirements. Write to us for full particulars and specifications.



# W. ANDREW BRYCE & CO. LTD.

SHENLEY ROAD, BOREHAM WOOD, HERTS.

Tel: ELStree 1875 & 1117

## SHEETS AND STAMPINGS



for

# THE ELECTRICAL TRADE

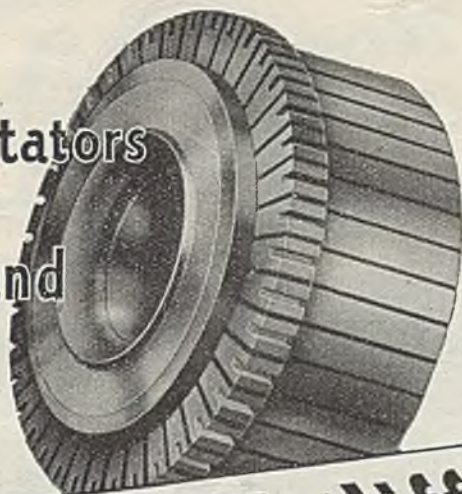
**JOSEPH SANKEY  
& SONS, LTD.**

**BILSTON · STAFFS**

London Office:  
168, REGENT STREET, W.1



for  
Commutators  
of all  
types and  
Sizes



**Consult Watliff**



A commutator made by Watliff is expertly produced and gives no trouble in service.



Advice from commutator experts is always available to users of our products.



We recommend that designers should use our standard sizes (full details on request) wherever possible, but we can always supply specials to customers' exact requirements where needed.



We have been making commutators and slip rings for over 25 years and are confident that we know our business.



We produce over one million commutators yearly and we are still growing.



**WE MAKE THEM FROM THE  
SMALLEST TO THE LARGEST**

**WATLIFF**

**MANUFACTURERS OF COMMUTATORS  
FOR OVER 25 YEARS**

TELEPHONE: LIBERTY 1181 - 1182 - 1183  
TELEGRAMS: WATLIFF, PHONE, LONDON.

**CO. LTD. LOMBARD ROAD, MORDEN ROAD, SOUTH WIMBLEDON, LONDON, S.W.19**

TAYLOR 574



## MINERVA ELECTRICAL

# Insulating Varnishes

STOVING VARNISHES ( <i>Natural Resin Type</i> ) ...	... Black and Clear
STOVING VARNISHES ( <i>Synthetic Resin Type</i> ) ...	... Black and Clear
THERMO-SETTING VARNISHES ... ..	... Black and Clear
AIR-DRYING VARNISHES ... ..	... Black and Clear
CLOTH VARNISHES ... ..	... Black and Clear
SLEEVING VARNISHES ... ..	... Black, Clear and Colours
CORE-PLATE VARNISHES ( <i>Stoving and Air-drying</i> ) ...	... Black and Clear
COPPER-WIRE ENAMELS ... ..	... Black and Clear
ACID AND HEAT-RESISTING ENAMELS ... ..	... All Colours
CABLE LACQUERS • MICA BONDING VARNISHES • COMPOUNDS	

*All Varnishes conform to B.S. Specifications wherever applicable.*

*Please submit your problems to our Electrical  
INSULATING VARNISH TECHNICAL DEPARTMENT.*

# PINCHIN JOHNSON

15 CLIFFORD STREET • LONDON • W.1

Telephone: REGent 7471



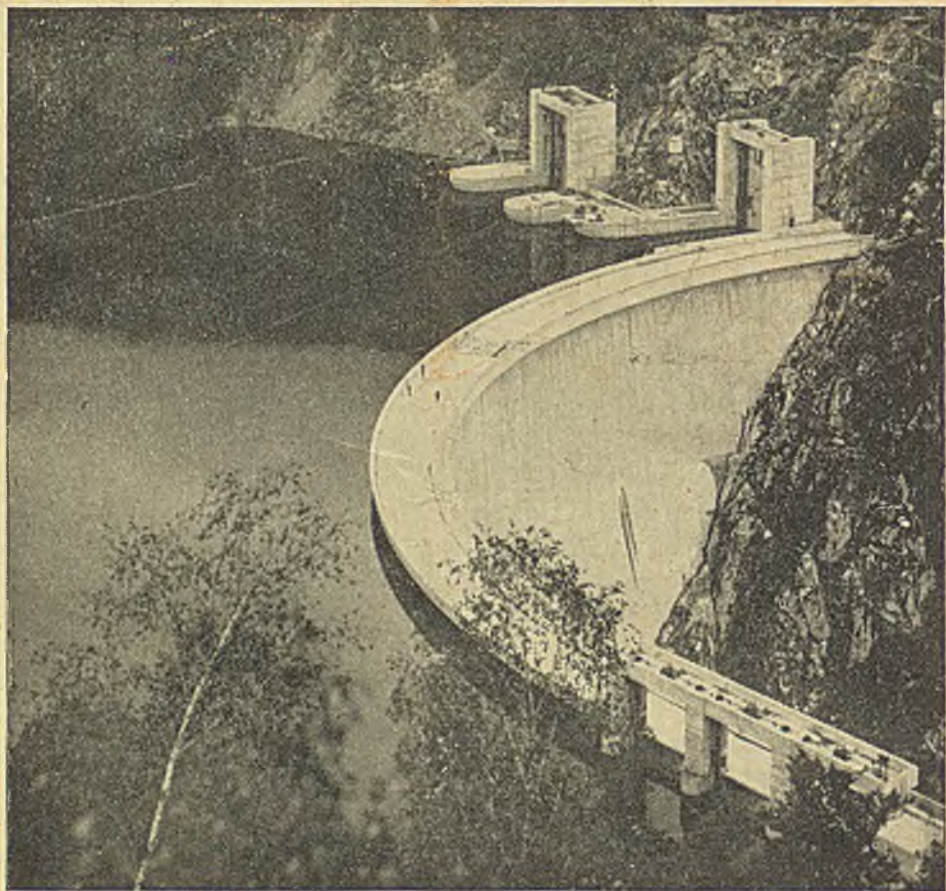
*Cotton & Paper covered*  
*Cotton Braided H.C.*  
**COPPER WIRES & STRIPS**

**Any length  
without join  
Equal gauge**  
To  
*BESA Specifications*

*Send enquiries to*

**THAMES**  
**WIRE AND CABLE Co. LTD.**

**BATH HALL WORKS, BELL LANE, HODDESDON, HERTS**  
**PHONE: HODDESDON 2485**



*FAMOUS HYDRO-ELECTRIC STATIONS.*

*The Mareges Dam is in South-West France on the Dordognes River. It is an arch dam constructed of concrete with a height of 297 feet and a capacity of 170,000 h.p.*



**MEASUREMENT LIMITED**

*Electricity and Water Meters of Quality*

**TERMINAL HOUSE, LOWER BELGRAVE ST., LONDON, S.W.1**

cm 31

Printed in Great Britain by STRAKER BROTHERS LTD., 194-200, Bishopsgate, E.C.2. and published by BERN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, London E.C.4. (Registered at the General Post Office. Entered as Second Class at the New York, U.S.A., Post Office.) - Friday, December 13 1946