

29487  
11.02

THE

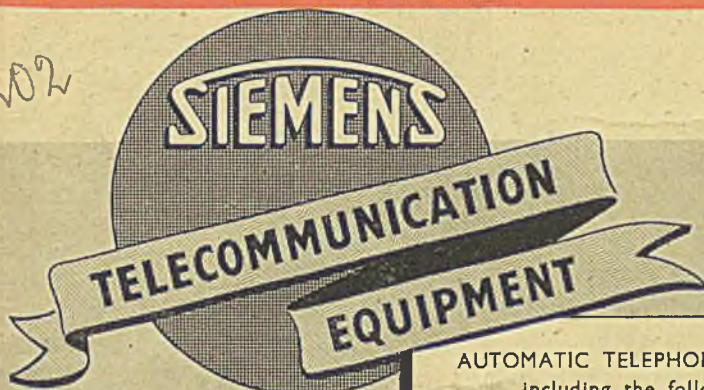
P. 60/46/II

# ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

202

19.



*Designed for service  
in all parts of the world*

BY close attention to technical detail the Company has maintained its position in the forefront of Telecommunication Engineers throughout its long experience. Its products enjoy a world-wide reputation for sound design and technical excellence.

The Company undertakes the supply and installation of complete Automatic and Manual Telephone Exchanges for Public and Private service, Automatic and Manual Trunk Exchanges, all types of Telephone Cables for Trunk and Local Service, Carrier Transmission Equipment and Cables, Radio Equipments for Ships.

## AUTOMATIC TELEPHONE EXCHANGES

including the following types

- |                |          |
|----------------|----------|
| Trunk          | T.A.X.   |
| Main           | M.A.X.   |
| Rural          | R.A.X.   |
| Unit           | U.A.X.   |
| Private        | P.A.X.   |
| Private Branch | P.A.B.X. |

## MANUAL EXCHANGES of all types

CARRIER TRANSMISSION EQUIPMENT

TELEPHONE INSTRUMENTS of all types

TELEPHONE SWITCHING EQUIPMENT

PROTECTIVE DEVICES

RELAYS

TELEPHONE CABLES, WIRES & CORDS

LOADING COILS

MARINE RADIO EQUIPMENT

SHIPS' TELEGRAPHS & TELEPHONES

CELLS & BATTERIES Dry, Fluid & Inert



**SIEMENS BROTHERS & CO., LIMITED**

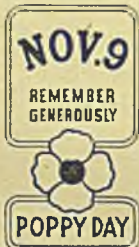
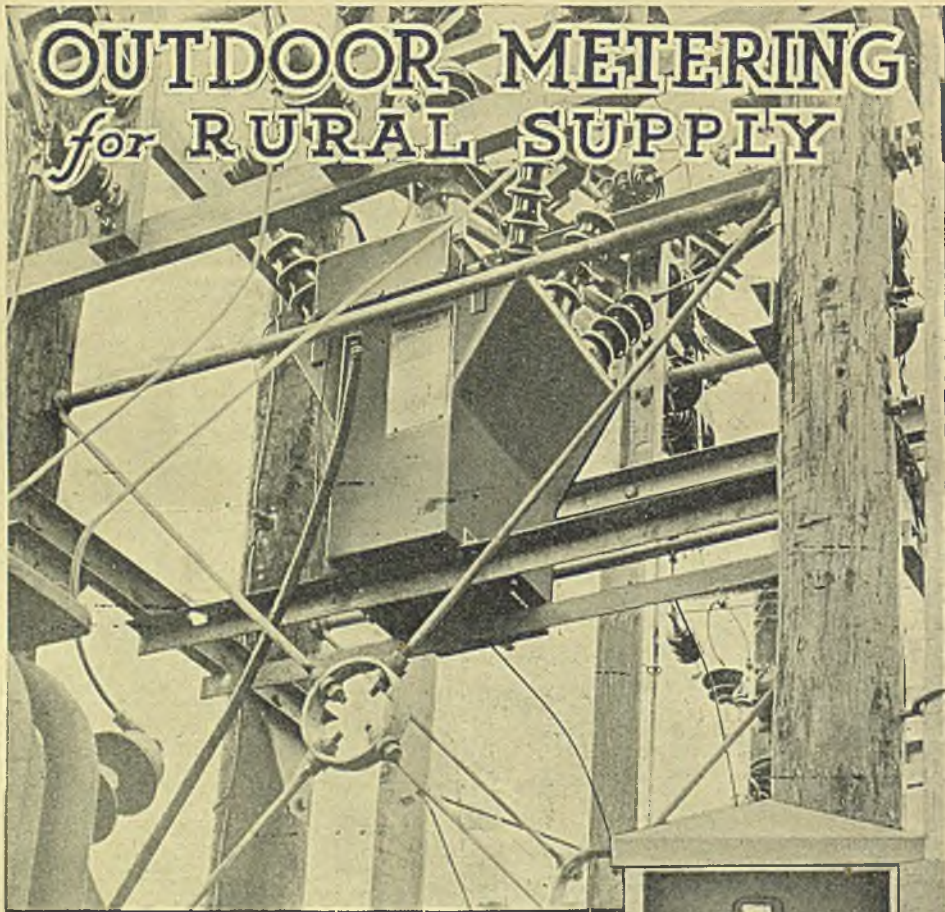
ESTABLISHED 1858

WOOLWICH, -LONDON, S.E.18

TELEPHONE: WOOLWICH 2020



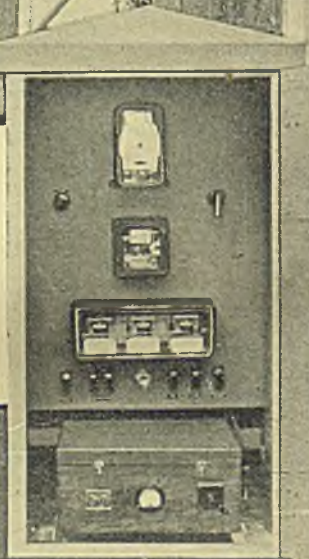
# OUTDOOR METERING for RURAL SUPPLY



This outdoor metering equipment is connected to an 11 kV system.

A voltage transformer and two current transformers are oil-immersed in the tank shown.

The kWh meter is mounted in a weather-proof steel pillar (shown inset) for mounting near the foot of the pole, but alternatively it can be housed in a sheet-steel pole-mounted cubicle.



**METROPOLITAN**  
**Vickers**  
ELECTRICAL CO., LTD.  
TRAFFORD PARK ... MANCHESTER 17.

G/A401

Switch to **METROVICK** Lighting when daylight fades



*You don't need that range of plugs? **Ho yes I do!** But one of these two takes any size of screw. **Any size screw? You're barmy, me boy!** Well, any size from 3 to 16. And fit any hole, too. **Fit any hole! Do they go round corners as well?** They fill any hole, however badly jumped. **I don't believe a word of it.** Very well, go on stocking a vast range of plugs then. **I will! I will!** OK, I hope they fall on you.*

*And remember this, because Philplugs fill the hole, no matter what kind of a hole you make, you can always make a firm fixture with Philplug Adaptas. And another thing, because you can use one of these 2 for any screw you get a perfect fixture every time — that's the beauty of Philplug Adaptas.*



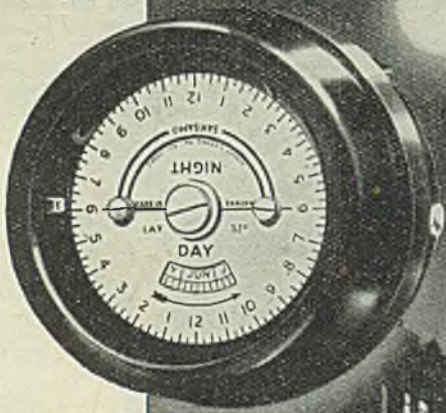
**one of these 2 for any screw . . .**

**PHILPLUGS fill the hole**

PHILPLUG PRODUCTS LIMITED · LANCELOT ROAD · WEMBLEY · MIDDLESEX · TELEPHONE: WEMBLEY 0140

C.R.C. 10a

The Solar Dial Time Switch which automatically makes its own adjustments for variation in times of sunrise and sunset during different months of the year.



## THE MAGIC EYE *of Peace*



Peace restores illumination; economy dictates rigid conservation in its use. Unnecessary fuel consumption can be avoided by installing the magic eye—the Sangamo Weston Time Switch, which turns lights on and off at predetermined times. Manual Work and supervision entirely superseded.

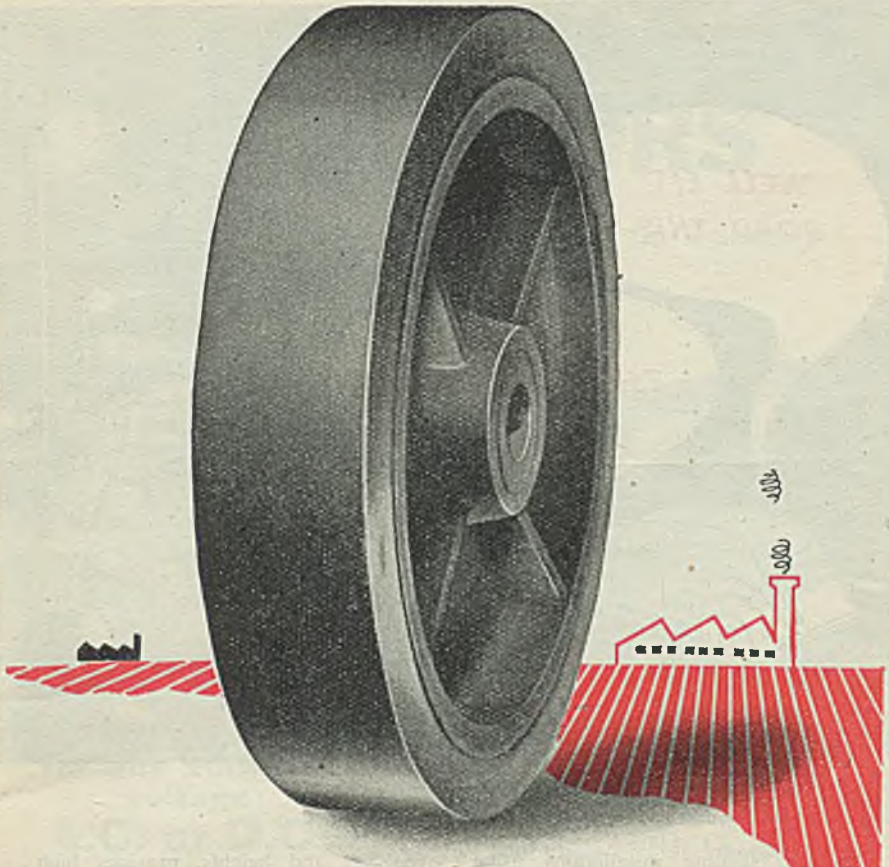
Write for full information.

# SANGAMO WESTON *Time Switches*

SANGAMO WESTON LTD : ENFIELD : MIDDLESEX

Phone Enfield 3434-1242





## PAXOLIN TYRES AND WHEELS FOR INDUSTRY

Paxolin tyres and wheels for industrial type trucks and trolleys have considerable advantages over those made from the more traditional materials. They neither distort under heavy loads nor develop flats during periods of idleness, and are practically unaffected by most materials with which they are likely to come into contact, including water, petroleum products, industrial solvents and chemicals. They will not cause sparks, and therefore can be used in explosive or inflammable atmospheres, and can, if required, form satisfactory components of an electrically insulated vehicle. Paxolin tyres and wheels can be recommended particularly for the movement of heavy loads over rough surfaces.



### THE MICANITE & INSULATORS COMPANY, LTD.

EMPIRE WORKS, BLACKHORSE LANE, WALTHAMSTOW, LONDON, E.17.

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN (Synthetic-resin laminated sheets, rods, tubes and cylinders). HIGH-VOLTAGE

BUSHINGS and TERMINALS for indoor and outdoor use. EMPIRE varnished Insulating Cloths and Tapes and all other forms of Electrical Insulation. Suppliers of Vulcanised Fibre, Leatheroid, Presspahn, etc. Distributors of Micoflex-Duratube Sleeveings and Kenutuf Injection Mouldings (P.V.C.).



Engineering & Lighting Equipment Co. Ltd.,  
 "Golden Ray" Lanterns at 120' x 25' with  
 Philips SO/H 140W Sodium Lamps.

**P**UBLIC lighting installations using Philips mercury or sodium lamps are ensuring road safety all over the country and in many parts of the Empire. The use of these efficient light sources, in suitable lanterns at recommended

spacings and heights, provides high visibility for low lighting costs and energy consumption. Philips Illuminating Engineers are at your disposal in all parts of the United Kingdom to give lighting advice without obligation.



# PHILIPS DISCHARGE LIGHTING

**FLUORESCENT**

**MERCURY**

**SODIUM**

PHILIPS LAMPS LIMITED. (LIGHTING DEPARTMENT)  
 CENTURY HOUSE, SHAFESBURY AVENUE, LONDON, W.C.2

Branches at : Birmingham, Bristol, Blackburn, Cardiff, Edinburgh, Glasgow, Leeds, Liverpool, Manchester, Newcastle-on-Tyne, Nottingham, Sheffield. (215B)

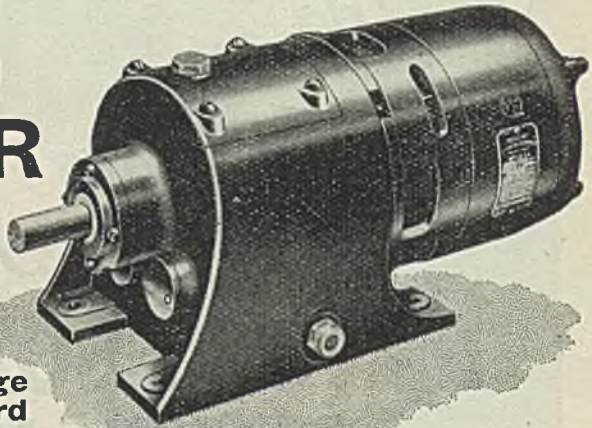




# FRACTIONAL HORSEPOWER MOTORS

*The most popular in the country*

## LOW- SPEED MOTOR UNITS



A complete range  
for any standard  
voltage  
**A.C. or D.C.**

Designed and built as  
a unit incorporating  
an electric motor and  
speed reducing gear.

**SPUR OR  
WORM GEARS**

Spur-gear'd  $\frac{1}{2}$  H.P. Low-speed  
Motor Unit with co-axial shaft  
for speeds down to 22 r.p.m.

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

# BTH

# RUGBY

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

J303 A





**The New** *B.I. Callender's*  
**FUSE BOX FOR  
 STREET LIGHTING**

Our new D.P. Street Lighting Fuse Box for looped in and out L.T. cables up to 0.0225 square inches incorporates a novel design which prevents moisture from creeping into the fuse box, thus effectively counteracting condensation and rain water seepage down the V.R. cables inside street lighting standards. The three-point attachment cast iron box, with single drop-down cover hinged at base and secured by a captive nut, carries two 15 amp. capacity H.O. type fuses and will fit into most cast iron, hollow steel or pre-cast concrete lamp standards. Change over links, if required, can be supplied.

**BRITISH INSULATED CALLENDER'S CABLES LIMITED**  
 NORFOLK HOUSE, NORFOLK STREET, LONDON W.C.2



GET ALL THE LIGHT YOU PAY FOR

MAKE THE MOST OF YOUR

EDISWAN LAMPS

YOU'D GET MORE LIGHT TO READ IN BED.

Make the most of your ROYAL EDISWAN LAMPS

From all Electrical Suppliers

THE EDISON SWAN ELECTRIC CO. LIMITED

DECORATE WITH LIGHT

EDISWAN LAMPS

Make the most of your ROYAL EDISWAN LAMPS

From all Electrical Suppliers

THE EDISON SWAN ELECTRIC CO. LIMITED

HOMEWORK WHAT THE LAMP IS TOO FAR FROM GEORGE & KITTY

Make the most of your ROYAL EDISWAN LAMPS

From all Electrical Suppliers

THE EDISON SWAN ELECTRIC CO. LIMITED

Illustrated here are specimen Window Displays and advertisements which are being used in our Autumn and Winter Lamp campaign.

Please ask your nearest EDISWAN Depot for full details, and particulars of showcards and other interesting material available.

Remember the public will be asking for Royal "Ediswan" Lamps by name.

# ROYAL "EDISWAN" LAMPS

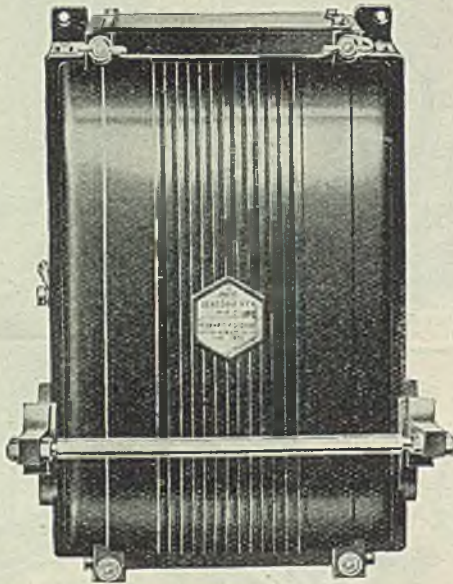
L.77



THE

EDISON SWAN ELECTRIC CO. LIMITED

# The NEW "Glasgow-Rex"



## The Famous M.E.M. Ironclad Switch re-designed for H.R.C. Fuses



The new "Glasgow-Rex" H.R.C. is the first of the M.E.M. programme of new developments. Its attractive styling is the work of a prominent industrial artist and is in keeping with the advanced design of the whole unit. Easily convertible for different duties and surprisingly compact, this new version of an already world-famous switch is convincing proof of the M.E.M. leadership in switchgear design.

The "Glasgow-Rex" complies fully with Home Office regulations and the

"Kantark" H.R.C. standard cartridge fuses with B.S.S. 88/1939 A.C.4 and D.C.3. Appearance, workmanship and finish of these switches will win the admiration of engineers everywhere. Yet this high quality equipment is offered at reasonable prices. Only M.E.M. intensive specialisation could produce such value.

A descriptive list No. 278 is available giving full details of the new "Glasgow-Rex" range rated from 30-200 amps. Send for your copy today.



*Switch, fuse and motor control gear, electric fires  
and localised lighting equipment*

**MIDLAND ELECTRIC MANUFACTURING CO. LTD., BIRMINGHAM, 11**

BRANCHES IN LONDON & MANCHESTER



IF YOU WANT TO  
 MAKE OR BREAK  
 HALF A THOU' OR  
 2½ MILLION KVA

*Switchgear  
 Specialists*

**REYROLLE**  
**REYROLLE**

*Hebburn-on-Tyne  
 England*

WE  
 CAN  
 HELP  
 YOU





## *'This time, gentlemen, I got an **ATLAS**'*

Atlas lamps preside at many a Board meeting . . . throwing light on important decisions . . . staying bright when speeches get dull! More and more responsible people are choosing Atlas lamps because engineers, electricians and those who take the trouble to check up on light values know that there is no better lamp. Every Atlas lamp is guaranteed to be made to strict B.S.I. specification and is tested at each stage of manufacture. Write for terms today.

### **A COMPLETE LIGHTING SERVICE**

Our lighting engineers will supply you with exactly the lighting you need, exactly where you need it. We design and supply modern fittings, using new materials boldly, yet

planned with common sense and 'eye-appeal'. We offer you a complete, individual lighting service. Why not get in touch? There is no obligation.

# **ATLAS LAMPS**



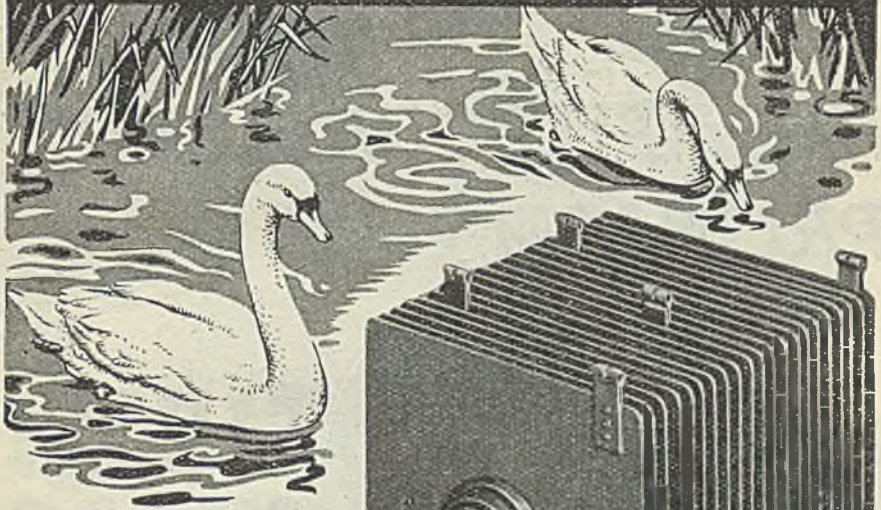
*for STAYING POWER*

**THORN ELECTRICAL INDUSTRIES LTD., 105-109 JUDD ST., LONDON, W.C.1. Tel. Euston 1183**

**NORTHERN BRANCH: STEVENSON SQUARE, MANCHESTER 1. TEL. CENTRAL 3185  
N.E. DEPOT: 46 SANDHILL, NEWCASTLE-ON-TYNE 1. TEL. NEWCASTLE 24068**



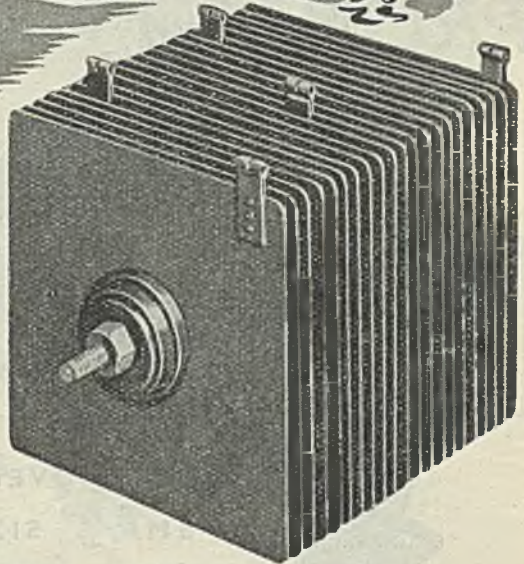
## HOW LONG DOES IT LIVE ?



### *The Swan . . .*

How often have you admired the swan as it glides smoothly across the lake? But did you know that this graceful inhabitant of our waterways has an average life of 20 years and some have even reached 70?

There is a lot to admire too in the Westinghouse metal rectifier, and one of its chief attributes also is its long and useful life. Many equipments have already been in continuous use for over 20 years and show no signs in falling off in output. One thing is certain—there are no more reliable rectifiers than

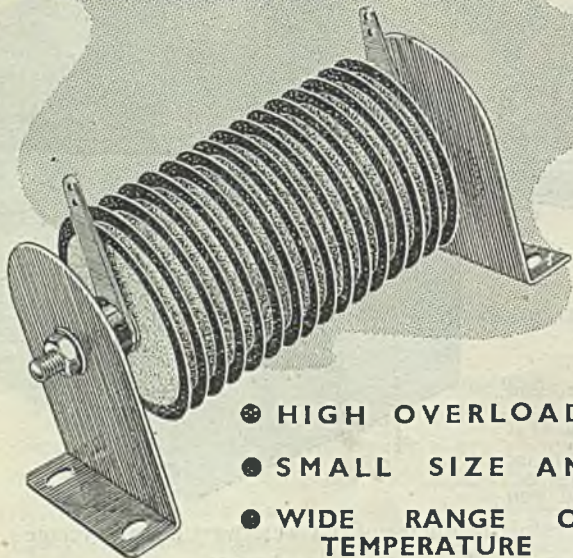


## METAL RECTIFIERS

**WESTINGHOUSE BRAKE & SIGNAL CO. LTD.**  
82, YORK WAY, KING'S CROSS; LONDON, N.1



LET **SenTerCel**  
REGISTERED TRADE MARK  
 RECTIFY YOUR A.C.-D.C.  
 PROBLEMS



- HIGH OVERLOAD CAPACITY
- SMALL SIZE AND WEIGHT
- WIDE RANGE OF WORKING TEMPERATURE
- SMALL TEMPERATURE/RESISTANCE VARIATION

**SenTerCel**  
REGISTERED TRADE MARK

SELENIUM RECTIFIERS

*Standard Telephones and Cables Limited*

(RECTIFIER DIVISION)

OAKLEIGH ROAD, NEW SOUTHGATE, LONDON, N.11

Telephone: ENTerprise 1234

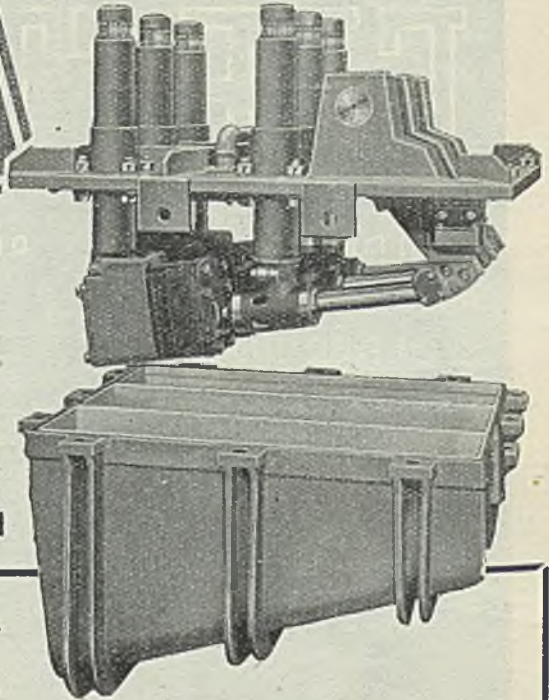
Telegrams: "Esseecee, Telex. London"



LOW OIL CONTENT • COMPLETE PHASE-SEGREGATION

TYPE  
D7

# OIL CIRCUIT BREAKER



500 & 750 MVA  
6.6 & 11 kV  
up to 1600 Amp.

*Fully tested and Certificated in  
accordance with BS 116/1937, Pt. 2*

The type D.7 low-oil-content circuit-breaker is of the completely phase segregated, arc-controlled horizontal single-break design. The breaker mechanism is simple, robust and trip-free, and has a high-speed operating characteristic.

# COOKE & FERGUSON

ELECTRICAL DIVISION

LIMITED

VICTORIA STREET  
MANCHESTER II



40-41 CRAVEN HOUSE  
KINGSWAY, W.C.2



# ELECTRIC

SOLDERING IRON

BRANDING IRON

ENGRAVING PEN

DRYING OVEN

SOLDER POT

GLUE POT



**BUCK & HICKMAN LTD.**

(ELECTRIC TOOLS DIVISION)

23 Albemarle Rd., Beckenham, Kent  
 27/32 Whitall Street, Birmingham  
 47/49 Robertson Street, Glasgow  
 13/15 Albion St., Gaythorn, Manch'r  
 264 Water Rd., Alperton, Middx.

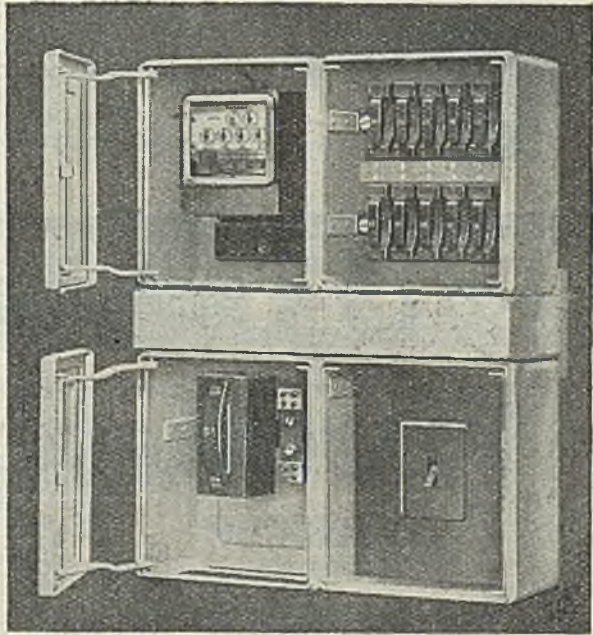


**NEAT..****COMPLETE****EASY to EXTEND**

## *The MODERN Electrical Distribution Unit for all kinds of buildings*

You build for the future as well as the present when you install CEMDU. The complete enclosure of all components—fuses, switch and meter—with no trailing wires or danger of dirt and damp getting at any part, reduces risk of trouble, whilst everything is arranged within easy sight and reach.

A CEMDU installation makes future extension to the Distribution System so much easier, without the need for costly and troublesome alteration. CEMDU is the MODERN System and is available in a number of arrangements in order to meet any particular requirement.



# CEMDU

CARLISLE ELECTRICAL  
MAINS DISTRIBUTION UNIT

*Write for full details to the Sole Makers.*

## CARLISLE

ELECTRICAL MFG. CO., LTD.

BENTCLIFFE WORKS, ECCLES, LANCS.

Phones: Eccles 1691-2-3-4.

grams: "Carlectric" Eccles.

CI



The registered Trade Mark on Ashley Electrical Accessories is a guarantee of reliability and of quality second to none.



It is regretted that supplies are still far short of customers' requirements, but output is being distributed in strict fairness to all.

As the raw material situation improves, delays and shortages will be eliminated.

**ASHLEY ACCESSORIES LTD**  
MANUFACTURERS OF ELECTRICAL ACCESSORIES  
**ULVERSTON · LANCASHIRE**

# FLUORESCENT STARTER SWITCHES

□  
 FULL RANGE OF MODELS EX STOCK



THE STANDARD  
 MODEL  
 S.B.C. TYPE  
 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

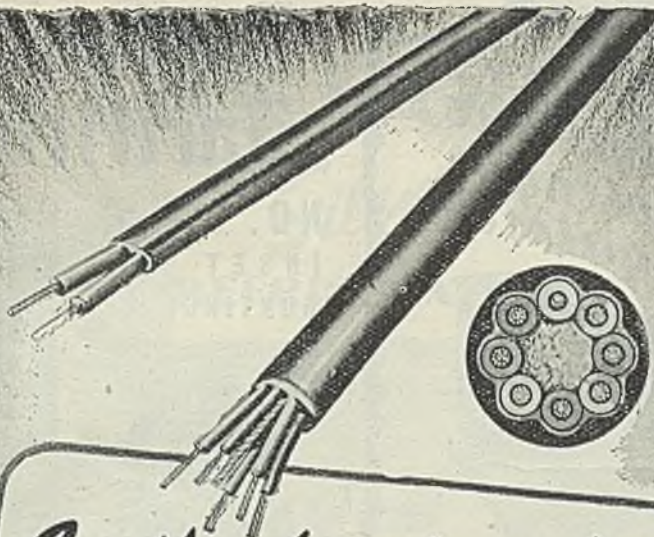
FLUORESCENT CHOKES EX STOCK

**THE ACRU ELECTRIC TOOL MANUFACTURING CO. LIMITED**

123, HYDE ROAD, ARDWICK, MANCHESTER, 12

Phone: ARDWICK 4284





*In the forefront of  
Cable Development*  
**'ASHTON'**

*Cables and Flexibles*

The wide range of 'ASHTON' Cables, Flexibles and Cords includes types and finishes to meet every requirement.

Manufactured under the strictest laboratory supervision throughout and finished to perfection: they are of the finest quality obtainable.

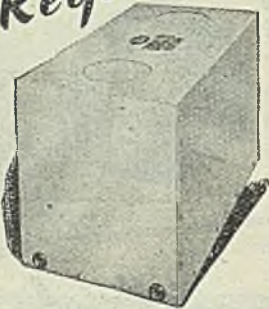
Supplies are available from numerous distributors throughout the country, but in case of difficulty in obtaining your requirements write direct to the makers.

**AERIALITE LTD**  
STALYBRIDGE · CHESHIRE





## Automatic Voltage Regulator



- CONSTANT A.C. OUTPUT
- WIDE A.C. INPUT LIMITS
- ENTIRELY AUTOMATIC
- QUICK ACTION

The constant A.C. input voltage called for in so many modern industrial and laboratory applications is provided with maximum accuracy and reliability by B.A.T. Automatic Voltage Regulators. Seven standard nominal ratings are carried in stock, 10-2,500 Watts, giving  $230\text{ V} \pm 0.5\%$  with 190-255 input. (Other ratings to special order.)

Excellent deliveries can be arranged, mostly from stock. No priority or "M" Certificates required. Please request Bulletin W.R. 10744 for complete data.

### ALSO SUPPLIERS OF

Static Mains Transformers of all types and "Variac" infinitely variable voltage regulating transformers.

# Claude Lyons LTD

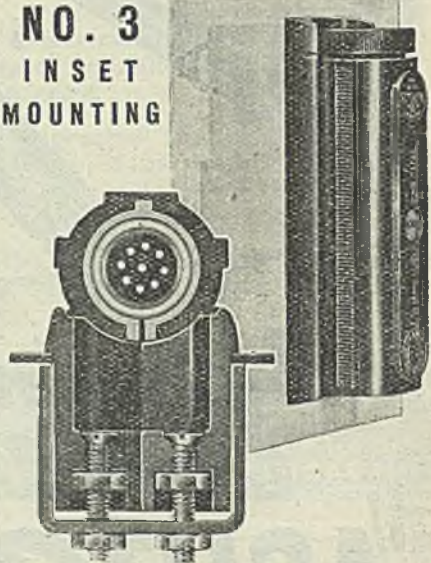
ELECTRICAL AND RADIO LABORATORY APPARATUS, ETC.

180 Tottenham Court Road, London, W. 1  
and 76 Oldhall Street, Liverpool Lancs.

THE ELECTRICIAN

# Fusing Facilities

NO. 3  
INSET  
MOUNTING



An unique facility of interest to designers and makers of Control Panels and similar equipment embodying flush mounted instruments, switches, etc. Frontal projection is reduced to one half the overall fuse depth and connections may be made direct into the base ends instead of through the usual back-studs. A simple fixing clip, as illustrated, eliminates the use of visible panel screws, thus facilitating ease of assembly and maintenance. Let us submit a sample mounting. You'll fall for it, sure!

Exclusive to the NEW 5 to 100 amp.

# SLYDLOK

## VIBRATION PROOF FUSES

EDWARD

*Wilcox*

& CO. LTD.

SHARSTON ROAD • WYTHENSHAW  
MANCHESTER

d.m. E.W.8

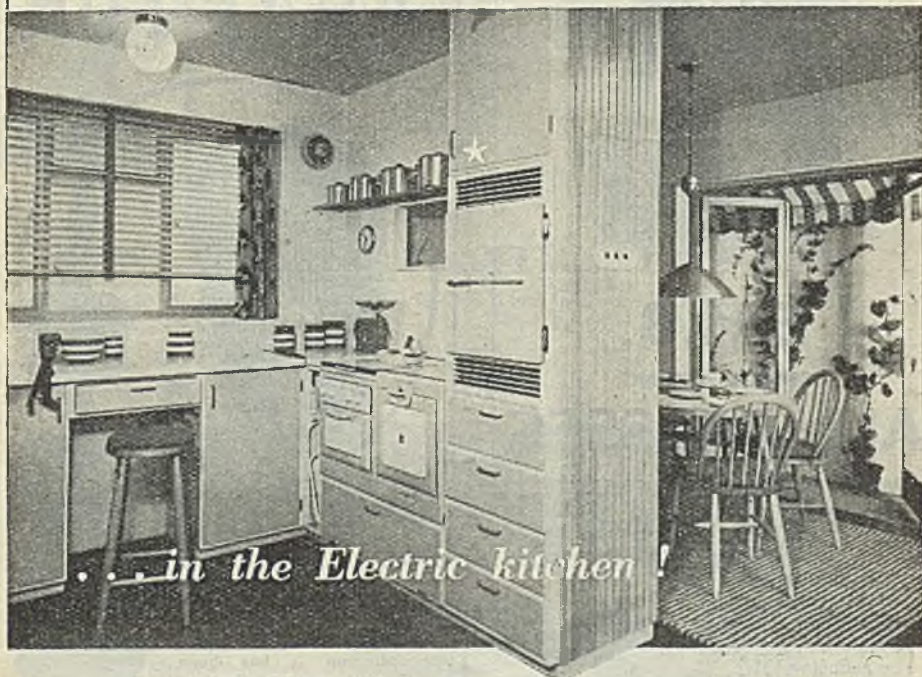
8 NOVEMBER 1946



# ★ Electrolux

## *Silent*

### REFRIGERATION



*... in the Electric kitchen!*

Here's the Electric Kitchen shown at the "BRITAIN CAN MAKE IT" Exhibition with its Electrolux Silent Refrigerator built in at convenient waist height.

Electrolux 'built-in' Refrigerators, which can be operated by Electricity, are once again in production; regular and adequate deliveries can be made in 1947 for Housing Schemes.

As Electrolux has no machinery, or moving parts, this means freedom from vibration, absence of wear and tear, low maintenance cost, all-round-dependability and, above all, absolute *silence* at all times.



By Appointment  
Refrigerator  
Makers

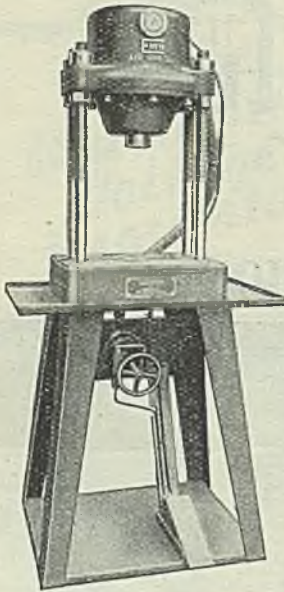
**ELECTROLUX LTD • LUTON • BEDS.**

Head Office: 153/5 Regent Street, London W.1

Also Manufacturers of the famous Electrolux Suction Cleaner



By Appointment  
Suction Cleaner and  
Refrigerator  
Manufacturers



**E.M.B.**

DIRECT ACTING

**AIR PRESSES**

WITH CONTROLLED PRESSURE

for— punching  
riveting clipping  
forming assembling

- Controlled pressure feature gives any pressure from zero to full line instantly by reducing valve.
- Operating valves fitted close to cylinder to give quick action.
- Interlocked safety guards available at extra cost.
- "GO" and "NOT GO" device for correct fit assembly available as an extra.
- Delayed action device available as an extra, ensures that required pressure is definitely obtained.

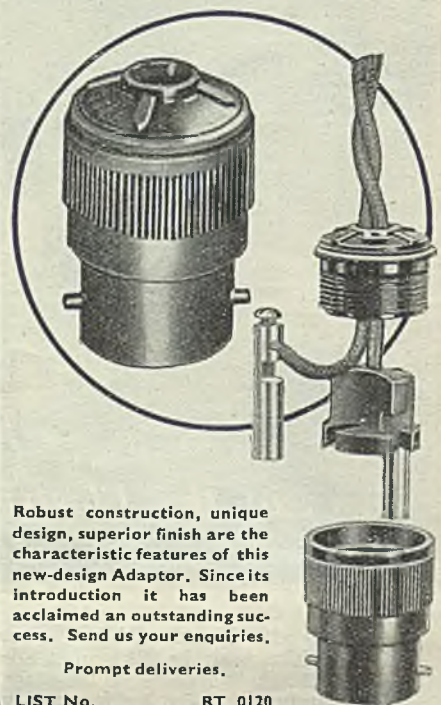
5 sizes:—1, 2, 4, 7 and 11 tons at 80 lbs per sq. in.

EARLY DELIVERY

**E.M.B. CO. WEST LTD. BROMWICH**

**NETTLE**

*Improved*  
**B.C.  
ADAPTOR**



Robust construction, unique design, superior finish are the characteristic features of this new-design Adaptor. Since its introduction it has been acclaimed an outstanding success. Send us your enquiries.

Prompt deliveries.

LIST No. . . . . RT. 0120

**VICTOR H  
IDDON** *Ltd*

HARPER ROAD  
WYTHENSHAW  
MANCHESTER



*A beautiful and  
practical table lamp*



**AVAILABLE FOR  
IMMEDIATE DELIVERY**

The "Wandalite" Adjustable Table Lamp gives light exactly where you want it; always "stays put" yet its balanced action moves at a finger's touch. One of the many good things the Cornercroft organisation has in hand.

Write for Illustrated  
Leaflet and Trade Terms.

REGISTERED MARK  
**WANDALITE**  
ADJUSTABLE TABLE LAMP

**CORNERCROFT (PLASTICS) LTD.**

*subsidiary of Cornercroft Ltd. ACE WORKS, COVENTRY*

WL.13

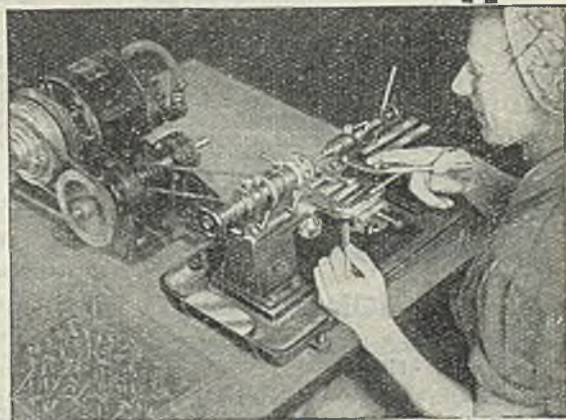
*It's possible to turn a hair on a*  
**PULTRA MICRO-LATHE**

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.

**PULTRA**  
MANCHESTER



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

You are looking  
for . . . .

- Cover Plates and Formers for Electric Iron Elements.
- Mica pieces for Toasters.
- Mica and Micanite pieces for Kettle Elements.
- Mica stamping in a myriad shapes.
- Condenser Blades.
- Laminated Plastic Tubes.
- Micanite Tubes.

We have large manufacturing capacity and good raw material stocks.

Your enquiries and problems will receive our unsurpassed service.

## LANGLEY LONDON LTD.

161 BOROUGH HIGH ST., LONDON, S.E.1  
ENGLAND

Phone : Grams :  
HOP 2946 (P.B.E.) Laglycol, Phone, London

## MISCELLANEOUS ADVERTISEMENTS

### TENDERS

#### CITY OF BIRMINGHAM ELECTRIC SUPPLY DEPARTMENT.

DOMESTIC ELECTRICAL APPARATUS.  
The Electric Supply Committee invites Tenders for the following Domestic Electrical Apparatus to be delivered as required for a period of twelve months from date of contract:—

| Specification No. | Item.                                   |
|-------------------|---|
| APP. 31.          | Kettles.                                |
| .. 32.            | Aluminium Saucepans.                    |
| .. 33.            | Cookers.                                |
| .. 34.            | Wash-boilers.                           |
| .. 35.            | Water Circulators.                      |
| .. 36.            | Storage Water Heaters (1½ (1½ gallons). |
| .. 37.            | Cooker Control Units.                   |
| .. 38.            | Circulator Control Panels.              |

The General Conditions of Contract (which include the Corporation's Fair Wages and Conditions of Labour Clause), Specifications and Forms of Tender, may be obtained on application to the undersigned, stating which Specifications are required.

Sealed Tenders, enclosed in the official envelope provided, and endorsed for the purpose, must be delivered to the undersigned NOT LATER THAN 10 A.M. ON MONDAY, 25th NOVEMBER, 1946, when they will be opened. Tenders not complying with the foregoing will be rejected.

F. W. LAWTON,  
Chief Engineer and Manager.

14, Dale End,  
BIRMINGHAM, 4.

#### BOROUGH OF EPSOM AND EWELL.

##### ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply, delivery and erection of the following:—

- (a) 1—500 K.V.A. 3 phase Transformer
- (b) 1—10 panel 11 000 v. 150 M.V.A. Truck type Switchboard.

Specifications and Tender Forms may be obtained from W. B. Hayden, M.I.E.E., Borough Electrical Engineer, Electricity Showrooms, Church Street, Epsom, upon payment of one guinea which will be refunded on receipt of a bona fide tender. Additional copies may be purchased at a cost of 5s. each.

Tenders on the prescribed forms, in sealed envelopes endorsed "Tender for Transformer" or "Tender for Switchgear," as the case may be, must reach the undersigned not later than 10 a.m. on Monday, 16th December, 1946. No name or mark indicating the sender must be placed on the outside of the envelope. Any Tender not complying with these requirements will not be considered.

The Council do not bind themselves to accept the lowest or any Tender.

EDWARD MOORE.

Town Hall, Town Clerk.  
The Parade, EPSOM, Surrey.  
October 31st, 1946.

#### SITUATIONS VACANT

#### IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

(City and Guilds College.)

THERE is a vacancy in the Electrical Engineering Department, on the side of electrical machine and power, for an Assistant Lecturer. The appointment is for a period of three years with salary of £400 p.a. with F.S.S.U. superannuation. An Honours Degree and some practical experience of heavy electrical engineering are essential.

Applications, accompanied by full statement of qualifications, and with references, should be sent to the Head of the Electrical Engineering Department, City and Guilds Colleg., Exhibition Road, London, S.W.7.



## SITUATIONS VACANT

**BOROUGH OF HARROGATE.  
ELECTRICITY DEPARTMENT.****Appointment of Borough Electrical Engineer's  
Secretary.**

APPLICATIONS are invited from suitably qualified persons, male or female, for the above permanent position. The duties will include the supervision of the shorthand-typing and filing staff. Applicants should be expert shorthand-typists and conversant with modern filing methods, whilst a knowledge of the terms in use in the Electricity Supply Industry will be an advantage.

The post is graded within the Clerical Division of the National Joint Council's Scales salary £315 to £360 (Males) and £252 to £288 (Females), subject to Cost of Living Bonus at present £59 16s. and £48 2s. respectively.

The appointment will be subject to the National Joint Council Scheme of Conditions of Service, the provisions of the Local Government (Superannuation) Act, 1937, and to the successful candidate passing a medical examination.

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

Candidates, when making applications, must disclose in writing whether, to their knowledge, they are related to any member or Senior Officer of the Council.

Applications, giving full particulars of qualifications, should be addressed to me at the undernoted address, the envelopes being endorsed "Secretary," and should reach me not later than the 15th November, 1946. Copies of testimonials are not required, but the names of three referees should be given.

A. KELSO,  
Borough Electrical Engineer,  
Municipal Offices,  
Harrogate,  
Yorks.

30th October, 1946.

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

**A . S . E . E .****Employment Bureau**

The Association of Supervising Electrical Engineers invite employers, seeking the services of fully qualified Electrical Engineers for administrative and Supervisory positions, to avail themselves of the Association's Employment Bureau.

There are no charges, and only suitably qualified applicants are submitted.

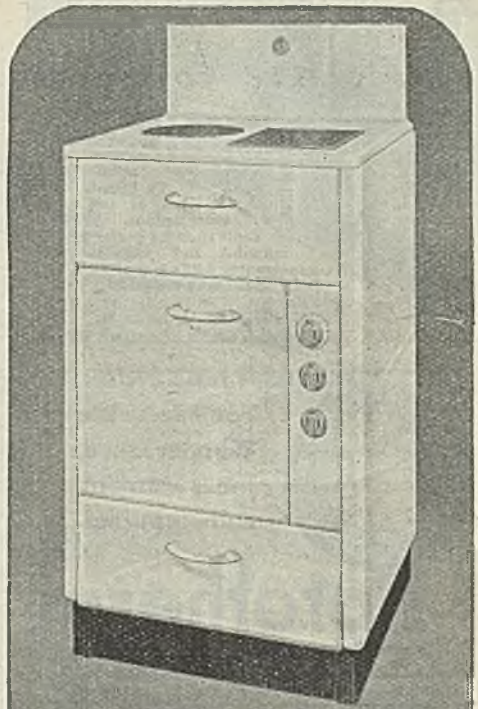
Enquiries to

THE GENERAL SECRETARY

The Association of Supervising  
— Electrical Engineers —

54, Station Road, New Barnet, Herts.

Barnet - - - 673112

*A magnificent job*

As with all Falco products, the beauty of this new electric cooker grows out of functional efficiency. Every part is soundly conceived and fashioned to fulfil its purpose. Points of particular interest are:—entire absence of dirt-traps (no awkward corners or protrusions); drop-down oven door to facilitate the handling of hot pans and dishes; a utility drawer for keeping sundry appliances handy.

**THE FALCO '15'**

*Streamlined*

**ELECTRIC COOKER**

FALCO ELECTRICAL APPLIANCES LTD

(Prop. : Allied Ironfounders Ltd.)

COALBROOKDALE, SHROPSHIRE






**GREY & MARTEN LTD.**

*for* **GOLDER** *for*

all Electrical Work.  
To British Standard or any other specifications. With a reputation for purity of constituents and excellence of appearance. **GREY & MARTEN, Ltd.**  
Southwark Bridge, S.E.1.

Phone: Hop 0114. Grams: Amalgam, Boroti  
BIRMINGHAM: 11, James St.

Phone: B'ham 3 Cent. 6006. Grams: Amalgam, B'ham.



For accurate  
Temperature,  
measurement  
and control.

**Rototherm**

THE BRITISH ROTOTHERM CO., LTD.,  
Merton Abbey, S.W.19. Liberty 3406.



*Capital for the job!*

## CABLE END FERRULES

Strong, accurate, well made and highly finished ferrules in casein plastics, giving brilliant and permanent colours for quick identification in even the poorest lighting conditions. Standard colours: black, white, blue, green, yellow and red. Plain, or engraved to customers' own requirements.

Manufacturers:

**CRITCHLEY BROS. LTD.**  
**BRIMSOMBE · STROUD · GLOS.**

### SITUATIONS VACANT

#### CITY OF BRADFORD ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the following appointments on the staff of the Department:—

- (a) ONE ELECTRICAL DRAUGHTSMAN.  
(b) ONE MECHANICAL DRAUGHTSMAN.  
(c) ONE CLERK OF WORKS (Sub-stations).

Candidates must have a sound knowledge of Drawing Office practice and have had experience in the preparation of drawings and specifications for power station and sub-station plants. Corporate Membership of the appropriate Professional Institution or exempting qualifications will be an advantage.

Applicants for the post of Electrical Draughtsman should have sound knowledge of high voltage and low voltage switchgear installation, and experience of cable work and electrical equipment generally.

Applicants for the position of Mechanical Draughtsman should have experience in the lay-out of boiler plant, turbine plant and pipework.

Applicants for the post of Clerk of Works should have experience in the supervision of erection of buildings and the installation of electrical equipment.

The salaries and conditions of employment will be in accordance with the N.J.B. Agreement, the salary for positions (a) and (b) being that attaching to Class H, Grade 8b (£429/438/447), and for position (c) that attaching to Class H, Grade 9a (£365/373/381).

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

Applications, stating age and giving details of education, technical training and experience, together with copies of two recent testimonials, must reach the undersigned not later than Tuesday, the 26th November, 1946.

T. H. CARR.

Electrical Engineer and Manager.

45-53, Sunbridge Road,

BRADFORD.

November, 1946.

### MINISTRY OF EDUCATION.

#### H.M. INSPECTORS.

APPLICATIONS are invited from men and women for posts as H.M. Inspectors under the Ministry of Education. Candidates, who should be under 50 on the 31st March, 1947, should possess appropriate professional qualifications and/or degrees, together with teaching experience in technical colleges or universities, and industrial experience in one of the following:—

Textiles, Electrical Engineering, Aeronautical Engineering, Industrial Chemistry (Artificial Fibres, Food Technology), Building.

Those candidates who appear most suitable from their application forms will be invited to appear before a Selection Board in London.

The posts, which are permanent and pensionable, carry a salary scale of:—

£750 by £30—£1 050 by £50—£1 200 (Man), and £600 by £25—£750 by £30—£1 025 (Woman), together with a consolidated addition varying from £90 to £120 for men, and £72 to £96 for women. Inspectors working in the London area receive an additional £50 at each point of the scale.

In special cases, successful candidates may be appointed at a commencing salary above the minimum.

Further particulars, together with the application form, may be obtained on application in writing to The Secretary (Inspectors' Section), Ministry of Education, Belgrave Square, London, S.W.1.



**SITUATIONS VACANT  
BOROUGH OF LUTON.  
ELECTRICITY UNDERTAKING.**

**A** PPLICATIONS are invited for the following appointments:—

**(1) Assistant Mains Engineer (Development).**

Candidates must have sound technical training and first-class experience of distribution technique and should give details of distribution work on which planning experience has been obtained. The successful candidate will be required to specialise on development work in urban and rural areas and will work in close co-operation with the Assistant Distribution Engineer (Operation) under the Distribution and Mains Engineer and in close liaison with the Technical and Constructional Engineer. He will be responsible for the detailed layout, estimates and programming of schemes involving underground cables, overhead networks and Sub-stations, also changeover from D.C. to A.C. of the remaining D.C. portions of the urban areas.

Salary will be in accordance with the National Joint Board Schedule, Class J, Grade 6 (at present £616, rising to £644 per annum).

**(2) Domestic Representative (2 Vacancies).**

The successful candidates will be required to carry out consumer service activity with domestic consumers within the Undertaking's area of supply. Candidates should be between 25 and 35 years of age, and must possess practical experience of domestic wiring installations, be familiar with positioning service terminals and meters, and have a full knowledge of domestic appliances and the application of electricity. Preference will be given to candidates who possess specialist experience on water heating.

Salary will be in accordance with the National Joint Board Schedule, Class J, Grade 10 (present salary £355, rising to £371 per annum).

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

Applications, giving age, details of training and experience, present position held, and accompanied by copies of three recent testimonials, should be delivered not later than Friday, 22nd November, 1946, to C. T. Melling, M.Sc.Tech., M.I.E.E., M.I.Mech.E., Borough Electrical Engineer, Electricity Offices, St. Mary's Road, Luton.

Canvassing directly or indirectly will be a disqualification.

W. H. ROBINSON,

Town Hall, Luton, Beds. Town Clerk  
31st October, 1946.

**BRIERFIELD URBAN DISTRICT COUNCIL.  
ELECTRICITY DEPARTMENT.**

**Electrician.**

**A** PPLICATIONS are invited for the position of Electrician on the permanent staff of the above Department.

Applicants must have had practical experience in erecting, testing, connecting and maintaining all types of electrical apparatus and carrying out and maintaining all classes of wiring.

Wages and Working Conditions in accordance with the D.J.I.C. (No. 3 North Western Area), Schedule, Electricity Supply Industry. Present rate 2s. 2.63d. per hour for a 47-hour week.

Applications, endorsed "Electrician," stating age and experience, and accompanied by copies of recent testimonials, are to be delivered to the undersigned not later than mid-day, Saturday, 16th November, 1946.

L. G. ASTON, A.M.I.E.E.,

Electrical Engineer and Manager,  
Electricity House,  
Colne Road,  
BRIERFIELD, Lancs.  
4th November, 1946.



**MICA**

DISCS  
DIAPHRAGMS  
ELEMENT STRIPS  
CONDENSER PLATES  
STOVE PANELS  
RAW MICA  
WASHERS  
etc

BRITISH MICA C<sup>o</sup> L<sup>td</sup> -BEDFORD.

**BIRMINGHAM PRODUCTS Ltd.,**

176-178, NEWHALL ST., BIRMINGHAM 3.

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

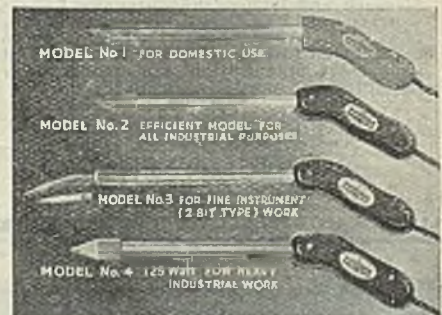
ROLLED THREAD SCREWS, WOOD SCREWS,  
BOLTS AND NUTS, RIVETS, WASHERS, ETC.

LARGE STOCKS CARRIED.

'Grams :  
ROLTHRED, B'HAM.

'Phone :  
CENTRAL 2661-2-3-4.

**Rockman  
SOLDER GUNS**



*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



## REWINDS

MOTORS, GENERATORS, TRANSFORMERS  
ALL SIZES WITH THE MINIMUM DELAY

FOR EFFICIENT SERVICE WIRE

"PORTER," LINCOLN

PENNEY & PORTER (1932) LTD.,  
LINCOLN

Grams: Porter.

Phone: 1706/7.

## INSTRUMENT WIRES INSULATING MATERIALS

WEST INSULATING COMPANY  
LTD.,

2, Abbey Orchard Street,  
Westminster, London, S.W.1

## EXPERTS ON EXPORTS

Sit back and let us iron out your Export worries. MARKETING, SHIPPING FORMALITIES AND EXPORT FINANCE are taken care of by our Service. Our world wide sales organisation can handle your products now. Get in touch with

**STANDHAM  
EXPORTS**  
*Limited*

LLOYD'S HOUSE, LLOYD ST., MANCHESTER



## SITUATIONS VACANT

### CIVIL SERVICE COMMISSION.

APPLICATIONS are invited for the following posts at the Royal Military Academy, Sandhurst:—

Head of Department of Applied Science and Electro-Technics.

Head of Mathematics Department.

Head of Department of Modern Studies.

Head of Department of Languages (French, German, Spanish).

Senior Lecturers and Lecturers in Science (Physics, Chemistry, Engineering).

Senior Lecturers and Lecturers in Mathematics.

Senior Lecturers and Lecturers in Modern Studies.

Senior Lecturer in Languages (French, German, Russian).

The inclusive scales of salary are (Heads of Department) £950 by £30—£1100, (Senior Lecturers) £650 by £25—£850, (Lecturers) £400 by £20—£600.

Every assistance will be given in finding accommodation.

Candidates must be of British nationality and must have not less than a second class honours degree. Successful candidates should be prepared to take up duty on 1st January, 1947, or as soon as possible after that date. The posts are permanent with Superannuation benefits under the Federated Superannuation System for Universities.

Full particulars of the posts and a form of application may be obtained from the Secretary, Civil Service Commission, Burlington Gardens, W.1, quoting No. 1677. Application forms must be returned to him by 28th November, 1946.

### METROPOLITAN BOROUGH OF FULHAM.

#### ELECTRICITY DEPARTMENT.

THE Council invites applications for the following position in the Electricity Undertaking:—

#### Second Architectural Assistant.

Candidates must be not more than 35 years of age and must be either a registered Architect or preferably an Associate of the R.I.B.A. Applicants must have had training and experience in the preparation of plans and specifications, bills of quantity, etc., for all types of buildings, including electricity sub-stations, showrooms, etc.

The salary will be in accordance with the A.P.T. Division IV of the National Joint Council for Local Authorities Administrative, Professional, Technical and Clerical Services commencing at £440 per annum and rising by annual increments of £15 to maximum of £485, including London weighting. Salaries are at present subject to an addition of Cost of Living Bonus amounting to £59 16s. per annum.

Forms of application may be obtained on sending stamped addressed foolscap envelope to the undersigned to whom completed applications must be returned not later than 12 noon on December 11th, 1946.

CYRIL F. THATCHER.

Town Hall.

Town Clerk.

FULHAM, S.W.6.

REFRIGERATION.—Sales Engineer Manager required to take complete control of commercial refrigeration department of a large electrical establishment in Yorkshire with many branches. Applicants must have a wide knowledge of all types of domestic and commercial refrigerating plant; also suitable practical and technical knowledge together with commercial and sales organising abilities. Reply fully, stating age, details of experience, sales results, and salary required.—Box No. 1, S.S., "THE ELECTRICIAN," 154, Fleet Street, E.C.4.



**SITUATIONS VACANT**  
**CORPORATION OF GRAVESEND.**  
**ELECTRICITY DEPARTMENT.**  
**Draughtsmen.**

VACANCIES exist in this Department for two Draughtsmen, at a salary of £413 per annum, Grade 8A, Class F, rising to £429 and thereafter to £442 or £459, according to ability. Considerable extensions are in progress on the distribution system and new offices and workshops are being designed. Power Station reconstruction is also in hand. Applicants will be considered from both manufacturing firms and supply undertakings.

One Draughtsman will be specifically required to deal with building construction work, while the other will be concerned with mains records, wiring and diagrams, etc.

The conditions of employment are those of the N.J.B. Agreement, and successful applicants will be superannuated after passing a medical examination. Applications should be sent to the undersigned before 16th November.

G. V. HARRAP, A.M.I.E.E., M.I.I.A.,

General Manager and Engineer.  
**DRAUGHTSMEN** required by switchgear engineers. Experienced in contract work, protective gear diagrams or design. Applications in writing, with full particulars, to—**FERGUSON, PAILLEN LIMITED, MANCHESTER, 11.**

**ELECTRICAL** 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.

**SITUATION FILLED**

**COUNTY** Borough of Brighton.—Chief Constructional Assistant.—This position has been filled. All applicants are thanked.

**FOR SALE**

**ONE** ton of Polished Bakelite Cuttings, mostly in pieces 6-ft. to 8-ft. long by 9 in. wide by 3 in thick.—John J. Dewhurst, The Mill, Duddington, near Stamford.

**CABLE**, 502 yds. .003 19-core V.R. L.C.S.T.A. on drum, £250.—Anderson, Angell and Co. Ltd., 22, Craven Road, W.2.

**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.

**SURPLUS** Disposal.—50% discount. R.I. Lead Alloy Sheathed Cable: 2 drums 300 yds. 37/083, 1 drum 100 yds. 61/093, 3 drums 500 yds. 91/093, 7 drums 1200 yds. 127/093. T.R.S. Single Core 660 volt Cable: 12 coils, 3 000 yds. 7/064, 3 drums 5 000 yds. 19/052, 5 drums 1 400 yds. 19/064. All original makers' packings. Must be cleared. All or any offers considered.—Electrical Agencies (Belfast) Ltd., College Street, Belfast. Phone 24813.

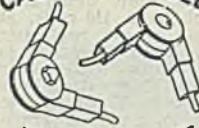
**FOR SALE**.—Two Adamson Turbo GENERATOR Sets, each direct coupled through D.B.S. reduction gear to 500 kW 400 volts. A.C. Generators by Mather and Platt, complete with surface Condensers, pumps, piping and auxiliary instruments. One vertical type Bellis and Morcom Steam ENGINE, direct coupled to two 550 amp. 230/260 volt D.C. Generators by Bruce Peebles.—Apply.—John Smith's Tadcaster Brewery Co., Ltd., The Brewery, Tadcaster, Yorkshire.

**FLUORESCENT** Starting Switches, 80 w., Thermal type, sample 8s. Trade supplied.—Hasted, 152, Elibank Road, London, S.E.9.

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

**INVISAFLEX**  
**INDUSTRIAL LOCAL**  
**LIGHTING UNITS**

**CABLE ENCLOSED**



**THROUGHOUT**

*Bench, wall  
 or universal  
 conduit base*



ELECTRICITY SERVICES LTD., 86 CANNON ST., E.C.4

**VULCANIZED FIBRE.**

**EBONITE, BAKELITE**

Sheets, Rods, Tubes and Machined Shapes.

**LEATHEROID** Sheets, Rolls, etc.

“CLIFTEX” Insulating Tapes.

Insulating Staples, Jointing, Presspahn.

**MOSES & MITCHELL LTD.**

60-68, Ironmonger Row, London, E.C.1.

**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

**PRESSPAHN, LTD.**

Electrical Insulative Material Manufacturers



EST. 1900

Telephone: **BRADFORD 5050**

Telegrams & Cables: **“PRESSPAHN” BRADFORD**

**REGISTERED OFFICES:**

**38 WELL ST., BRADFORD, England**



## FOR SALE

**EXHAUST Fans**, 2-18 in., new, 3-ph., 415 v., fitted in short circular section air trunk, £20 ea.—Smith and Hammond Ltd., 5, Buckingham Street, W.O.2. TEM. 5063.

**FOR SALE.—ELECTRIC LIGHTING PLANT.** 200 volt, 15 kW, Ruston Hornsby 22 h.p. Diesel Engine, Crompton 60 amp. Generator; Park Royal 3-panel Switchboard, 110 cells, 300 amp. hour, by P. and G., wants replating, otherwise in good order. Machinery may be inspected at the Stables, Cluny Castle, Aberdeenshire, on receiving suitable notice here. Offers to be lodged with H. R. Mollison, Factor, Cluny Estates Office, 16, Union Terrace, Aberdeen.

**ONE** practically new Kohler **ELECTRIC LIGHTING PLANT**, 10 kW, guaranteed in perfect condition. Can be seen by appointment near Corwen, North Wales. Nearest offer to £450 accepted. Apply in first instance to Herbert and Mills, Ltd., Church Road, Ashford, Middlesex.

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

**SUPERIOR** Type Builders' Ladders now in production; also Steps, Trestles and Extension Ladders.—Phone: Shaftesbury ladders, Ltd., 455, Katherine Road, E.7. Grangewood 3363/4.

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

**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.

**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.

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

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

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

**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.

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

## FOR SALE

**LAMP SHADE Wires**, any design, from own drawings or samples. Enquiries invited.—Regent Wares, 57a, Queen's Road, Walthamstow, London, E.17.

**FAN** Blowers, arranged for 60 cu. ft. of air per minute, against 3 in. Total Water Gauge. 220/50/1. 2½ in. outlet.—T. Porter and Co., Weaste Works, Salford, 5.

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

**SPECIAL MACHINES and MACHINERY** designed and manufactured. Early deliveries.—Dyne Engineering Co., 17-18, Lonsdale Road, Kilburn, London, N.W.6.

**SECTIONAL TIMBER BUILDINGS** consisting of Army and Air Ministry huts which are completely reconditioned and equal to new.

Size: 6 ft. by 6 ft.—18 ft. by 15 ft.—36 ft. by 16 ft.—80 ft. by 19 ft.—167 ft. by 16 ft. 6 in., and others.

For many years we have been supplying buildings to several of the largest business concerns in the country.

D. McMASTER & CO., 38, Mount Bures Works, Bures, near Colchester, Essex. Phone: Bures 351-2.

**DYNAMIC** Balancing Motors, Production Type, supplied in four standard sizes, accommodating electric and other rotors weighing from a few ounces up to about 5 cwt. Portable Dynamic Balancing Equipments for larger rotors of all kinds and weights, adapted for balancing operations on test-stand or on site. Early delivery.—C. F. R. Giesler Ltd., River Place, Essex Road, London, N.1.

**BRAIDED V.I.R. CABLE**, non-association size, 2 029 in 200 yd. coils. Price 30s. per coil. In excellent condition, deliveries from stock.

**COX AND DANKS LTD. PLANT AND MACHINERY DEPARTMENT, FAGGS ROAD, FELTHAM, MIDDX.** Phone: Feltham 3471.

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

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

## WANTED

**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 URGENTLY**.—One 1,000 h.p. Slip-ring or Synchronous Motor, 3 000/3 300 volts 3 phase 50 cycle, complete with control gear if possible.—Box L.S.O., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

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

**WANTED:** 250 K.W. Alternator 400/440 volts.—Particulars to Box No. L.S.R., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

## REPAIRS

**COOKERS**.—We can give good deliveries of Sheet Metal Vitreous Enamelled Electric Cooker parts.—JOHN KING & SON (ENAMELLERS), LTD., PYRO WORKS CHESTERFIELD. Phone: 5405.

**ARMATURE ROTOR AND STATOR WINDING**.—We specialise in the repair and re-wind of all types of electrical machines from fractional H.P. upwards. Special departments for vacuum cleaners, dryers, portable tools, etc. All work fully guaranteed.—Walter Crane, Greencoat Electrical Works, Westgate, Wakefield. Telephone 2472.



## MISCELLANEOUS

**BATTERY** Charges Modernised. Your old Charger made like new by specialists. Conversion from valve to metal rectification. Send for interesting leaflet "Q.D." on this service.—Itunbaken Electrical Products, Manchester. 1.

## PATENT AGENTS

**KINGS PATENT AGENCY, LTD.,** B. T. King, A.I.Mech.E. (Patent Agent), 146A, Queen Victoria Street, London, E.C.4. **ADVICE, Handbook, and Consultations free.** 'Phone: City 616L

## A. E. HILL

Chartered Patent Agent,  
27, Chancery Lane, London, W.C.2.  
Chancery 8444

## AGENTS

**L. GOODMAN (RADIO), LTD.,** 9, Percy Street, W.1, are sole London agents for the "Midco" Elongated **FLUORESCENT CHOKE** and Fluorescent Starter **SWITCHES** Museum 0216.

## AGENTS WANTED

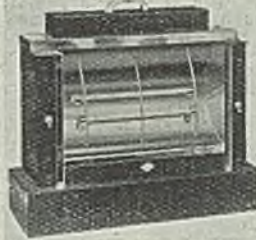
**MERRIBULL** Black Heaters are being extensively advertised in the National Press. We need area distributors. Write for Booklet and details of areas available.—J. M. Merison and Co., RUISLIP, Middx.

**APPLICATIONS** invited from interested parties wishing to be appointed as Agents for the Harbilt Electric Truck. Reply to—Harborough Construction Co. Ltd., Harbilt Works, Market Harborough, Leics.

## BROOKS &amp; BOHM LTD.

"Attracta" No. 1, 2 kw. reflector fire with two strong metal switches, one for each fire bar. Reflector made from polished heavy alloy combined with strong metal frame in assorted crackled colours. Easily carried from one room to another. Strong handle

fitted on top. Suitable length of 3-core flex supplied. Tubular element made from white clay which is easily replaced. Approx. size:—Height 15", width 19", depth 7". Immediate delivery 230/250 volts and other voltages supplied by special arrangement. Retail price 73s. 4d. each. Generous trade discounts.



This is only one of a multitude of other household electrical appliances available: radiators, heaters, toasters, etc.

90, Victoria St., London, S.W.1

Telephone: VIC 9550/1441

Belfast Office:

Ulster Bank Chambers, 4/6, Ann Street, Belfast

*The Process of Wire Drawing (No. 1)*

**Wire DRAWING**

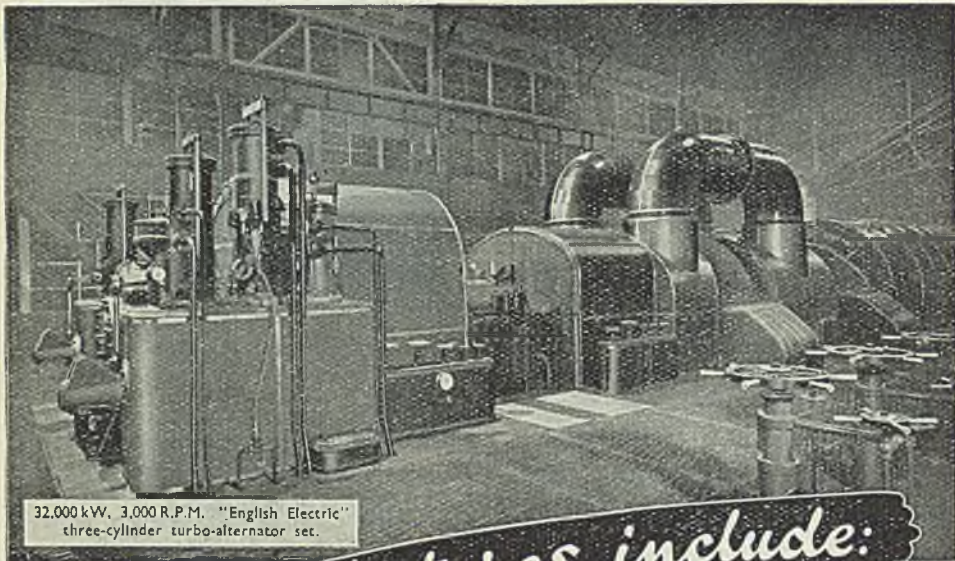
Wires, from thickest to medium gauge, are drawn in one operation on all British high speed machines using Tungsten Carbide and Diamond dies, giving perfect finish and gauge to meet the most exacting specifications required to-day.

**R. H. SYMONDS Ltd.**

47, Victoria Street,  
Westminster, London, S.W.1  
Telephone: Abbey 2771 (Pte. Br. Ex.)  
Works: Enfield, Middlesex



# 'ENGLISH ELECTRIC'



32,000 kW, 3,000 R.P.M. "English Electric"  
three-cylinder turbo-alternator set.

*Manufactures include:*

COMPLETE POWER  
STATION PLANT

STEAM TURBINES

SURFACE CONDENSERS

WATER TURBINES AND  
ALTERNATORS

DIESEL ENGINES

TURBO-ALTERNATORS

DIESEL ENGINE  
ALTERNATORS AND  
D.C. GENERATORS

COMPLETE RAILWAY  
ELECTRIFICATION  
EQUIPMENT

ELECTRIC LOCOMOTIVES  
AND MOTOR COACH STOCK

DIESEL-ELECTRIC UNITS

ELECTRICAL EQUIPMENT  
FOR RAILWAY AND ROAD  
VEHICLES

TRAMCARS AND TROLLEY  
BUSES

DIESEL-ELECTRIC AND  
TURBO-ELECTRIC EQUIP-  
MENTS FOR MARINE  
PURPOSES

AIRCRAFT

INDOOR AND OUTDOOR  
SWITCHING STATIONS

TRANSFORMERS OF ANY  
SIZE, TYPE OR VOLTAGE

H.T. AND L.T. CIRCUIT  
BREAKERS

E.H.T. AND L.T. SWITCHGEAR

FUSEGEAR OF ALL TYPES

AUTOMATIC SWITCHING  
EQUIPMENTS

MERCURY ARC RECTIFIERS

SYNCHRONOUS CONDENSERS

MOTOR CONVERTERS  
AND GENERATORS

ELECTRICAL EQUIPMENT  
FOR IRON AND STEEL WORKS  
COLLIERIES, MINES AND  
INDUSTRIAL UNDERTAKINGS

ROLLING MILL MOTORS

ELECTRIC WINDERS

ARC AND STUD WELDING  
EQUIPMENTS

A.C. AND D.C. MOTORS  
AND CONTROL GEAR

DYNAMOMETERS

HOUSE SERVICE METERS

IGNITION TESTERS

ELECTRICAL APPLIANCES  
FOR DOMESTIC AND  
INDUSTRIAL PURPOSES



**THE ENGLISH ELECTRIC COMPANY LIMITED**

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

WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL



# THE ELECTRICIAN

ESTABLISHED 1861

Bouverie House - 154 Fleet Street - London EC 4

Telegrams: "BENBROTRICFLEET LONDON" Telephone: CENTRAL 3212 (12 lines)

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

Publisher and Manager: JOHN VESTEY

Number 3571

8 NOVEMBER 1946

Vol CXXXVII No 19

## CONTENTS

|                                       |      |
|---------------------------------------|------|
| Views on Current Affairs .....        | 1271 |
| Developments in Electronics .....     | 1274 |
| "Southern" Extensions .....           | 1275 |
| Neasden Conversion Scheme .....       | 1277 |
| Calculations and Electronics .....    | 1279 |
| Plastics in Electrical Industry ..... | 1281 |
| Southampton Electricity Jubilee ..... | 1285 |
| Immersion Element on Trial .....      | 1286 |
| Power Signalling Transmission .....   | 1287 |
| Electrical Personalities .....        | 1290 |
| Fluorescent Lighting in Tramcar ..... | 1293 |
| Cost of Installation Wiring .....     | 1295 |
| Lighting Old Buildings .....          | 1296 |
| Equipment and Appliances .....        | 1297 |
| Answers to Technical Questions .....  | 1299 |
| Industrial Information .....          | 1300 |
| Henley Students' Prize Giving .....   | 1304 |
| Electrical Inventions .....           | 1305 |
| In Parliament .....                   | 1306 |
| Electricity Supply .....              | 1307 |
| Electrical Statistics .....           | 1308 |
| Contracts Open .....                  | 1309 |
| Company News .....                    | 1310 |
| Commercial Information .....          | 1312 |

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

## Southern Example

OF the main line railways the Southern has long held the lead where the adoption of electric traction is concerned, and judging from the announcement last week that the company's existing 714 route miles of electrified line are to be extended by a further 240, it will continue to do so for some time.

The scheme allows for the complete elimination of steam locomotives from the company's system east of Portsmouth, the inclusion of 200 Diesel-electric engines and the building of 150 electric loco's. The scheme will, in addition, reduce the number of steam locomotives operated by the company from 1 800 to 800, and will result in Waterloo being the only Southern terminal receiving steam engines. The cost of the scheme is estimated at £15 million and all passenger trains and principal goods services in Kent, Surrey and Sussex will be worked electrically, with Diesel-electric traction being used for feeder and local goods trains. In time, the western side of the company's system will also be improved.

In these days when economy in coal consumption is becoming increasingly important, it is of interest to note that the Southern electrification schemes at present in operation, represent a potential saving in coal of some 400 000 tons a year, and the latest proposals will mean a saving of a further 300 000 tons



annually; an example which the other main line railways might follow with advantage not only to themselves but also to the benefit of the public.

### **Courage of Private Enterprise**

THE railways are at the moment operating under the cloud of nationalisation, but it stands to their credit, and particularly to that of the Southern, that the shadow cast is not being allowed in any way to interfere with the expansion schemes which would be carried out in other circumstances. Whether it is to be nationalised or not the Southern, at least, intends running its public service in a way which will bring about the highest efficiency over the widest possible area of the country covered, and it speaks volumes for the courage of private enterprise that such expansion should be made at a time when, instead of receiving the support of the Government it has in the last two years been threatened with extinction.

### **Naval Electrical Engineers**

SO important to the offensive and defensive powers of the British Navy have become the developments in marine electrical equipment, that, as recorded in our last issue, a new branch is being created by the Admiralty for its operation. The L Branch, as it will be called, will be officered by personnel who will spend three years at Cambridge University and during the vacations receive training in the electrical manufacturing industry. At Cambridge, they will take a three-year course equivalent to that for an honours degree. On leaving they will receive a further two years' training, partly at sea, partly at a naval electrical school, and partly with firms manufacturing naval electrical equipment, making in all, with one-year's general service training, six years' graduation. This compares with the professional standards obtaining ashore, and will henceforth ensure in naval circles the status which sea-going electrical engineers have long deserved.

### **Developments in Electronics**

THE twenty-first anniversary dinner of the British Institution of Radio Engineers last week, was not only an important occasion in the history of the institution, but it also marked something of a milestone in the development of

electronics. We say this because not only is the institution now presided over by such a distinguished personality as Admiral Lord MOUNTBATTEN, but because in the address delivered on the occasion of the dinner were revealed many details of the progress of electronics which were not before generally known to the public. So important were these pronouncements regarded, that the B.B.C. broadcast the address practically in full in the Light Programme the same evening, and the Home Service Programme was extended after the normal closing time in order to give a special broadcast of the address. So far as we know no similar distinction has ever been accorded the addresses given by other speakers on electrical engineering subjects, and those engaged in the electronics field are no doubt fully appreciative of the honour. As to the address itself, as will be realised from our abstract of it this week, the subject matter warranted the tribute paid to it and is in some measure a recognition of the outstanding achievements which have been made in high frequency engineering.

### **Newspapers and the Eniac**

WE have on several occasions criticised the daily newspapers for the way in which items of engineering and scientific interest have been treated, and we do so again, for their handling of the news of the electronic numerical integrator and automatic calculator was an example of reporting by contradiction. One newspaper after another gave various names to the "inventor"; some said the only machine in existence was in the U.S.A., others that there was at least one in use in this country; some said that the equipment included 2 000 valves, others 18 000 and so the contradictions went on until Sunday, when a further series of confusing statements were made. It is appreciated that the publicity given to the Eniac at the dinner of the British Institution of Radio Engineers justified the national newspapers pursuing the subject, but when they found, as we found, that information on the equipment was not available without some research, the subject should have been handled with more care, and a better attempt made to reach agreement. That authentic information upon which to draw was



there for the seeking is indicated by the publication in this issue of facts which show that this country is, if anything, in advance of the U.S.A.

### Tramcar Lighting

WHEREAS the trolley-bus in most cases rivals the grandeur of the motor-bus and provides the travelling public with a degree of comfort almost comparable with the private car, the average tramway vehicle is less luxurious. For this reason the experimental fluorescent lighting scheme installed in one of the tramcars of Sheffield Transport Department is of special interest, and judging from public reaction the experiment is so successful as to encourage the hope that the day when all tramcars may be so illuminated may not be too distant. The technical details involved in lighting a tramcar by this means present a problem entirely their own, and in this issue is given the solution arrived at in the case of Sheffield. The passenger carrying capacity of the tramway system, particularly in London, suggests that the tramcar will remain on the road for some time. While that condition obtains, what reason can there be for not improving its appointments as has already been done in the case of non-rail public vehicles? With current already available, why should not the tramcar set a lighting example its rival vehicles will find it hard to follow?

### A Regrettable Necessity

ON another page will be found details of the London Transport plan for the conversion of six pulverised fuel boilers at the Neasden generating station to oil-firing. When completed, it will be the largest conversion of its type so far carried out in Great Britain. The eventual saving in coal is estimated by Mr. H. BRANTON, assistant electrical engineer to the Board, to whose work the detailed plan is largely due, at something approaching 70 000 tons per annum. This, taken in conjunction with the forthcoming conversion to oil of

locomotives on the main line railways, will represent a substantial part of the saving of a million tons per annum which Mr. SHINWELL, in a statement more modest than his original forecast of three million tons, recently promised. Unlike the Southern Railway electrification, which will also effect a large reduction in coal consumption, this scheme can only be considered, from the national point of view, as a necessary, but backward, step. The advantages of oil-firing are well-known and numerous. On the other hand, fuel oil, which in any case represents a drain on foreign exchange, costs to-day more than twice as much as coal, while the relative thermal efficiency is in the ratio, ton for ton, of only three to two. The Neasden conversion will, undoubtedly, make a useful contribution to the national economy campaign; the pity is, that it has become necessary.

### Electrical Statistics

THE official figures regarding the manufacture of domestic electrical appliances during September, show that there was an appreciable increase over those for the same month last year, and in some cases an improvement upon the output for August this year. Electrical equipment, other than of the appliance type, is also being manufactured in greater quantities, though with the needs of the Government-sponsored housing schemes to be satisfied, there still remains relatively little for the open market. It is reported that the total production of electric lamps is now running at a rate of some 180 million lamps a year, compared with the 1935 figure of some 100 million, while the production of cookers, wash-boilers, water-heaters and house

service meters has also increased. The manufacture of many appliances and machines is still, however, difficult on account of the raw material position. But it is consoling at any rate, to realise that the industry is able to increase the availability of appliances, at least a little each month.

#### GLASGOW TECHNICAL EXHIBITION

*Benn Brothers, Ltd., proprietors of THE ELECTRICIAN, will be exhibiting their trade and technical journals and other publications on their Stand, No. DD, at the Technical Exhibition which will be held in the Kelvin Hall, Glasgow, from November 15 to November 27 (10 a.m. to 8 p.m.). Readers are cordially invited to visit the Stand and to make full use of the services available there.*



# DEVELOPMENTS IN ELECTRONICS

## RADIO ENGINEERS CELEBRATE 21 YEARS OF PROGRESS

THE 21st anniversary dinner of the British Institution of Radio Engineers was held in London, on October 31, when the new president, Admiral Lord Mountbatten of Burma, in succession to Mr. Leslie McMichael, spoke of some recent developments in electronics; he also announced that the King had intimated his readiness to become patron of the institution.

### WAR-TIME STIMULUS

During the war, the President said, an opportunity was presented to scientists to close the gap between scientific theory and practical application. Great stimulus had also been given to all forms of electronic research, and much of this was now being directed to inventions for purely peace-time purposes. In the field of communications it was hoped that a standard system would be evolved, in which operators would be replaced by automatic apparatus such as the teleprinter, and probably in certain circumstances by facsimile transmitters, and that a single unified world-wide network of stations would be set up over which messages would be passed automatically, or semi-automatically, from origin to destination without appreciable delay at any necessary intermediate stations.

The value of integrating the technique of service communications to the greatest possible degree was demonstrated during the war, and it was encouraging that the three Fighting Services as well as civil and commercial interests in the British Commonwealth were now considering the possibilities of a network of this kind.

The war not only taught us a great deal about techniques, but it proved the occasion for new departures in application, particularly in electronics, which had augmented the present human senses. Apart from radar, which aided to a remarkable degree the sense of sight, we might in future be able, by pooling and transforming the potentialities of other forms of radiation, such as light, heat, sound, X-rays, gamma rays, and cosmic rays, to receive the counterpart of radar screen pictures from inside our bodies, or even from individual body cells. Or perhaps we might receive them from the interior of the earth, or from the stars and galaxies.

Continuing to look into the future, Lord Mountbatten said that the sense-machine might present information not only visually but also in the form of sound or even of feeling; for there was

reason to believe that facilities for impressing information and knowledge on the human brain, at present largely limited to sight and sound, might be extended by the direct application of electrical currents to the human body or brain. This extension of the sense of feeling was still in its infancy, but it had already been demonstrated as a practical possibility; and the information from the sense-machine might very well reach us in forms which would be unintelligible until we had trained ourselves to interpret new ranges of sight, sound, and feeling.

The stage was now set for "the most Welshian development of all." It was considered possible to evolve an electronic "brain," which would perform functions analogous to those at present undertaken by the semi-automatic portions of the human brain. It would be done by radio circuits activating each other in the way brain cells do; one such machine was the electronic numeral integrator and computer (Eniac), employing 18 000 valves.\*

### MATHEMATICAL CALCULATIONS AT SPEED

A machine of this kind received information from various systems and, acting in accordance with overall directions given to it by human beings, even at a distance, could solve complicated mathematical problems in a fraction of the time taken by a mathematician. Abstuse calculations on which mathematicians might spend years could now be solved in a few hours. Machines were now in use which could exercise a degree of memory, while some were being designed to employ those hitherto human prerogatives of choice and judgment. One of them could even be made to play a rather mediocre game of chess. In the field of memory alone, it seemed likely that man was to be provided with vastly greater and speedier access to the inherited knowledge of the ages than he was able to command at present.

Now that the memory machine and electronic "brain" were upon us it seemed that we were facing a new revolution; not an industrial one, but a revolution of the mind, and the responsibilities facing the scientists to-day were formidable and serious. "Let us see to it," he concluded, "that we not only insist on being allowed to shoulder it; but that when we have established our right, we can also prove our fitness."

*[\*An explanation of the development of the electronic calculator and of the position in this country is given on p. 1279.—Ed.]*



# ELECTRIFICATION EXTENSIONS

## £15 MILLION SCHEME FOR SOUTHERN RAILWAY

PROPOSALS for the complete elimination of steam locomotives from the lines of the former London, Brighton and South Coast and South-Eastern and Chatham Railways by the extension of electrification and the adoption of Diesel-electric traction for the subsidiary services, have been approved by the Southern Railway board of directors. The scheme, estimated at present prices, to cost £15 million, will affect the services throughout south-east England east of Portsmouth, and will provide speedier and more frequent services of trains. The work is scheduled to be completed by 1955, but the time will depend upon the availability of materials and labour and it may only take five years. The company will next consider the extension of the electrification of lines westwards and the use of Diesel-electric locomotives of possibly over 1 600 h.p. on the main lines from Waterloo to the West Country.

Outlining the scheme in London on October 31, Sir Eustace Missenden, general manager of the Southern Railway, mentioned that the company owns 2 156 route miles of track, of which 714 miles, or nearly one-third of the total system, are already electrified, making it the largest electric suburban service in the world. The actual mileage of electrified single line track, including sidings, is 1 777. Fifty-five per cent. of the total train mileage is

at present worked electrically, the remaining 45 per cent. being operated by steam. The new proposals involve the further conversion to electric traction of 284 route miles, or 610 miles of single line track, including sidings, on the main lines to the Kent coast and on secondary routes to Brighton.

This, we are informed, will increase the annual consumption of electricity by the Southern Railway electric train service, now of the order of 600 million kWh., by 50 per cent. and involve the construction of between 60 and 80 new sub-stations taking supplies from the grid system. The central power control point will be at Canterbury.

The routes to be converted are:—

(1) Gillingham to Margate and Ramsgate, with secondary line from Faversham, via Canterbury, to Dover.

(2) Sevenoaks, via Tonbridge and Ashford, to Folkestone, Dover, Deal, Sandwich and Ramsgate, with secondary lines from Maidstone to Ashford, Maidstone to Paddock Wood, and Ashford, via Canterbury, to Ramsgate.

(3) Tonbridge, via Tunbridge Wells, to Bexhill and Hastings.

(4) The secondary line to Haywards Heath and Brighton from South Croydon, via Oxted, East Grinstead and Horsted Keynes.



Map showing the proposed extension of electrification of the Southern Railway lines in the area east of Portsmouth



(5) The secondary line from Horsham, via Steyning to Shoreham.

All passenger trains and principal freight trains in the counties of Kent, Surrey and Sussex will eventually be worked electrically, Diesel-electric traction being used for feeder services and local goods trains. Steam services to and from the London termini of London Bridge, Victoria, Charing Cross, and Cannon Street will also be withdrawn.

It is proposed to convert the main line to Dover first; then the Kent coast lines, to be followed by the Hastings section.

To-day the Southern Railway owns over 1 800 steam locomotives. When the proposed conversion is completed the number will be reduced to under 800. Electrification schemes already undertaken save some 400 000 tons of coal per annum, and the proposed extensions together with the adoption of Diesel-electric traction, will result in a further saving of 300 000 tons of coal a year.

Sir Eustace Missenden said the company had the greatest electrified suburban system in the world and they carried three-quarters of a million people in and out of London every day. The Southern Railway as a whole carried nearly 400 000 000 passengers a year, which was only a million fewer than the people carried by the whole of the surface railways in the U.S.A.

#### DIESEL-ELECTRIC TRACTION IN U.S.A.

After D-Day the company's senior officers spent a good deal of time completing plans commenced before the war for the extension of electrification. Then it became known that during the war there had been considerable development of Diesel-electric traction in the U.S.A., and the company deemed it well to send some of their highly trained young officers to America, Switzerland and Sweden to see what developments had taken place. The main delegation went to America, headed by Mr. J. L. Harrington of his personal staff, Mr. S. B. Warder of the chief electrical engineer's department, an operating officer and a representative of the chief mechanical engineer's department. On reading their report he was very much impressed with the standard of efficiency of the Diesel-electric engines operating in the U.S.A. After considering that report, together with that of the chief officers who had been reviewing the extension of electrification, he submitted to his board a scheme for the complete electrification and Dieselisation of the whole of the company's lines east of Portsmouth.

All the main lines to the Kent coast and Dover will be completely electrified and the boat trains will be drawn by the latest type of electric engine. During the war period, the company built two electric engines

capable of a speed of 75 miles an hour, which had been used on coast trains, and they were doing a fine job. One electric engine would do the work of two steam engines on seven days in the week without having to be fed with coal and water, which was a great advantage. In addition to the express trains, freight trains would be drawn by electric engines, and the cross-country routes would be worked by Diesel-electric engines. The most economical way of handling the inter-mediate freight traffic was by Diesel-electric engines.

#### TRACK GAUGE PROBLEMS

America had gone in for some big Diesel engines, and the company, in consultation with the important builders in this country, were going to try out some of the latest types of Diesel-electric main line engines for the western area. Those for the intermediate sections would be from 400 to 600 H.P. For the western section, from Waterloo to Ilfracombe, for instance, Diesel-electric engines of 1 600 H.P. may be used. The track gauge in this country created a problem in relation to Diesel-electric engines that had to be faced; it would not take engines of 2 500 H.P. The problem was to pack enough power in a confined space to meet the track gauge.

The Diesel-electric engines are to be built in this country, and the number will be somewhere in the region of 200. There will also be required 150 electric locomotives. The ordinary passenger traffic will be carried by multiple-unit trains—both electric and Diesel-electric. The traffic in the marshalling yards will be handled by Diesel-electric shunting engines; some of which have been used with success over the last eleven years, and are still, in spite of war service, in excellent condition.

"My board, under the chairmanship of Colonel Eric Gore-Browne, is a progressive one," declared Sir Eustace Missenden, and it takes the view that, whatever the future may hold, a big concern like ours, with a staff of over 77 thousand, cannot stand still. We have either to go forward or go back, and we intend to go forward.

"If the railways are nationalised we shall endeavour to the best of our ability, to hand over this great concern in a high state of efficiency, we shall go forward with all speed, and if we have to hand it over we shall be proud to say: 'This is an efficiently run concern.'"

In reply to a question, he said the company expected to get a return of 6 per cent. on the capital expenditure.

British Insulated Callenders Cables, Ltd., Prescott, have presented a modern No. 4 Herbert capstan lathe, with self-contained motor drive and full equipment, to the St. Helens Technical College.



# Neasden Conversion Scheme

## Details of Oil-Firing Project at L.P.T.B. Power Station

**F**OLLOWING London Transport's announcement, last week, that part of the boiler plant at Neasden generating station is to be converted to oil-burning, a representative of *THE ELECTRICIAN* interviewed Mr. H. Branton, assistant electrical engineer to the Board, who has been largely responsible for the conception and detailed planning of the scheme.

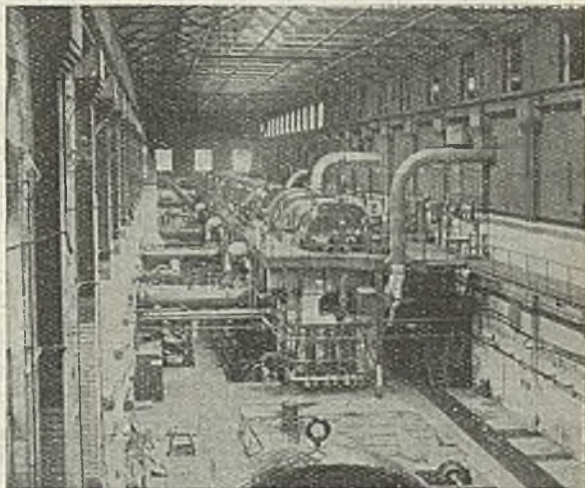
The Neasden plant, with a total capacity of 87 000 kW, serves, in conjunction with Lots Road, the entire tube and Metropolitan line systems in the L.P.T.B. area. Transmission is at 11 kV, 33 cycles, and the average daily peak instantaneous load is approximately 60 000 kW. The existing boiler plant comprises 11 units, the six boilers to be converted being installed in 1929-30.

The present scheme, explained Mr. Branton, has been adopted only because of the shortage of solid fuel, and represents the biggest conversion from coal- to oil-firing on which work has so far commenced in this country. It is divided into two stages: a temporary conversion, involving the modification of one 80 000 lb. per hour pulverised-fuel boiler, which is now nearing completion and will, it is hoped, be ready for use before the end of the year and, subsequently, the modification of five more 80 000 lb. boilers and the building of a fuel supply system for the six units together.

Apart from the obvious advantages of coal economy, which will amount, ultimately, to about 64 per cent. of the coal at present consumed—an eventual saving approaching 70 000 tons of coal per annum is hoped for—a considerable increase in plant flexibility and reliability is expected. The more even distribution of burners possible will cut down the amount of boiler maintenance required, and much of the work at present involved in the operation of coal-handling plant will become unnecessary. From the point of view of relative efficiencies, something like two tons of oil is required to replace three tons of coal. Against this must be set the fact that the heavy pool oil required is appreciably dearer than coal, so that, even allowing for the reduced operating expenses, the cost

per unit is likely to increase with the adoption of oil-firing.

For the temporary scheme of adapting one boiler, most of the necessary equipment is already available and, Mr. Branton states, only the burners have still to be delivered. The work of conversion has been carried out during the normal service-



*An interior view of the Neasden station*

ing time of the boiler. Oil consumption on the one unit will be 50 tons per day, which will be delivered, for the present, by road.

The permanent scheme for the modification of five more pulverised fuel boilers will be completed, it is hoped, in about 18 months' time. Considerable structural work in providing a fuel storage system for a four weeks' supply of fuel will be necessary, in addition to the work on the boilers themselves.

On the assumption that the oil consumption of the six boilers will reach—or possibly exceed—40 000 tons per annum, a month's supply will be 3 200 tons. This is to be stored in two tanks, each of capacity 1 660 tons. These will be situated on the site of present coal sidings, the further tank having 600 ft. of pipe-run from the boiler-house itself. Since the fuel will be delivered in trains of 20 tankers each holding 12 tons of oil, the installation has been planned to permit quick unloading and turn-round of the trucks.

The storage tanks themselves, which will be of welded steel construction, 50 ft.



in diameter and 30 ft. high, are to be erected in catchpits designed to have a capacity 20 per cent. more than that of the tanks and 100 ft. in diameter, with 10 ft. high reinforced concrete walls. An 8 in. unloading pipeline will enable the 20 trucks to be emptied simultaneously, the line being connected to a 6 in. suction pipe and thence to five 10 tons per hour oil transfer pumps, which will serve the dual purpose of filling the storage tanks from the railhead and emptying them into the supply lines.

The supply lines will terminate in three service tanks, situated adjacent to, but not actually in, the boiler house, and each of 25 tons capacity. These will be connected through a ring mains system to three duplex firing units. The fuel, passing through the firing units, is heated and supplied at vapourisable temperature to the burners themselves. Each firing unit contains two separate pumps and heaters, each capable of serving two boilers, so that 100 per cent. stand-by is provided. Overflow pipes run from the service tanks back into the suction lines and thence to the storage tanks.

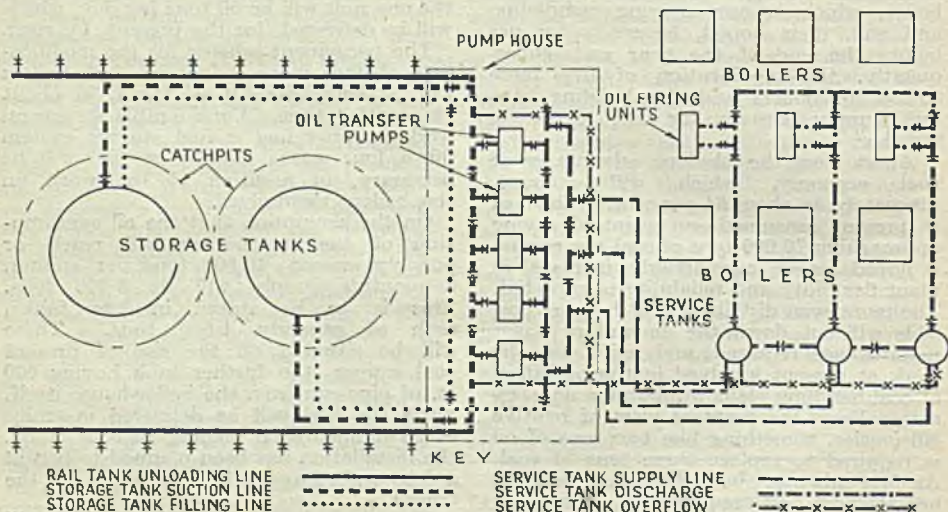
The large-scale structural work will be carried out by the London Transport Civil Engineering (New Works) Department, and will include the foundations for the two storage tanks, the building of which is expected to take six months. The tanks themselves are to be supplied by Whessoe, Ltd., of Darlington, while British Combustion Equipment, Ltd., of Dorset, will, it is anticipated, be responsible for some, at least, of the burner assemblies. The oil transfer pumps are being made by the Hamworthy Engineering

Co., Ltd., of Dorset, and the oil firing units by Babcock and Wilcox, Ltd., Glasgow. Much of the installation work will be done under the supervision of Mr. Branton, who has received advice from the Petroleum Board in the design of the fuel system.

## The Magnetron

THE current number of the Bell System Technical Journal, published July 16, is devoted to the development of the magnetron oscillator as manufactured in the U.S.A. during the war. From the time the British model was taken to America, and tried in the Bell Telephone Laboratories on October 6, 1940, its development and usage proved a king-pin in all defensive and offensive radar. The paper is both theoretical and practical, and leads to the following statement:—

The British magnetron was first reproduced in America at the Bell Telephone Laboratories for use in its radar developments and those at the Radiation Laboratory of the National Defense Research Committee, which was then being formed at the Massachusetts Institute of Technology. Since that time, extensive research and development work has been carried on in our laboratories, in other industrial laboratories, and in the laboratories of the National Defense Research Committee. Several manufacturers have produced the resultant designs. Magnetron research and development was also carried on in Great Britain by Governmental and industrial laboratories. There has been a continuous interchange of information.



Schematic layout of the proposed fuel supply system at Neasden



# CALCULATIONS AND ELECTRONICS

AUTOMATIC COMPUTATOR DESIGNED BY THE N.P.L.

**A**N "automatic computing engine" known as the A.C.E., far in advance of any calculating machine yet constructed, has been designed by the National Physical Laboratory. This is revealed in a statement by the Department of Scientific and Industrial Research, giving the history of calculating machines and the work now in progress at the National Physical Laboratory. It is intended that the A.C.E. shall tackle whole problems instead of being limited to carrying out a sequence of prescribed operations.

After giving a brief outline of the early history of calculating machines, the note states that punch-card accounting machines were used to demobilise the Armed Forces at the end of the last war.

## A BRITISH PIONEER

"Between the two wars, great strides were made in the use of all these types of machines, originally designed as the tool of the cost-accountant and business man, in scientific work. Dr. L. J. Comrie, formerly superintendent of the Nautical Almanac Office, is an outstanding pioneer in this field. He adapted a bank ledger-posting machine of American manufacture for the construction and checking of mathematical tables, and used the punched-card accounting machines for constructing tables of the motion of the moon up to the year 2 000 A.D.

"During the war, however, it became apparent that the needs of scientific research were outstripping the mechanisms provided by the purely commercial development. At Harvard University there was constructed a machine, which, although its components were such as might be found in a commercial accounting machine, was put together in a novel way, and with very differing ends in view. Thus came about the construction of the automatic sequence controlled calculator, made by the International Business Machines Corporation, and presented to Harvard University. It consists of 72 adding mechanisms, a mechanism for multiplication and division, three tape feeds carrying tables of mathematical functions and a punched-card input and output.

"These various mechanisms are interconnected through what is virtually an automatic telephone exchange and the "instructions" to the machine are coded in the form of perforations on a punched tape—the "sequence control" tape—which controls the working of the machine. The setting-up of a problem on the machine consists in planning the sequence of arith-

metical operations to be performed, converting these operations into the code used on the tape and punching it on a special typewriter. The links between the successive operations are electrical, through the built-in telephone exchange. Instead of having to make these connections during the progress of the work, the human operator plans a long sequence of them in advance, and leaves the machine to carry them out.

"Although this Harvard machine is an independent and original development, the possibility of the construction of such machines, and indeed, more elaborate ones, had already been foreseen in this country. Dr. A. M. Turing, a Fellow of King's College, Cambridge, had written in 1936 a severely mathematical paper in which he had discussed the properties of such machines in connection with certain problems of mathematical logic, without considering practical methods of construction.

"Now a telephone relay is a device for switching a current on or off. A wireless valve can be used in the same way, but at much higher speeds. Sooner or later, therefore, someone was bound to attempt to make a machine which would use valves in place of relays, and attain hitherto unheard-of speeds of calculation. This has now been done. At the Moore School of Electrical Engineering, University of Pennsylvania, there has been constructed an electronic equipment which will add two numbers together in less than a thousandth of a second, and multiply them in a few thousandths of a second. This machine, christened the E.N.I.A.C. (electronic numerical integrator and computer) contains 17 000 valves and consumes 150 kW.

## A NEW CONTRIBUTION

"The National Physical Laboratory has, through its Mathematics Division, maintained an interest in these developments. It has planned a machine called the A.C.E. (automatic computing engine), which will work at the speed of the E.N.I.A.C., or possibly somewhat higher, and which will take advantage of new technical developments, making possible both a greater memory capacity and a higher degree of complexity in the instructions. The logical control mechanism will be far more complicated than the calculating mechanisms. At these high speeds time cannot be spared to prepare a full set of detailed instructions for each problem. Instead, instruction programmes for standard calculations will be stored in a special library, and the instructions for a particu-



lar problem will be assembled from these prefabricated units, possibly linked together by special instructions. It is in the organisation of these instructions that the National Physical Laboratory feels that it has something new to contribute, and the major effort of the Mathematics Division has been in the preparation of these instruction programmes, for upon the form decided upon for these the technical design largely depends.

#### MECHANICAL MEMORY

"It will be two or three years before the completion of this machine can be hoped for, since its construction presents formidable problems, both mathematical and technical. To do its work the A.C.E. has to be provided with the equivalent of three things required by the normal human mathematician. Firstly, there is a paper on which the computer writes down his results as he goes on; secondly, there are the instructions as to what processes are to be applied, which normally the mathematician carries in his head; thirdly, there are the function tables to which the mathematician makes reference when working out his problems. These problems all involve storage of information or mechanical memory, and the mechanical device designed for this can be called upon by the logical control to give up its stored information at the required moment. The internal memory capacity of the A.C.E. will be 75 000 decimal digits as compared with 200 decimal digits of the E.N.I.A.C. One of the ways in which the greater memory capacity of the A.C.E. shows its usefulness is in the setting up of problems. Whereas in the E.N.I.A.C. a problem must be set up by a laborious process of plugging and switching, the A.C.E. may be told what it is to do and will remember what it has been told. The process of "telling" consists of passing through the

|          |            |
|----------|------------|
| 1 = 1    | 9 = 1001   |
| 2 = 10   | 10 = 1010  |
| 3 = 11   | 11 = 1011  |
| 4 = 100  | 12 = 1100  |
| 5 = 101  | 13 = 1101  |
| 6 = 110  | 14 = 1110  |
| 7 = 111  | 15 = 1111  |
| 8 = 1000 | 16 = 10000 |

machine a pack of cards on which instructions have been punched. This may take about a couple of minutes, as compared with several hours in the case of the E.N.I.A.C. The internal working of the machine will be entirely in the binary system, in which a number is represented by a series of 1's and 0's, the 1's being pulses and the 0's the spaces between them. The answers will be given in the decimal system.

The tabulated figures above show how digits in the decimal system are represented in the binary system.

A thousand million has 30 digits compared with the ten digits in the decimal system.

The machine will work at very high speeds. For instance, it is intended that the multiplication of two ten figure numbers shall be carried out in two milliseconds. The machine will alter the whole question of what is a difficult and what is an easy problem. There is a class of mathematical problems which, owing to their extreme complexity and the enormous length of time required to solve them, are so difficult as to be almost impossible of solution by the pencil and paper mathematician. Such problems are well within the scope of the A.C.E. For instance, simultaneous equations with more than twelve unknowns are beyond the patience and time of most mathematicians, but the machine will be able to tackle equations with fifty or even a hundred unknowns. Problems for which the machine might be used are the construction of range tables, involving the calculation of trajectories by small arcs for various different muzzle velocities and quadrant elevations; the calculation of the radiation from the open end of a rectangular wave guide; the finding of the potential distribution outside a charged conducting tube.

#### LEADERS OF THE TEAM

"The machine will cost in the region of £100 000 to £125 000. It is unlikely that other similar machines will ever be made. So great is the speed with which it will work, that this one machine will be able by itself to cope with all the exceedingly abstruse problems for which it is designed. Furthermore, it is probable that during its construction, or shortly after its completion, further advances will become clear, and subsequent machines will be designed to do even more than the A.C.E. The work is being done mainly in the Mathematics Division of the N.P.L. The leaders of the team are Sir Charles Darwin, F.R.S., director of the N.P.L., and a theoretical physicist of international repute; Dr. A. M. Turing, in whose brain the idea of the A.C.E. developed, who is 34 years of age and now with the Mathematics Division; Mr. J. R. Womersley, who is superintendent of the Division; and Prof. D. Hartree, Professor of Physics of Cambridge University, who is the only man in this country who has worked the E.N.I.A.C. machine in the U.S.A.

"The U.S.A. has been ahead of this country in the design of calculating machines, although, perhaps, the British have been more resourceful in the use of the machines than the Americans. Mathematicians in this country have every reason to be grateful for the pioneering courage of the Americans in this field."



# PLASTICS IN ELECTRICAL INDUSTRY

by T. J. FIELDING, O.B.E., A.M.I.E.E.

EVERY industry presents its own peculiar test problems and it is both difficult and pointless to attempt to decide which series of

tests or which set of conditions is more complicated in this or that process.

The testing of plastics materials present many problems which are peculiar to the industry alone. Its basic raw materials start further back than is the case with many other industries. The quality of coals is obviously not constant and its distillation products exhibit similar variations. The plastics raw material manufacturer inevitably, therefore, encounters variation between certain limits in the raw materials from which he produces resins. The properties of the resin will be affected by those of the raw materials from which it is produced, as well as by changes in formulation and conditions of manufacture.

At a still later stage other raw materials such as wood flour, plasticisers, etc., are introduced to produce moulding material and each one of these is capable of introducing its own contribution of variations. The length of time that the embryo moulding material spends on the heated rolls affects its properties and finally the conditions under which the moulding is produced provide an even more important variable.

Because the process of producing plastics is synthesis, many of the disadvantages of a natural product can be overcome. The inevitable variations which have been briefly outlined can, if the testing methods are sufficiently vigorous and sufficiently in-

*This article continues from last week, a detailed description of the production of Bakelite materials as used in the electrical industry. The author this week deals chiefly with electrical tests, what they mean and why they are made.*

formative, be corrected as the product progresses stage by stage through the works.

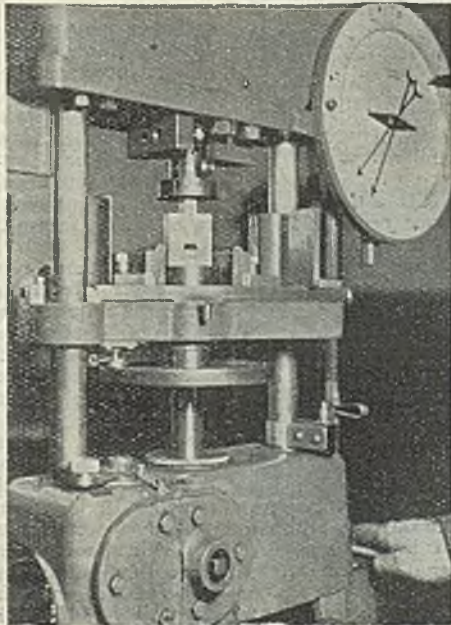
In the Tyseley Works of Bakelite, Ltd., raw materials

entering the works are all tested by the laboratory and must conform to an agreed standard before being released to stores for subsequent use. From this time onwards there is effective laboratory control of each stage of manufacture.

Intermediate testing is carried out on most of the company's products. For instance, melting point tests are taken on resins while they are in the still so that they can be run out at the correct figure. Viscosity and specific gravity tests are made on varnishes while they are mixing in the tanks. With resins, a sample is taken as soon as the ingredients are transferred to the still to ensure that the right mixture has been used.

Another sample is taken after the initial reaction and further intermediate samples are taken towards the end of the process to see that the melting point, degree of polymerisation or other characteristics of the resin are within standard. Assuming all these tests prove satisfactory, further samples are taken when the resin is cold to test for melting point, flow, amount of volatile matter and speed of cure.

All these tests are aimed at ensuring that the resins passed for moulding material and laminated production are as uniform as possible. The laboratory will subsequently watch the progress of moulding material and laminated through its various stages of production



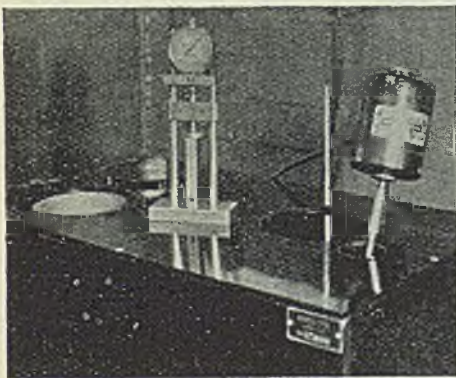
*The shear strength of Bakelite laminated parallel to laminations is obtained with the equipment illustrated. Test pieces of rectangular section are placed in a jig (centre of picture) and sheared by the sliding member. The force required to shear the material is recorded on the dial seen in the top right-hand corner*



to ensure that the requisite standards are maintained.

The variables already discussed are inherent in the manufacturing process and make their contribution to variation in the finished product. For this reason it is necessary to carry out comprehensive testing to ensure that the required standard of quality is maintained. In addition to the variations introduced by the process of manufacture, it must always be borne in mind that finished mouldings may also vary owing to variations in the moulding procedure followed. To test moulding material therefore, it is necessary to produce moulded test pieces, and the procedure followed for moulding these also has to be very carefully standardised. As a result of all the causes of variation mentioned it is found that even with the most rigidly controlled manufacturing and moulding procedure, a significant degree of variation occurs in the test results, hence, to obtain accurate test data, it is necessary to examine a larger number of specimens than is usually the case with non-plastics materials.

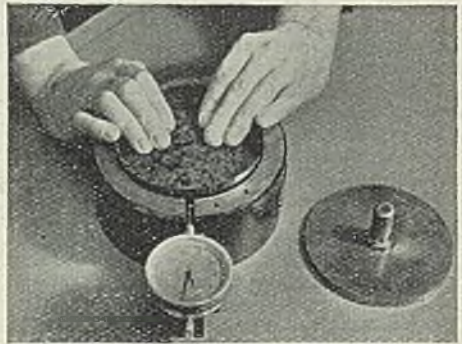
An example which illustrates this point is the method of testing impact strength of moulding materials (B.S.771). The specimen is a bar  $\frac{1}{2}$  in. square and  $2\frac{1}{2}$  in. long in which a  $45^\circ$  notch is moulded in one face. All the dimensions are laid down in the specification to very close limits, no positive tolerance being allowed on width or on the depth of the notch. The specimen is then placed in an Izod impact testing machine and the specimen



*Measurement of the thermal expansion of Bakelite laminated in a direction parallel to the laminations*

broken by allowing the pendulum to strike squarely across the full width of the specimen. If this is carried out on a Bakelite shock-resisting moulding material, different test specimens may give important

variations in the impact strength figure. This is readily understood when it is realised that the filler for a shock-resisting material is pieces of fabric and by an accident of manufacture the particular test

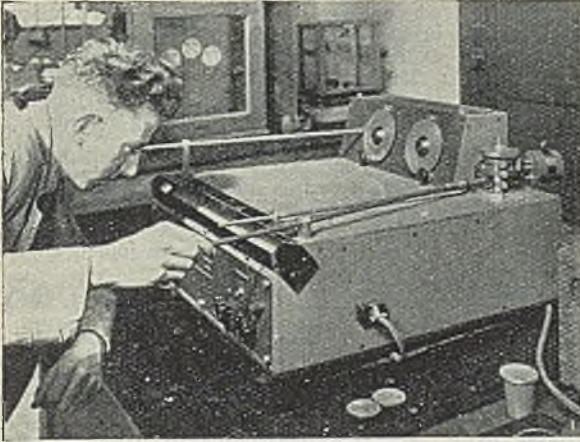


*Test to determine the moulding shrinkage of Bakelite moulding materials. The gauge in which the mould is placed differs by a known amount in diameter from the mould in which the disc was moulded, enabling the shrinkage to be computed*

specimen may have been produced so that all the fibres are lying flat-wise which greatly increases the strength of the specimen, or it may even happen that the notch coincided with the absence of fabric filler or on the other hand, across the face of a piece of fabric. In this last case the difference would be between the impact strength of unfilled resin and one with an adequate fabric filling. The test result figure would thus show extremely wide variation. As a consequence, several specimens are tested from each batch and the impact strength quoted is the minimum obtained on any test.

There are other features, each capable of affecting the test result for impact strength which requires the conditions to be laid down rigorously in the test specification. The temperature conditions and in particular, the humidity, can make a big difference to the impact figure obtained. If, for example, the moulded test specimen is immediately ejected from the mould into cold water, a far higher impact strength figure would be obtained than if the specimen had been allowed to cool down normally. Similarly, variation can be introduced by the test conditions which make comparison between one grade of material and another useless, unless the conditions of test under which the results quoted have been obtained, are identical. Strenuous efforts are being made by the industry to standardise all types of tests





*Measurement of p.f. and permittivity is possible on this test equipment up to frequencies of 100 m/cs.*

which are carried out so that a set of figures obtained by one manufacturer can be correlated with those of another. The situation now is infinitely better than it was ten years ago, and in the early days testing was largely a matter for the individual manufacturer. Standard specifications will necessarily be concerned with finished products so far as the individual manufacturer is concerned, but in his own interests the manufacturer will also undertake a large number of tests at various stages of manufacture to provide adequate control over his finished product. Efforts are now being made to place the testing of plastics on a statistical basis and in the works of Bakelite, Ltd., a system of quality control has been in operation for some considerable time, and has afforded extremely valuable data.

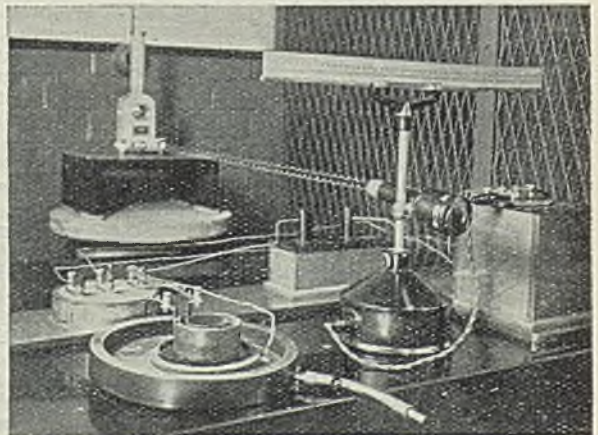
The principal standard specifications now existing which affect phenolic plastics used by the electrical industry are B.S.S. 771, 972 and 1137. B.S.S. 771 deals with phenolic mouldings and moulding materials. B.S.S. 972 covers synthetic resin bonded sheet for electrical and mechanical purposes, while B.S.S. 1137 is concerned with synthetic resin bonded paper sheets for use for electrical insulation at power frequencies.

It is not really practic-

able to take electrical tests out of the context of the specification, since a given moulding material, for example, which accords with the specification is required to satisfy all the conditions at the same time. As has previously been noted, important changes in the properties of the material can be made by the moulding material manufacturer, but usually the improvement of one property will be at the expense of another. Section III of B.S.S. 771 is concerned with ultimate tensile strength, impact strength, water absorption, swelling after immersion in water, plastic yield and various moulding properties, as well as with the electric

strength and surface resistivity. Although, therefore, the notes which follow, deal with the methods used for electrical testing, their intimate relationship with the various other tests laid down must always be borne in mind.

Testing for electrical strength requires the production of a moulded disc 4.5 in. in diameter and 0.125 in.  $\pm$  0.01 in. thick under carefully controlled moulding conditions. This sample is then placed between solid brass electrodes of specified dimensions. The whole assembly is then immersed in insulating oil and the temperature of the specimen and electrodes



*To determine the surface resistivity of mouldings produced in Bakelite material, moulded test specimens are subjected to standard voltages and the leakage current measured. This test is conducted following 24 hours immersion in water*



maintained in the oil at 90° C. (194° F.) for 15-20 minutes. At the end of this time a test voltage of 20 V/mil. is applied to the specimen using an alternating voltage of a frequency of 50 c/ps. The voltage must be applied between the electrodes and raised from zero to the full test voltage as rapidly as is consistent with its value being observed on the measuring instrument, and in any case not less than 1 kV per second. The full test voltage is then maintained for one minute.

The specification requires three test specimens to be investigated and if two fail, the material represented must be rejected. If one fails, three further specimens must be tested and all must pass to avoid rejection of the material. This condition of rejecting the material if there is more than one failure in six specimens is standard and is, therefore, applicable to various other tests described below.

The method of testing surface resistivity requires that the specimen shall have been immersed in water for 24 hours and shall under the conditions of test laid down, provide a minimum surface resistivity of 100 megohms. The test specimen for this purpose is of the same dimensions as that used for determining the electrical strength, and the surface resistivity must be measured after ten minutes and before 15 minutes from the time of the removal of the specimen from the water. The surface resistance between the electrodes is measured after one minute electrification at a potential difference of 500 V d.c. The apparatus used for this test comprises a glass container with mercury at the bottom, in which the specimen is placed. On the upper surface of the specimen are placed two concentric tubes, the larger of which has a double wall. Mercury is poured into the space between the double walled tube and also within the inner tube. Contacts are made between the inner and outer rings of mercury thus formed; with the result that the surface resistivity of the specimen between these two mercury electrodes can be measured by means of the leakage current recorded on the galvanometer.

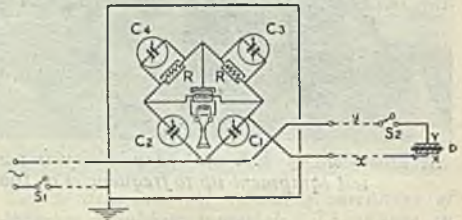
As is well known, tests of power factor and permittivity of an insulating material at audio-frequency and at reasonably low pressure may be used as a criterion of its electrical quality. The product of these two quantities (termed the power loss factor) indicates the total loss of power in the material when placed in an alternating electric field.

The method used for the determination of power factor requires a specimen—usually in the form of a disc—to be floated in mercury and covered with mercury to form a condenser. The power factor of this

condenser is measured on a Schering bridge at 800 cycles per second, and is expressed as a percentage of unity.

The function of the Schering bridge in this test is explained in the following method of operation, making reference to the circuit diagram.

The specimen D of insulating material to be tested is placed between suitable electrodes X and Y which are set up at a distance of about 3 or 4 feet from the bridge. The electrodes are joined to the



*Circuit used for the determination of power factor values*

bridge by means of straight wires x and y, well separated. The wire x is left permanently joined to the earthy surrounding or lower electrode X and the circuit of the other wire y is only completed when the small low capacitance switch S<sub>2</sub> is closed.

With the specimen in place but the switch S<sub>2</sub> open, the condensers C<sub>1</sub> and C<sub>4</sub> are set at zero and the bridge initially balanced by alternate and repeated adjustments of condensers C<sub>2</sub> and C<sub>3</sub> until absolute silence is obtained in the telephone. The condensers C<sub>2</sub> and C<sub>3</sub> are then left untouched throughout the test.

The specimen is then connected to the circuit of the bridge by closing the switch S<sub>2</sub>. The bridge is then rebalanced by alternate and repeated adjustments of condensers C<sub>1</sub> and C<sub>4</sub>.

The reading of the dial C<sub>1</sub> then gives, directly, in micro-microfarads, the capacitance of the specimen, the power factor of which is obtained directly as a percentage by the reading of the dial C<sub>2</sub> divided by that (already obtained) of the dial C<sub>1</sub>.

Insulation resistance of Bakelite laminated sheet is obtained in accordance with B.S.1137. This test requires a rectangular specimen to be cut from the laminated sheet, and three holes 0.193 in. in diameter are drilled in the specimen to form an equilateral triangle with 1½ in. between centres. Brass washers and 2 B.A. screws and nuts are used to form contacts. Depending upon the quality of the sheet, the subsequent conditions of test



vary somewhat, but for type I sheet the specimen is immersed in water for 24 hours with the electrodes in position. The insulation resistance is measured between each pair of electrodes at a p.d. of 500 V d.c. All the readings have to be taken within five minutes of the removal of the specimen from the water.

The testing of plastics provides a most

interesting study. Test procedures now in use are searching and at the same time range over all aspects of the materials. In no other way can uniform standards of quality be maintained.

*[Other articles dealing with plastics in the electrical industry appeared in THE ELECTRICIAN of August 16, August 23, August 30, September 6, and November 1.]*

## Southampton Electricity Jubilee Dinner

OVER 600 guests, including members of the staff and retired employees, met at dinner at the Guildhall, on October 29, in celebration of the jubilee of the Southampton electricity undertaking. An exhibition marking the undertaking's 50th birthday was opened by Mr. Shinwell, at the Civic Centre, Southampton, on April 27, and was reported in THE ELECTRICIAN of May 3. The Corporation was represented by the Mayor and Mayoress (Councillor and Mrs. R. H. Stranger), and members of the Electricity Committee.

Giving the toast of "The Staff and Employees of the Corporation Electricity Department," the Mayor said that since the early days, when the undertaking was acquired by the Corporation, enormous progress had been made. The sales of the local undertaking were now 140 000 000 units per annum, and they supplied nearly 60 000 customers in an area of 44 sq. miles. The cash receipts for the sale of current came to £750 000 per annum.

In the course of a tribute to the Borough Electrical Engineer, whose name he coupled with the toast, the Mayor said he had done everything possible to place before the Electricity Committee the views of the employees. The employees had a great deal to thank him for on their side, as had the Corporation, for his efficiency and well-known technical ability.

After referring to the work of the technical staff, particularly during the bad periods of the war, the Mayor said he wished particularly to acknowledge the services of Alderman Fred Brown, who had been chairman of the Electricity Committee for 23 years, until 1944. As examples of loyal service to the undertaking, he would mention the names of Mr. S. H. Gibbs, chargehand turbine driver for 45 years, and Mr. R. P. Avens, station superintendent for 41 years. There was present the largest gathering who had ever sat down to a meal in the Guildhall at any one time. That, he suggested, was absolutely fitting of the undertaking: it continued to break records.

In his reply, the Borough Electrical

Engineer (Mr. W. G. Turner) said he was glad to think that the efforts of the past and present members of the staff and employees had in no small measure contributed to the tremendous development which had taken place during 50 years of municipal ownership. Whilst they did not know what the nationalisation plans had in store for electricity supply, they trusted that their endeavours would be at least as faithful.

The electricity supply service had had a phenomenal growth and was, perhaps, the greatest contribution in the history of mankind to the convenience, comfort, and well-being of the human race. It therefore behoved all on whom the responsibility laid to ensure that abundant electricity was made available to all who might wish to participate in its benefits, at a price within the reach of everybody, and in particular the low wage earner.

Mr. Turner paid tribute to the work of the past and present members of the Electricity Committee and referred to the present chairman, Alderman Bascomb, who, like the Mayor, had been a member of the Committee for 13 years. He was responsible for the recent formation of the Electricity Department Works Whitley Committee, which was functioning so successfully.

"The Electricity Committee and Guests" was submitted by Mr. W. Deacon (vice-chairman of the Works Whitley Committee), who offered a sincere tribute to the pioneers of the old Electric Lighting Committee. To them, he said, great credit was due, and also the gratitude of the town. The members of the present Electricity Committee were carrying on in the same tradition.

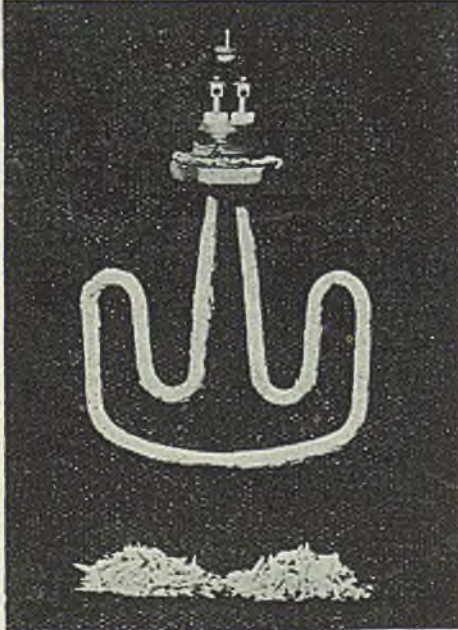
Replying, Alderman G. B. Bascomb (chairman) said that, in common with Britain, they were well served electrically in Southampton. Whatever complaints the people of Southampton might have against other activities of the Corporation, there could be very little complaint about the efficiency and service of the borough electricity supply undertaking.



# Immersion Element on Trial

## Interesting Life Test on New Water Heater

IN a recent paper\* delivered before the I.E.E., reference was made to modifications in the design of the conventional water-heater baseplate, which would permit the use of a better and more widely



*The element after 6500 gallons had been heated.  
The sludge has been heated*

spread heating element, if and when a handhole were available in the hot water storage tank or cylinder. The form of heater described would be, it was suggested, valuable in hard water areas.

The Northmet Power Co., Ltd., inform us that some months ago a heater of this type, rated at 2 kW, was installed in a galvanised m.s. tank, of dimensions 24 in. by 24 in. by 15 in., with an approximate cold water capacity of 27 gallons. The tank was supplied with water averaging a temporary hardness of 24°, or 3.41 lb. of scale-forming matter per 1 000 gallons, and a permanent hardness of 4° (5.7 lb.). The total hardness was thus 28°, equivalent to 4 lb. of scale per 1 000 gallons.

The storage temperature was main-

tained at approximately 140° F., and hot water was drawn at the rate of 60 gallons per working day. The illustration on this page shows the condition of the heater after approximately 6 500 gallons of water had passed through the tank. The result, after the equivalent of a run of approximately 32 weeks at an average of 200 gallons per week at 140° F. is considered as definitely encouraging. The scale and sludge collected from the floor of the tank, immediately below the heater, weighed only 2½ oz.

After the photograph had been taken, the heater was replaced in the tank for a further run of approximately 6 500 gallons per week at 140° F., is considered photographed. This test procedure will be continued until such time as definite evidence is obtained that the accumulation of scale materially interferes with the free circulation of water through the heater, or until the electrical action of the heater fails.

The water selected for the test, as reference to the tables showing temporary and permanent hardness of the water supplied by the various undertakings in the British Isles shows, was among the hardest (temporary) in the country.

\* \* \*

The authors of the paper referred to, which, with its ensuing discussion, was summarised in THE ELECTRICIAN of March 22, 1946, dealt with the combination of a solid-fuel fire with an electric immersion heater. The system when properly applied, they stated, gave excellent results at a reasonable cost: there were signs that it would be extensively used in new housing schemes. Compared with other systems of piped hot water, it increased the amenities and lowered the annual cost. Experience had shown, however, that economical working could not be obtained unless the plumbing work was laid out in a proper manner. If this were not done, the energy which came through the wires might be wasted in the pipes. During the discussion, several speakers thought that there was some misunderstanding in the authors' references to the corrosion of tin-copper immersion heaters in hard water. The cupro-solvency properties of hard waters were often very much less than those of soft acid waters. The failure of the heating elements, to which the authors had referred, might be due not to normal corrosion, but to the very high temperature which the copper reached during operation.

\*"Engineering Principles Applied to the Design of Domestic Water Heating Installations of the Solid Fuel/Electric Type," Ronald Grierson and Forbes Jackson, delivered March 14, 1946.



# SIGNAL POWER TRANSMISSION

by H. C. TOWERS, M.I.E.E.

THE increasing use of induction motors and other inductive loads, usually in industrial plants, has caused a steadily decreasing power factor. Power undertakings

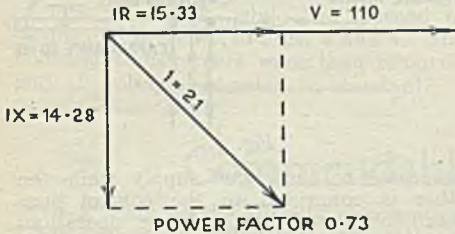


Fig. 1—Tests taken at transformer

have had to face demands for increased loads resulting in larger generators and cables. The benefits to be gained by power factor improvements have been recognised for many years and advantages have been taken of this facility to deal with inductive loads.

The use of condensers for the purpose of phase advancing is too well known to require much explanation. A description of how these were utilised to avoid replacement of a railway signal power main may, however, be of interest.

The installation was an electro-mechanical signalling scheme on an important Indian railway.

The signal box, situated at the south end of the station, operated the goods yard connections to the up and down fast lines, also a platform loop connection from the up fast line for long distance steam trains. At the north end of the station a smaller plant worked the points and

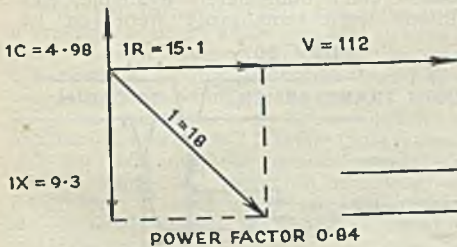


Fig. 2

signals in connection with the local goods yard. The signals on the local lines are three aspect colour light automatic and are not connected with the interlockings in any way.

The work as originally intended retained the signal box at the north end, the only

alteration being the conversion of main line mechanically-operated semaphore signals into colour light signals. Subsequent developments enabled this box to be removed, thereby effecting considerable economy in wages and stores. Sufficient spare levers in the south box permitted the goods yard connections to be operated from this frame by power. This was



Inspection of the condenser, carried out at regular intervals, is facilitated by the simplicity in design of the equipment

accomplished by driving the points and cross-overs by all-electric point machines and replacing the mechanical shunt signals with electrically-operated signals.

Power for track circuits, signals, points, etc., is obtained from a traction cubicle near the middle of the local line north bound platform. Transformers at this cubicle step-down the 2 200 V supply to 220 V for station lighting and 110 V for signalling circuits.

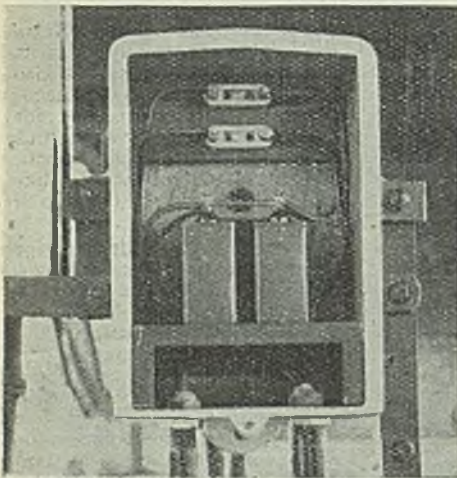
The signalling load is usually a fairly constant one consisting of signals, relays, track circuits, etc. There is little difference between the power consumed by a track circuit whether shunted by a train or not. Load for signal aspects remains the same since only one aspect is displayed at a time. The only slight fluctuation in load is due to the energising and de-energising of line relays controlling sig-



nalling circuits in the cabin relay room.

The operation of all-electric point machines produces a considerable fluctuation in voltage. The type employed on the railway are of the a.c. series type and take a current of from 9 to 12 A, while winding over. When the work is completed (the point switches changed and locked), the motor is cut out and the current decreases to a constant load of about 0.4 A, required for energising the point controller. A short description of the operation of points by an all-electric point machine will make this clear.

An a.c. series motor, operated at 110 V 50 cycles, drives an escapement through a gear train. The escapement operates the point switches and also locks them in



Arrangement of capacitors as installed at the transformer site

position when correctly set. Contacts capable of very fine adjustments are fitted to the machine and these detect the position of the point switches and also, that they are correctly locked. These indication contacts act as a pole reverser on a two-wire circuit to the signal box controlling a point indication relay in the relay room. This relay operates visuals behind the point lever, showing whether the points are "normal" or "reverse," and the signal control circuits reading over the points are looped through the relay.

The point control circuit consists of two wires connected to the circuit controller on the point lever. This also acts as a pole changer reversing the polarity of the control according to the lever position. These wires are connected to the point controller at the points which is really a reversing switch operated by a motor

whose rotor is only capable of partial rotation, backwards and forwards. One element of this motor is permanently

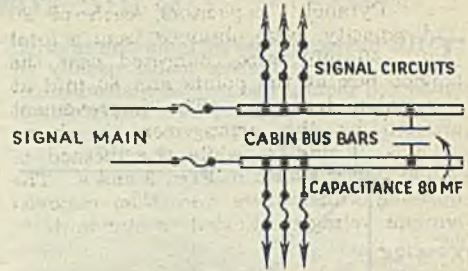


Fig. 3

connected to the signal supply while the other is connected to the control lines from the signal box. Lever operation, therefore, reverses the polarity producing partial rotation either way, as required. The heavy current momentarily required for the point motors is therefore obtained locally from a supply box and fed over the point controller contacts. This avoids the necessity for a heavy control cable, the latter only having to carry the small current required by the controller coil.

In the installation under reference, the main supply cable was a two core 7/.064, and with the addition of extra signals and track circuits, a total voltage drop of only 5 V was experienced at the signal box which is at the furthestmost end of the line. During point operation, however, the additional current taken from the main by the point motors caused a serious voltage fluctuation across the cabin busbars which, although only lasting for a few seconds, caused the signal stick relays to drop which put signals to danger when they had already been "cleared." This being a very serious situation, and no cable of larger cross-section being immediately available, conditions were temporarily improved by

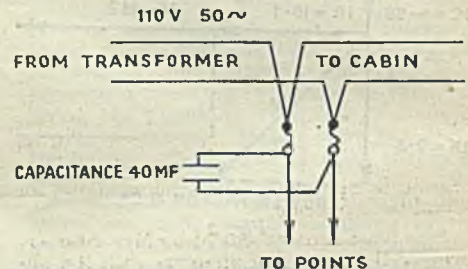


Fig. 4

using small boosting transformers on local circuits.

After making a number of tests, it was decided to endeavour to avoid chang-



ing the supply cable by employing condensers to improve the power factor. Six "Pyranol" capacitors, each of 20 mfd capacity, were obtained from a local firm. 40 mfd were connected near the service box at the points and 80 mfd at the cabin busbars. The improvement effected by this arrangement is shown in Figs. 1 and 2, while the method of connection is shown in Figs. 3 and 4. The boosting transformers were then removed and all voltages adjusted to standard.

These capacitors being available in convenient units, they can be connected at various signal locations as required, thereby effecting power factor improvement along the supply line.

The improvement of power factor on railway signal power transmission lines overcomes the necessity of changing cables, or if considered in conjunction with new works, enables cables of minimum cross-section to be used as well as transformers of a capacity lower than would ordinarily be permissible.

## Commendable Co-operation

AS a result of the friendly co-operation of two private enterprise companies in Derbyshire, 5 000 tons of industrial coal will be saved annually. This practical response to the Government's appeal for fuel efficiency has been made possible as a result of a mutual aid scheme between the Renishaw Iron Co. in North Derbyshire and the Derbyshire and Notts Power Co.

Just over a year ago the Renishaw Iron Works, one of the oldest ironworks in the country, put into operation a blast furnace which had been rebuilt and modernised during the later war years. The blast furnace gases have been used to generate electricity used within the works, but some have been wasted.

On October 23, a second furnace, which has been overhauled and modernised was "blown in." The two will have an output of some 2 300 tons of pig iron a week, and the work is part of a reconversion scheme being carried out by the managing director, Captain J. F. Stanier, who returned from the Services, to direct the work.

With two furnaces in full blast there was a prospect of much waste gas, and to avoid this, representatives of the ironworks and the power company got together and devised a scheme to utilise the gas. A 1 000 kW turbo-generator is to be installed with auxiliaries, and some 7 500 000 units a year will be fed into the power company's mains, which will result in a saving of 5 000 tons of coal a year at their main station at Spondon. The scheme allows for suitable expansion.

The blast furnace was lit by Mrs. Stanier, wife of the managing director, with the observance of a ceremony nearly 200 years old. The Rector of Eckington (the Rev. C. W. Silk) blessed the furnace and all the 40 workmen received free beer.

Speaking at a complimentary luncheon to guests and officials, Mr. J. E. L. Wallace who, with Messrs. Blaney and Briggs,

represented the Derbyshire and Notts Power Co., said it was not only a great day for the Renishaw Ironworks, but also marked the satisfactory conclusion of negotiations between the two companies for the efficient and mutually advantageous utilisation of surplus waste gas, which, with the help of statutory authorities like themselves, could be made to perform a useful function.

They were confident that the demand for electricity would increase, if no artificial barriers were placed in the way by the Government. Although they had large power resources at their disposal, it had always been the policy of the company to take a favourable view of additional sources of supply which could be made to fit in with their existing schemes. It was difficult to imagine that the negotiations which had been completed by the two companies could have been conducted by two government departments, with the dead hand of officialdom and the stranglehold of red tape killing all initiative and personal interests.

## The Fight for Liberty

The Society of Individualists and National League for Freedom, which is fighting to restore to British public life the spirit of individual liberty and responsibility, goes from strength to strength. The just-published annual report shows that 9 852 new members have been enrolled during the year, and there are now 23 branches of the society, in addition to the sister Society of Individualists in Scotland, and a growing body of members in Canada. Nearly 100 000 copies of the society's "Manifesto on British Liberty" have been issued, propaganda leaflets and booklets distributed have been brought up to well over a million and a half, and speakers have addressed 323 meetings during the year.



# Electrical Personalities

MR. G. J. HIGGS, of Llantwit-Major, has been appointed by the Cardiff Electricity Committee as assistant sales engineer.

MR. W. B. NODDINGS has been appointed by the Central Electricity Board



MR. W. B. NODDINGS

to be deputy commercial manager in place of the late Mr. J. B. M. Gubbins. Mr. Noddings, who has been assistant commercial manager for the past two years, joined the board's staff in 1928, having previously held an appointment as assistant engineer with Messrs. Merz and McLellan. A graduate of Liverpool University, where in 1923 he took his B.Eng. (Hons) Degree with First Class Honours, he received his early training with Metropolitan-Vickers Electrical Co., Ltd.

MR. C. L. SAINTY has resigned from the board of the Carrier Engineering Co., Ltd.

MR. R. G. MCGOWAN has been elected a director of the Parsons Engineering Co., Ltd., in place of Mr. C. P. Parsons who has resigned.

MR. W. F. MOIR, chairman of the E.L.M.A. Council, on October 29 opened the 44th illumination design course at the Lighting Service Bureau, 2, Savoy Hill, London. It was a four-day course which had been arranged, in response to requests, to supplement the normal programme of lighting education and was restricted to those engaged in the electricity supply in-

*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.*

dustry. The illustration on this page shows the attendance at the opening session.

MR. M. I. LIPMAN, general manager of the special products division of E. K. Cole, Ltd., relinquished his position with the company as from October 31.

MR. H. M. SAYERS wishes it to be known that he may be reached by telephone No. Painswick 3337. The name to which this number is allocated is Mrs. C. D. Watts, his daughter, in the Gloucester area directory.

MR. JAMES MILLS, deputy electrical engineer and manager of the St. Helen's undertaking, has been recommended by the Bury Electricity Committee for appointment to the position of engineer and manager of the Bury electricity undertaking. Mr. Mills is 44 years of age.

MR. HARRY TOWERS has been elected to the board of A. Reyrolle and Co., Ltd., of which company he has also been appointed general manager. He will assume his new duties on January 1 next, from which date his resignation from Edmundson's Electricity Corporation, Ltd., will become effective. Mr. Towers joined Edmundson's in 1933, and has been general manager since 1939. He is also a director of their associated and subsidiary companies.

SIR WILLIAM HALCROW, on taking over the duties of president of the Institution of Civil Engineers, on Tuesday, delivered his Presidential Address, an abstract of which is given in this issue. Sir



*The audience at the opening session of the 44th illumination design course at the E.L.M.A. Lighting Service Bureau, London*



William Halcrow was a member of the panel of engineers, appointed by the Minister of Fuel and Power, which reported recently on the Severn barrage scheme. Among other positions which he has filled are those of consulting engineer to Government Departments, the L.P.T.B. (for tube railways) and other public corporations and companies, including the North of Scotland Hydro-Electric Board; member of War Cabinet Engineering Advisory Committee; of the Advisory Council of Building and Civil Engineering

by Mr. W. H. Everard, who has been with him for 32 years, but will still be available as a consultant.

PROF. LABORDE, head of the Central Research Department, Electricite de France, M. F. Cahen, of the same department, and M. R. Brongniart, Transmission Section, Electricite de France, recently visited the B.I. Callender's h.v. cable demonstration at Dorland Hall, London. In the photograph reproduced on this page they are shown looking at a stabilised glaze insulator for a 132 kV sealing end, which is being described by Mr. G. L. Smith, of the technical sales staff of the company.

MR. G. LESLIE WATES, the chairman and managing director of Johnson and Phillips, Ltd., presided at the first post-war dinner of the J. and P. Foremen's Association on October 18, when 82 members and guests gathered at the R.A.C.S. Restaurant, Woolwich. He was supported by Mr. W. Glass and Col. R. W. C. Reeves, directors of the company, and the Committee of the association. In proposing the toast of the Chairman, Mr. S. Simmons included the name of the company, with which Mr. Wates had had such a long association. He mentioned the many services to the employees which had been instituted by the management, and recalled the ready assistance given to those who suffered injury or loss during the war years in the form of convalescent home treatment, services of a repair squad, and financial help. He also referred to the pensions scheme and provident fund. Replying, Mr. Wates expressed his pleasure that those small services were remembered and appreciated, and said he had always regarded the J. and P. organisation as a very large family and while he hoped that there would never again be the necessity for such help as was given during the war years, he trusted that as members of the family they would always be ready to help each other when the need arose. "Toasting" the guests, Mr. H. Bill extended a special welcome to Col. Reeves on his return from active service and wished him a quick recovery from his war wounds.



*French electrical engineers at the B.I. Callender's h.v. cable demonstration at Dorland Hall*

Industries to the Minister of Works and of the Advisory Council of the D.S.I.R.

CAPTAIN H. S. HAYES, of Bristol, has been appointed to the Colonial Service as an electrical and mechanical engineer in the Public Works Department, Nigeria. Captain Hayes served in the Royal Engineers during the war. Previously he held engineering appointments on the Continent and in Teheran.

MR. A. W. BUNN, manager of the London and West branch of Hoover, Ltd., has been appointed to the new post of sales promotion manager to co-ordinate all sales matters between Hoover dealers and branch and district managers. Mr. Bunn is the brother of Mr. F. H. Bunn, director and general sales manager of the company. Succeeding Mr. Bunn as manager of the London and West branch, is Mr. H. E. Duggans, who recently rejoined the company from the Forces.

MR. T. H. SKELTON, manager of the electric melting and Tropenas steel converting and foundry heat treatment departments of Edgar Allen and Co., Ltd., retired at the end of October for health reasons. He joined the company in 1901 as a member of the laboratory staff. Mr. Skelton, who is 61, will be succeeded

#### Obituary

MR. F. B. LEONARD, formerly deputy chief electrical engineer at Marylebone. He retired in 1944.

MR. HERBERT TAYLOR, rolling stock superintendent to Darlington Corporation, aged 59 years. He had been at Darlington about 30 years, and before then was at Bradford, where he helped in starting the town's trolley 'bus system.

MR. RICHARD G. BOTTING, manager and director of the Aberdeen Electrical Engineering Co., Belmont Street, Aber-



deen. He went to Aberdeen 50 years ago to instal electrical equipment at the Mitchell Hall and decided to stay. He carried out many big installation contracts.

MR. JAMES FORD, chief clerk in the electricity department of the Stalybridge,

Hyde, Mossley and Dukinfield Transport and Electricity Board since 1934, aged 59 years. Previously he was chief clerk in the Bury (Lancs.) electricity department. He was an acknowledged authority on electricity finance.

## I.E.E. and Further Education Grants

UNDER the Further Education and Training Scheme of the Ministry of Labour, provision is made for grants to be awarded to assist those whose technical education or training was interrupted by military service. The grants are designed to enable those who have obtained university degrees in electrical engineering, or who have qualified in some other way as graduates of the I.E.E., and who have been prevented by their national Service from completing their practical training, to undertake a specially designed course conforming to the requirements of Bye-law 12a of the I.E.E.

Under the scheme, employers will be expected to pay the usual national scale applicable to engineering graduates and the awards will take these salaries into account.

The majority of those who have served in certain technical branches of the Services should be able to complete their practical training in a 12 months' course, which might be designed on the following lines: (1) Special processes, e.g., foundry work, pressing of metals plastic mouldings, moulding and drawing of non-ferrous metals, 8 weeks; (2) Assembly erection and wiring of electrical machinery and apparatus, 8 weeks; (3) Testing of electrical machines and apparatus, 12 weeks; (4) Departmental progress section, 12 weeks; (5) Departmental drawing office, 12 weeks.

Those who have not had any previous training in industry and only limited technical experience in the Services will, however, require a full two-years' apprenticeship and should follow an approved graduate apprentice training scheme. Provision may also be made for those who, through having resigned from an apprenticeship in order to join the Services or, for any similar reason were not eligible for resettlement but whose practical training was deemed to be nearly completed by their national Service, to receive a special training grant for six months' refresher training in industry.

A plan of training will be drawn up by the employer before the grant is awarded and a report of the apprentice's work will be prepared every three months by the trainee himself and submitted to the Ministry by the employer, with the ad-

dition of a report on the trainee's progress during that period. Flexibility of plan will be desirable in order to enable the employer to adjust the training scheme so far as possible to suit the needs of each individual, but any alterations which are to be made to the original programme should be recorded in the quarterly report. In addition, the Ministry will require a routine monthly report on which payment of the maintenance award is based.

It is difficult to lay down precise rules to define the length of training required by ex-Service personnel, because this would be affected by a number of factors of which the training (if any) acquired in industry prior to joining the Services and the type of work undertaken in the Services would be the most important. The following notes might, however, serve as a general guide: (a) A normal two-years' course will usually be required by all those who have had no previous industrial experience and have only obtained limited technical experience in the Services. (This will include, for example, Signals Officers without workshop training). (b) A special 12 months' course of further practical training will normally be required for both the following classes: (i) those with little or no industrial training who have served on suitable workshop duties in technical units for a period of 18 months or more, and (ii) those who have had between 12 and 18 months' industrial training and whose experience in Service workshops has been limited. (c) No further practical training will be required by those who have had 9-18 months' training in an industrial workshop and served for a period of more than 18 months on suitable workshop duties in technical units. In some cases 6 months' refresher training might, however, be advisable.

The scheme will be administered by the Appointments Officers of the Ministry of Labour at Birmingham, Bristol, Cambridge, Cardiff, Edinburgh, Glasgow, Leeds, Liverpool, London, Manchester, Nottingham, Newcastle-upon-Tyne, and Reading.

These officers will be in contact with local representatives of the I.E.E. Advisory Service, and intending applicants for grants are advised to notify the Secretary of the Institution when they apply to the Ministry.



# FLUORESCENT LIGHTING

## EXPERIMENTAL TRAMCAR INSTALLATION AT SHEFFIELD

ON the occasion of their recent jubilee, Sheffield transport department placed in service a new tramcar fitted with fluorescent lighting. This is believed to be the first instance in the country of fluorescent lighting being applied to such a duty, and the equipment was engineered and supplied by the Metropolitan-Vickers Electrical Co., in collaboration with the Corporation engineers.

In this experiment both a.c. and d.c. operated fluorescent lighting circuits have been tried out in order to assess their relative merits, a 110 V, 500 c/p.s. motor-driven inductor type alternator being used to supply current for the a.c. system, while d.c. supply is taken straight from the 600 V traction circuit.

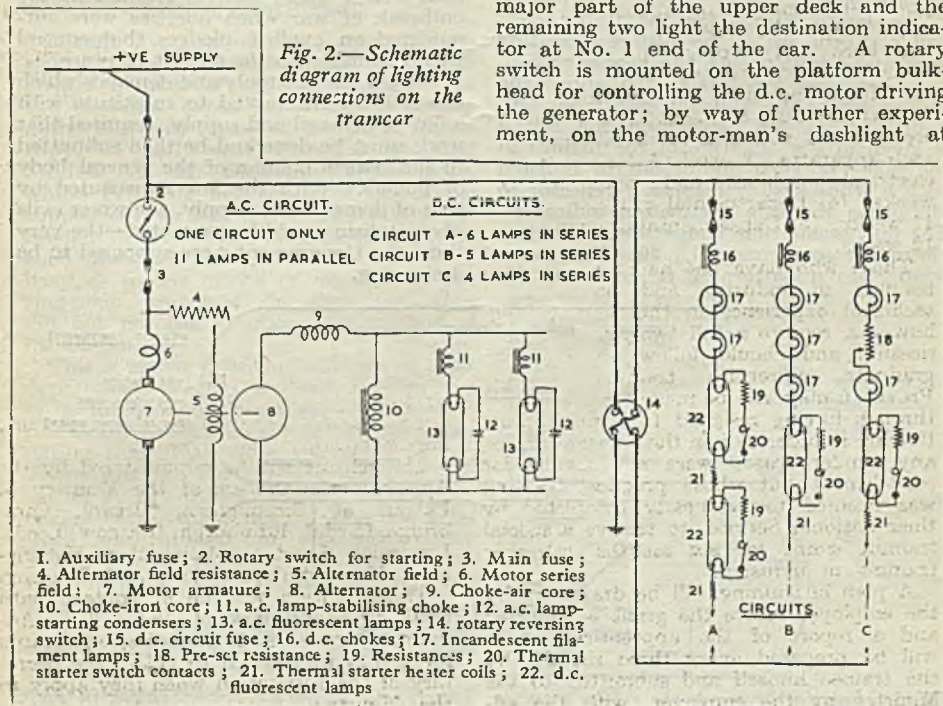
The motor-generator, of the company's type MG16, is mounted on rubber supports and is suspended from the car underframe. It supplies the single a.c. circuit with 110 V at 500 c/p.s., eleven fluorescent lamps being fed in

parallel. For starting, individual straight resonance is employed. The circuit arrangement is shown in Fig. 2 and the distribution of the lights illustrated



Fig 1.—The saloon of the jubilee tramcar of Sheffield Transport Department fitted with an experimental installation of Metrovick fluorescent lighting

Fig. 2.—Schematic diagram of lighting connections on the tramcar



in Fig. 3, both of which include the d.c. sections. Nine lamps illuminate the major part of the upper deck and the remaining two light the destination indicator at No. 1 end of the car. A rotary switch is mounted on the platform bulkhead for controlling the d.c. motor driving the generator; by way of further experiment, on the motor-man's dashlight at



each end of the car is an incandescent lamp supplied with 110 V, 500 c/ps. supply.

The d.c. lighting, as already mentioned, is taken from the main tramcar supply of 600 V and its arrangement is as in Figs. 2 and 3. Three separate circuits are disposed as follows: Circuit A-6 fluorescent lamps stabilised by 2 incandescent lamps; circuit B-5 fluorescent lamps stabilised by 3 incandescent lamps; circuit C-4 fluorescent lamps stabilised by 2 incandescent lamps and a resistance.

The lamps are started by the conventional method of employing chokes and thermal starter switches. Eight lamps illuminate the saloon, two the destination indicator at No. 2 end, two the platform, and three complete the lighting of the upper deck. In order to avoid the "dark end" effect in the lamps which is liable to occur on continuous running with the current in one direction, a rotary switch is mounted on the platform for reversing the polarity of the supply every time the lights are switched on. The seven incandescent lamps used for stabilising purposes are applied to the signal lights and air brake gauges, and are of the series burning type. Two other incandescent lamps, not used for stabilising, are mounted in standard motor-bus headlight fittings with reflectors modified to suit, and are used as headlights.

The lamp fittings for the upper deck and platform are of the surface mounting type and accommodate the necessary control auxiliaries, whereas in the saloon the fittings are of the fully recessed type. An impression of the lighting in the saloon is given in Fig. 1. One of the fittings in the saloon on each side of the car is fitted with a white opal "Perspex" reflector to illuminate the side destination indicators. The fluorescent tube lamps throughout are Metrovick experimental, 20 W, warm-white, bi-pin pattern, 2 ft. in length by

1½ in. diameter, while the lampholders, starter switches and details are also the company's standard accessories.

From the point of view of the results, the experiments appear to have been quite successful judging from public reactions. The level of illumination obtained in both the upper deck and the saloon is approximately 10 lumens per sq. ft.

Acknowledgments are due to Mr. R. C. Moore, general manager of the Sheffield transport department, for permission to include the illustrations accompanying this article, and to Mr. S. W. A. Sturman, rolling stock engineer.

## Toolmakers' Association

THE chief speaker at the luncheon of the Gauge and Toolmakers' Association in London, on October 31, was Sir Ernest Benn, who said that the association, only four years old, had been recognised by Government departments and received advance copies of statutory rules and orders, which enabled them to circulate full and prompt information to their member firms. He would, he declared, have preferred to learn that on receiving these S.R. and Os. the association had circulated every M.P. pointing out that they had been issued under powers granted at the outbreak of war when liberties were surrendered on explicit pledges that control would vanish with the advent of peace.

The old law of supply and demand, which it was being attempted to substitute with a law of demand and supply, required that work must be done and be then submitted to the critical opinion of the general body of buyers. With the law substituted by that of demand and supply, the worst evils of capitalism would be promoted—the very thing the Government were supposed to be destroying.

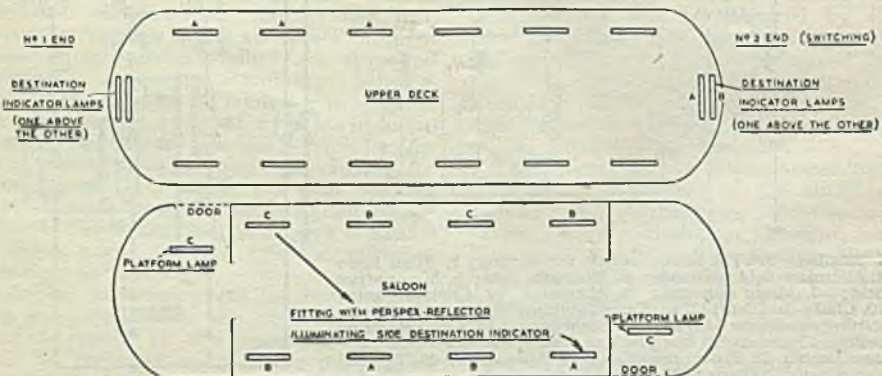


Fig. 3.—Lighting layout in the jubilee tramcar. Letters refer to the d.c. circuits shown in Fig. 2



# COST OF INSTALLATION WIRING

by "SUPERVISOR"

TO all intents and purposes, most electrical installations going in to-day seem to be in the 1930 stage of development. This is especially true of those controlled by local authorities, county and municipal, and which form the bulk of those projected or in actual process of installation. A recent visit to county and other authorities in various parts of the country has been something of an eye-opener to the writer, and some of the methods and systems in use have to be seen to be believed.

For once, this is not a plaint that installations are too cheap or nasty, but that they are, on the other hand, too heavy and expensive. One wonders how many unnecessary pounds are being spent on heavy jobs in small cottage dwellings, and what is the use of relaxations and new approved methods of installation if news of them never percolates to the level where they would be of most use? Whose job is it to see that the county engineer's department or the architect's branch in the local authority knows something of recent developments? Is there anyone whose job it should be?

## RECENT EXPERIENCE

Recent investigations have covered some eight county authorities and a much greater number of local authorities. In the electrical departments of the county authorities only three of the eight had a copy, or had seen, Post-War Building Studies No. 11, Electrical Installations, whilst five only had copies of the March supplement to the I.E.E. Regulations. It needed no very severe cross-examination to elicit the fact that all eight were very hazy as to the merits or demerits of the ring-main proposals; in any case, they did not propose to utilise the method of installation.

This is rather unaccountable, as all eight departments visited enjoyed the services of a full-time electrical engineer, but in practically every case the old specifications dating from 1938 were still being issued. There was the old prejudice against the use of 1/.044 cables, and a very obvious dislike of anything new. Not one good word was uttered in connection with P.V.C. insulated cables, although most of the engineers admitted that they had not been tried.

The stock answer to all inquiries as to why certain newer ideas were not under contemplation was—will the local supply authority approve? Apparently the sole arbiter as to what was good practice and

what was not so good was the supply authority, and it is hoped that they realise their responsibility in this direction. One of the older generation of engineers, due shortly for retirement, stated that he distrusted all forms of v.i.r. cables, and pointed with pride to the installation in the county hall in which we were then chatting. Incredible as it may seem, this had been carried out with t.r.s. cables in heavy gauge steel conduits. One gathered that if he had his way, all future installations would be carried out in the same super system.

## COSTLY SPECIFICATIONS

One or two specifications then being issued by these local authorities were examined. Not one of them would permit the use of single-strand cables, one only contemplated the use of light-gauge close-joint steel conduit with lug-grip fittings. The remainder wanted brazed or welded light-gauge conduits, and two of these specified the use of the heavy screwed type of fitting with a very expensive split-cone continuity device. Apart from heavy expense, here were all the elements of delays and hold-ups, representing further unnecessary cost to someone.

One authority only specified cables to B.S.S. No. 7, the remainder preferred to keep to C.M.A. grades. As a matter of interest, the writer went through one specification in detail with the engineer concerned, and made certain suggestions, all of which fell within the scope of the Regulations, and showed that it was possible to effect a saving of about twenty per cent. in cost with, if anything, a more convenient installation. As this specification was to be applied to a contract for some twenty-eight rural houses, the total saving was about £140.

To the comment—"I am sure that the local supply people will never approve this" there was no immediate answer, but an opportunity was made to see the local authority. Their comment was "We have been wondering when County Hall would wake up to the fact that there are cheaper ways of making installations than their specifications call for, but its not our job to tell them how." Apparently the old and tried methods will still prevail, and the taxpayers' money still be unnecessarily poured out.

It is not surprising that similar conditions apply to the local authorities, as in this case the preparation of electrical schemes and specifications falls upon the



already overworked architect's department, and he cannot be expected to be an authority on every branch that he handles. So many of these architects are very young men, probably recently returned from service with the Forces, and the temptation to use the specifications prepared by their more experienced predecessors must be very strong.

Yet the matter is even more important in the case of the local authorities, as they will be handling the bulk of installation work for some years to come. Here are samples taken from a few of the specifications now being issued, and which, it must be remembered, will apply to small houses of the 1 000-1 200 sq. ft. floor area type, in fact, to cottages in most cases. "The 15 A heating points will be wired in pairs to a 30 A distribution board, with 7/.036 cables to the first point and 7/.029 to the second." There are five of these points in each house, so that the odd one will presumably be taken back to a 30 A way on its own.

Almost incredibly, the 30 A distribution board is to be controlled by a 60 A main switch fuse. It is extremely doubtful if the heating load in a house of this type will ever exceed 4 000 W, as the small rooms could not stand it. In addition to all this, the cooker point is to be wired with 7/.044 cables with a separate 30 A main switch fuse, for an estimated maximum demand of about 15 A.

"No more than seven lighting points to be placed on one circuit" is almost a commonplace provision, and it would seem that this number survives from the days of carbon filament lamps; no other evidence can be secured. Quite a number of specifications betray distrust of conduit earthing, and call for a separate earth wire for cookers and on heating circuits.

#### TOO HIGH A STANDARD ?

It seems clear that many of these extravagant provisions will prevail for several years to come, and one wonders what can be done about it. Would it not be possible for the E.D.A. to prepare and circulate a specimen specification for small houses, prefixing to it the written approval of the local supply authority to anticipate any query of the type mentioned above? Such a specification should be free from any prejudices or fads and fancies, and take advantage of all possible economies which modern methods make available. The standard E.D.A. consumer's unit could be insisted upon, if thought desirable, as even so, a considerable saving should be possible.

The saving of even a couple of pounds on small installations would in the aggregate represent an enormous amount, but in the writer's view the possible saving would

be more likely to be about five or six pounds per installation. Any such saving could be expended in greater facilities for the consumer, for although some of the present installations are expensive, they still represent something below what the consumer should enjoy.

Anyway, the present restriction to £1 200 per house should not have to carry an unnecessarily expensive electrical installation, lest the local authority decide for gas services instead.

### *Lighting Old Buildings*

IN a paper given at a joint meeting of the Royal Institute of British Architects and the Illuminating Engineering Society, on Wednesday, Messrs. E. H. Penwarden and S. Anderson dealt with New Lighting for Old Buildings, in which some reasons for the improvement of artificial lighting were discussed.

The current outlook on lighting and its relation to other factors was covered, and the characteristics of contemporary electric light sources compared. Considerations involved in light control were dealt with, and mention was made of some of the materials now used, with indications as to their suitability for particular applications.

The variety of buildings considered was limited to those employed for historic, civic, official and domestic purposes and some consideration was given to the architectural styles encountered. Their broad classification into (a) buildings of historic style and tradition requiring improved lighting, and (b) buildings whose use dictated the adoption of a modern standard of illumination, was made, and the broad implications of each requirement outlined.

The co-ordination of the requirements of the architect and of the illuminating engineer was considered. Various practical methods of treatment were suggested including the adaptation of existing fittings to take new lamps and light control equipment, the installation of new fittings specially designed in appropriate style, the use of modern fittings of simple exterior design, and light from concealed sources.

Long and short wave transmitting equipment worth nearly £20 000 has been ordered from Marconi's Wireless Telegraph Co., Ltd., by the Swedish Telegraph Administration. The contract covers the supply of a 40 kW air-cooled long-wave transmitter to be installed at Karlsborg in southern Sweden and employed on the European telegraph service; and two 7 kW short-wave transmitters to be erected at Grimeton on the Swedish west coast and used to augment the existing telegraph service with America.



# Equipment and Appliances

## New Sound Film Projector—Compact Time Delay Switch

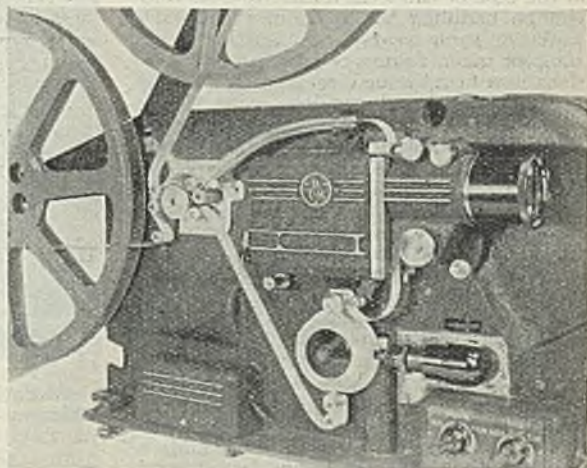
A NEW 16 mm. sound film projector now being placed on the market by B.T.H., the Type 301, is half the weight of its predecessor, and gives twice the screen illumination and twice the volume of sound. It will operate on incoming a.c. supplies of 90 to 270 V, 50 cycles; and, since it is driven by a constant speed motor of the synchronous capacitor type, sound distortion due to speed variation is virtually eliminated. Film threading is simplified by the use of two sprockets only, the sound sprocket being co-axial with the sound drum. Screen illumination is obtained from a 500 W or 750 W lamp with a high efficiency optical system, the lamp and lamp house being forced-draught cooled. The intermittent mechanism is designed as a completely self-contained assembly, including the aperture gate, shutter and lubricating system. An extremely quick "pull-down" time of 1/220 sec. (1/9 of "frame" time) is attained, enabling a relatively narrow shutter to be used, which gives three

obscurations per frame. The whole intermittent mechanism can be replaced in two minutes.

Quiet running is ensured by the provision of a sound-proof cover (blimp) which encloses the picture and sound gates, and swings down for access

for threading. The spool arms will accommodate 2000 ft. spools, and the take-up spool is chain driven through a friction driven variable gear, which enables correct film tension to be maintained automatically for spools from 400 to 2000 ft. and allows a fast power-rewind. The amplifier

can be removed in a few seconds by unscrewing two screws and disconnecting two 4-pin plugs and sockets. For servicing purposes the connections to the plugs



*New model 16 mm. sound film projector, showing simplified film threading*

have been made sufficiently long to allow the amplifier to be operated adjacent to the projector and the amplifier chassis has been designed to give maximum accessibility to all components. All valves are accessible by the removal of the projector cover. The amplifier circuit contains two stages of amplification, using midget valves, followed by two output valves in parallel. The latter are miniature beam tetrodes and are operated with a considerable amount of negative feedback to ensure high fidelity. The output is 10 W. All controls are grouped on one side of the machine. The projector unit, which weighs only 39 lb., fits into a carrying case, which also houses spare lamps, valves, etc. A second case acts as a baffle for the 12 in. p.m. speaker, and contains 50 ft. of speaker lead and a spare spool. The mains transformer unit gives the necessary output at 115 V for the projector lamp and 110 V for the motor and amplifier.

Among the recent products of Sunvic Controls, Ltd., Stanhope House, Kean Street, London, W.C.2, is a compact, adjustable time delay switch. The unit contains two bimetallic strips, one of which is heated by an element in the control circuit, while the other provides compen-

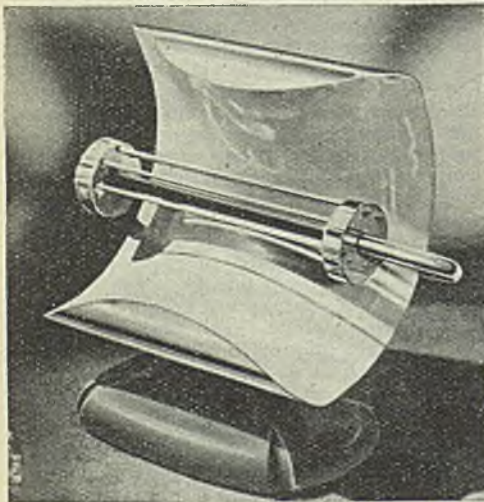


*A Sunvic adjustable time delay switch*



sation for ambient temperature variations. The switch itself is of the snap-action type and can be supplied with the contacts normally closed or open. Variable time-delay settings, between 15-90 seconds, are applied by means of a milled knob on the front of the unit. The weight is approximately 4 ounces, and the unit is supplied in standard voltage ranges of 12, 24, 100-110, 200-210, 220-230 and 240-250 V. When voltages in excess of 250 V are used, it is necessary to insert an external resistance in series with the heating element.

Recently on show at the Selfridge's exhibition of domestic appliances, the "Bruton" reflector fire is marketed by H.M.V. Household Appliances and is a two or three kW portable radiant type with a chromium plated duplex action steel reflector. The reflector is shaped as an equi-radial series of parabolas to give an even distribution of radiant heat. Six models for a.c./d.c. working are provided, rated at 200, 210, 220, 230, 240 and 250 V. The three kW models may be operated at half power. By using separate voltage ranges, the makers hope to obtain the maximum performance per unit consumed. A high temperature rod type nickel-chromium alloy wire element is wound on formers of a special refractory material designed to withstand very high temperatures. Simplicity of assembly and a positive electrical connection is achieved by a new method of fixing the element,

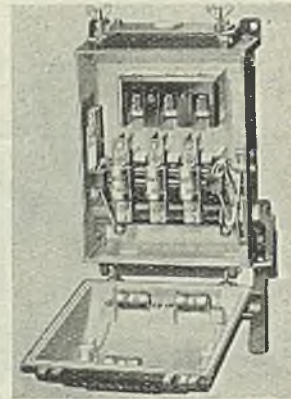


*H.M.V. Household Appliances "Bruton" reflector fire*

while a hinged base enables the fire to be tilted at any required angle.

As a first post-war development in their range of low-tension switch and fuse gear,

the M.E.M. Co., Ltd., of Birmingham, have re-designed their series of "Glasgow-Rex" switches. Some changes both in appearance and construction have been made to the series. In view of the growth in size of generating stations and distributing systems, with the possibility of correspondingly larger fault currents, it



*M.E.M.'s re-designed "Glasgow-Rex" h.r.c. fused switch*

has been decided to replace the semi-enclosed rewirable type fuses by h.r.c. cartridge fuse links. These have proved satisfactory under tests of 33 kA at 440 V a.c. — the equivalent of 25 000 kVA in a three-phase circuit and have also been tested at

16 500 A, 250 V d.c. with time-constant 0.006 seconds. The switch itself is designed to provide a double break on each pole. The cases are of sheet steel construction with end castings and cover of cast-iron. The cover, which has fittings for spare cartridge fuses on the inside, was designed by an industrial artist and is of pleasing appearance; the normal switch interlock is fitted. Where the conversion of triple pole gear (in the 30 to 100 A sizes) is required, neutral links can be added to the side of the cases, in which holes, sealed by metal knockouts, are ready drilled. All the switches are supplied fitted with switch links, but the switches can be converted to the fused type by fitting the standard pattern cartridge fuse in their place. The series is made in the range 30-200 A, 500 V a.c. or d.c. The 200 A switches are fitted with stirrup handles.

Among their new range of household appliances, Thermionic Products, Ltd., of Pratt Walk, London, S.E.11, announce the "Streamiron," a thermostatically controlled electric iron with the flex permanently attached. A light in the rear of the handle indicates when the plate has heated up to the required temperature. The thermostat adjusting knob is marked according to the type of material being ironed and the sole-plate is provided with bevelled edges. At present, this model is available for 220/240 V, a.c., only.



# Answers to Technical Questions

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

## What is a negative booster?

Tramways and railways which use the running rails as a return path for the traction current must take precautions to ensure that most of the current does actually return by the rails and not through the main body of the earth or by water pipes, lead cable sheaths, gas pipes or other circuits which may happen to lie adjacent to the track. The function of the negative booster is to prevent any serious amount of current straying in this way.

The reason why current may return along these various stray paths instead of along the rails is that the former may offer a lower resistance than that offered by the rails or any negative feeders connected to the rails. The negative booster must, therefore, ensure that the return feeder or feeders offer a very low effective resistance to the flow of current and this is done by injecting into them an e.m.f. which neutralises their voltage drop under all conditions of load.

On a d.c. system the stray currents would cause damage due to electrolysis and a negative booster for such a system is shown in Fig. 1—it consists of a d.c. generator capable of giving 20 to 30 V connected in series with the negative feeder and with its polarity as shown—this puts a very low effective resistance in parallel with the rail and any other stray paths so that practically all the current returns along the feeder. In order that the voltage drop in the feeder shall be neutralised at all loads the generator is excited as shown by a current which is proportional to the load.

With a.c. traction the chief disadvantage of the stray earth currents is that they form, with the trolley wire, a large loop of current which sets up an extensive

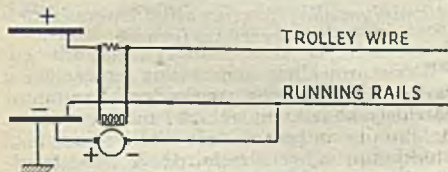


Fig. 1.—Direct current negative booster

electromagnetic field and this may give rise to considerable telephone interference. The negative booster principle can,

however, again be adopted, the booster consisting of a transformer connected as in Fig. 2. The return feeder is in this case mounted on the trolley-wire poles

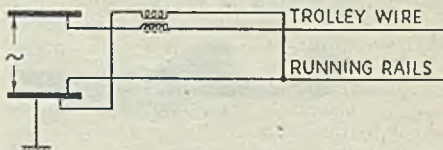


Fig. 2.—Single-phase a.c. negative booster

so that the distance between it and the trolley wire is small and the resulting electromagnetic field of the two is very limited. This scheme is extensively adopted on the Swedish State Railways which are electrified on the single-phase system with 16 000 V at 16½ c.p.s. on the trolley wire.—E. O. T.

## G.W.R. Fluorescent Lighting

Fluorescent lighting in the passenger coaches was a feature of an exhibition of new G.W.R. rolling stock, held at Paddington Station on Tuesday. In collaboration with B.T.H. illuminating engineers, the builders have incorporated a scheme of lighting, using 15 W warm-white tubes, which, if successful, is likely to become standard in all future coaches.

Power supplies are taken from the normal 24 V lighting accumulator, and converted to 110 V a.c. at 400 cycles by a 1 kW motor-generator mounted on the frame of each coach. The auxiliary gear, including ballast reactors, power-factor correction condensers and thermal type starter switches, is concealed under the seats in each compartment. Beyond the normal battery cut-out and voltage regulator no extra control gear is used.

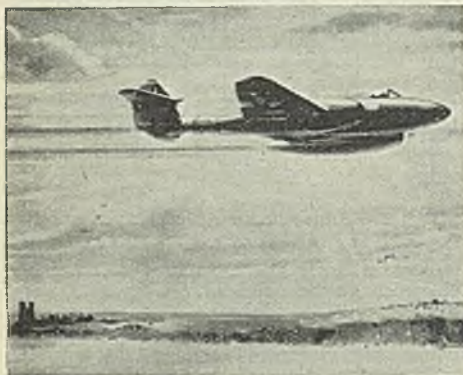
Several layouts of tubes are employed. In the first-class coaches, one centre fitting provides general illumination to each compartment, while two tubes, concealed behind the framework of each luggage rack, give an evenly diffused reading light. The corridors and toilet compartments are equipped with ceiling fittings. In the third-class coaches, independent reading lamps are not provided. Instead, two tubes, one of which can be controlled by passengers, are mounted on the ceilings. As in the first-class coaches, the toilet compartments have single tubes mounted over the mirrors.



# Industrial Information

## Lamp Sales Publicity

Lamp publicity by the Metropolitan-Vickers Electrical Co., Ltd., this winter is based on the slogan "When Daylight Fades Switch to Metrovick Cosmos Lamps."



*Gloster Meteor as shown on a Metrovick coloured folder dealing with infra-red electric lamp heating*

Attractive Press advertising designs are supported by large window displays opening to 9 ft., and small displays standing 3 ft. 6 in. in height. The latter have been designed especially for small windows and for those windows where the contractor wishes to include products other than lamps in his display. In preparation is a new comprehensive lamp catalogue with its distinctive orange cover, and a pin-up folder for the contractor, containing list prices, and prices with purchase tax. Much of the company's literature is still confined to descriptive leaflets, each covering a separate fitting, either industrial or street lighting, but as the manufacturing position becomes stabilised catalogues and brochures will be produced to show the whole range of Metrovick lighting equipment. To bring infra-red electric lamp heating for industrial processes to the notice of firms still unaware of its possibilities literature covering the whole subject is being prepared. This is taking the form of a series of coloured folders, and the first one (No. 4108/3-1) now available has an attractive cover showing the Gloster Meteor on its record-breaking run at Herne Bay in 1946. This aircraft was painted and fillers stove-finished by the company's electric infra-red lamp process.

## Fuel Saving in Glasshouses

"How Glasshouse Growers Can Save Fuel" is the title of Fuel Efficiency Bulletin No. 46, issued by the Ministry of Fuel

and Power. Thermostatic control is recommended where the forced draught system is employed. Among other bulletins in the series of publications issued by the Ministry for the guidance of industrial consumers are No. 13, "Fuel Economy by Saving Electricity"; No. 40, "Combined Power and Heating"; and No. 45, "The Installation and Maintenance of Boiler-house Instruments." These can be obtained free on application to the Ministry of Fuel and Power, Dean Farrar Street, Westminster.

## A Lesson in Metallurgy

The latest industrial organisation to appreciate the power of the documentary film in expressing complex ideas in simple form is the Aluminium Development Association, whose "Heat Treatment of Aluminium Alloys" was privately shown last week. In the space of 18 minutes, the film describes the initial discovery of age-hardening, by Alfred Wilm, in Germany, and, with the aid of expressive diagrams, illustrates in simple form the mechanism of "slip" and work-hardening in metallic crystals. This is followed by a description of the practical aspects of heat-treatment, which shows examples of the various types of furnace employed and stresses the importance of continuous and accurate temperature control in the



*Aluminium alloy forgings being lowered into a heat treatment furnace*

various annealing and rolling processes, a task which involves a considerable amount of thermostatic control and metering gear. A glimpse is given of the rolling of aluminium alloy sheets, their final heat-treatment and flattening, and the film concludes with a survey of the uses to which the materials may be put, in cooking utensils and large scale structural work as well as in the more familiar aircraft construction. Copies of the film, which is avail-



able (for sound projectors only) in both 35 mm. and 16 mm. sizes, may be borrowed, free of charge, by technical colleges and similar bodies for projection in their own theatres.

### Electrical Homes and Supply

At the final session of the three days' conference of electrical housecraft advisers and saleswomen in the electricity industry, held at the Connaught Rooms, London, from October 30 to November 1, under the auspices of the Electrical Development Association and Electrical Association for Women, a resolution was adopted to the effect there is an urgent claim for an uninterrupted supply of electricity in the home. The conference realised that, under existing circumstances it might be necessary occasionally to cut electricity service, but they urged the Government to give first priority to the extension and re-equipment of power stations, so that there might be no further need for load-shedding. Copies of the resolution have been forwarded to the Ministers of Fuel and Power, Supply, Works and Health and the President of the Board of Trade.

### Reports from Germany

Among further reports containing scientific and technical intelligence from German industry, and now on sale at the Stationery Office, are the following: C.I.O.S. XXXIII-36, Design of Turbo-generators Built for German Navy (9s.); and B.I.O.S. 674, The German Electrically Welded Steel Tube Industry (4s.); B.I.O.S. 725, German Research on Rectifiers and Semi-Conductors (4s. 6d.); F.I.A.T. 287, Quadded Toll Cables (1s. 6d.); F.I.A.T. 288, Rural Telephone Service, Dial Switching for Teletypewriter Systems and Miscellaneous Items (1s. 6d.); F.I.A.T. 669, Survey of German Low Voltage Motor Control Equipment (3s. 6d.); F.I.A.T. 115, Survey of the Carbon Brush Industry for Electrical Equipment of Germany (2s.); J.I.O.A. 59, Synchronised Broadcasting Systems in Upper Austria: Principle of Operation (1s.).

### Guide to Aerodrome Lighting

A guide to aerodrome lighting was issued by the British Standards Institution in 1932, to be followed in 1934 by a B.S.S. which was revised in 1937, but both guide and specification have been rendered completely obsolete by subsequent developments. It has not yet been possible to prepare an up-to-date specification, but a revision of the guide has just been published as B.S. 1332:1946. It gives a description of the probable future requirements of aerodrome lighting equipment to provide adequate assistance to the pilot

of an aircraft in all conditions in which it is anticipated that operations can be carried out, both by day and by night. The recommendations embodied in the guide are based on present knowledge and opinions, and may be subject to revision in the light of future international agreement. Copies of B.S.1332:1946 may be obtained from the B.S.I., Publications Department, 28, Victoria Street, London, S.W.1, price 2s., post free.

### German Fuel and Power

Investigation of the German fuel and power industries is the subject of Fuel Efficiency Bulletin No. 47, issued by the Ministry of Fuel and Power. The investigation of the German electricity industry was sponsored by the Control Office, the Board of Trade, and the Ministry of Supply, and the resulting reports are listed under Section 10 of the appended list of reports.

### Electrotechnics in Eire

The report for the year ended March 31, 1946, of the Controller of Industrial and Commercial Property in Eire states that the applications for patents in electro-technics did not disclose the extent of the progress made in its many branches to which pronouncements from reliable sources had given currency, but that this was partly due to administrative difficulties in the return to normal commercial practice. In the field of communications this progress had become manifest. Only in relation to electric fires and immersion heaters was any interest shown in electrical domestic appliances. One solution of space heating was given by two Irish inventors who proposed to embed un-insulated conductors in the lining slabs for walls and use a low voltage supply for heating them.

### Striking Advertisements

We have received from Rowlands Electrical Accessories, Ltd., Birmingham, replicas, printed on art card, of their recent patriotic advertisements which attracted considerable attention in electrical trade circles. They embody the Union Jack and a symbolical figure representing deliverance, and on one is printed the words of R. W. Emerson under the title "Land of Hope and Glory," while the other bears a verse from Swinburne's "England—my England!"

### Products Exhibited

The representative range of products of the General Electric Co., Ltd., selected for inclusion in the "Britain Can Make It" Exhibition at the Victoria and Albert Museum, South Kensington, are described and illustrated in a booklet published by the company for distribution. They com-



prise pendants and ceiling lighting fittings, a vacuum cleaner, an electric warming plate, an electric toaster, an inset and a portable electric fire with multi-parabola reflectors, a 6 in. Xpelair wall fan designed for the modern kitchen and an electric cooker.

### Electric Vehicles Class

To supplement the course of lectures on electric vehicles now being given at the L.C.C. Smithfield Institute by Crompton Parkinson specialists, a practical demonstration was arranged in Smithfield Market on October 29. Assembled for the occasion were two 1-ton Morrison-Electricar vans and a 1-ton chassis. After the demonstration and inspection, those taking the course were given the opportunity of driving either an electric van or the chassis. Several who had never driven an electric vehicle before remarked on the simplicity and ease of control. The lively performance, acceleration and lightness of the steering, received special comment. The illustration shows one of the lecturers instructing on control. The chassis is temporarily equipped for running on public roads. A movable spotlight is fitted for demonstration purposes. Battery housing, control gear and chassis construction are shown.

### Scottish Engineering Students

We have received a copy of the first volume of the "Transactions of the Scottish Engineering Students' Association" for the 1945-46 session. There is a foreword by Mr. J. L. Adam, chief surveyor, British Corporation Register of Shipping and Aircraft, and the contents include the Presidential Address by Sir Harold E. Yarrow, the hon. president of the association, and papers read before the members during the session as well as a report of the activities of the association.

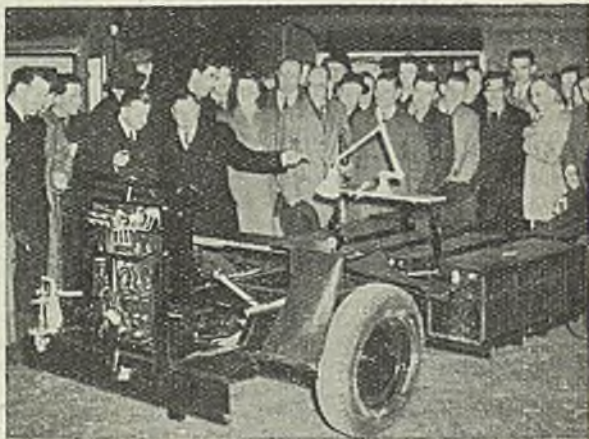
### Cast Iron Research

The last issue of the British Cast Iron Research Association's Bulletin contains the usual account of the activities of the association, and includes the abstracts from over 190 publications of foundry literature. There are also full comments on the F.B.I. conference on industrial research and the Government's White Paper on the Iron and Steel Industry. The difficulties encountered because of the shortage of scientists are dealt with in an article on the report

issued by the Lord President of the Council's Committee on Scientific manpower, which strongly urges the Government to encourage those who wish to enter for science courses at universities.

### Electricity Jubilee

The Hawarden electricity undertaking's 21st anniversary was celebrated on October 31, by a dinner given by the Rural District Council, at Queen's Ferry. Mr. L. F. Bartle, chairman of the North



*L.C.C. Smithfield Institute students receiving instructions on the control of a Morrison-Electricar van*

Wales and South Cheshire Electricity Association, said the undertaking was sturdy and strong and was bigger than many an undertaking of much greater age. Mr. L. McKeon said there were only nine rural district councils in England and Wales owning electricity undertakings, and Hawarden was the second largest.

### Change of Address

Britannia Batteries, Ltd., makers of Alkum and Britannia batteries, announce that they have moved into new offices at Trafalgar House, 9, Great Newport Street, London, W.C.2. (Telephone: Temple Bar 2354/5.)

### Airport Lighting Equipment

Among the equipment supplied by Chance Bros. and Co., Ltd., of Smethwick, for airport ground lighting, may be mentioned portable landing area floodlights, fixed landing area floodlights, illuminated landing direction indicators of the wind-controlled and servo-motor controlled types, boundary lights, obstruction lights, runway contact lights, threshold lights, range lights, airport location beacons, remote control desks, ceiling height indicators, and distribution switchgear. The



company announce that they will be in a position to supply equipment to fill the future requirements of modern airport lighting. High intensity runway contact lights are already being supplied to Heath Row Aerodrome.

### I.E.E. London Students' Dance

About 400 people, members of the I.E.E. London Students' Section and their guests, attended the informal dance, held

at the Royal Hotel, W.C.1, on Saturday evening. Among the guests were Mr. L. Austin Wright, of the Engineering Institute of Canada, and Mr. W. K. Brasher, secretary of the I.E.E. Student members concerned in the organisation of the dance included Mr. R. V. Darton, this year's chairman of the section, and Mr. D. H. Fisher, hon. assistant secretary (entertainments), who was assisted by Mr. W. Tennant.

## Henley Students' Prize-Giving

THE trade and student apprentices who took advantage of the education scheme of their employers, the W. T. Henley's Telegraph Works Co., Ltd., and associated companies, had their fourth annual conversazione and prize-giving at the Gravesend Technical Institute, on Saturday, November 2. It was attended



MR. E. W. WOODHEAD, *the Kent education officer, addressing Henley students*

by a number of distinguished guests representing the Ministry of Education and other educational bodies and institutions. Mr. G. V. Harrup (borough electrical engineer, Gravesend), Sir Montague Hughman (chairman) and officials of the Henley organisation, and some 400 students and parents. The address was given by Mr. E. W. Woodhead, county education officer for Kent, and Mr. E. E. Judge, works manager of the Gravesend cable factory of W. T. Henley's Telegraph Works Co., Ltd., presided.

After presenting the awards to the successful students, Sir Montague Hughman congratulated the recipients and recalled the fact that he had been for over fifty years in the electrical industry. The opportunities for the young man of to-day, he said, were wonderful compared with those available when he was a boy. Every lad who had any ambition or desire to progress in life should seize with both hands the glorious opportunity of education and other facilities now offered.

In his address dealing with the further education aspect of the new Education Act, Mr. E. W. Woodhead said it must

be made clear that industry and education should come together more and more because of their common service to the community. By September, 1947, local educational authorities had to produce an outline scheme of further education. They would have some basis on which to work in secondary education, and, in addition, they would have the valuable aid of what was being done educationally by such firms as Henley's.

Dr. P. Dunsheath, immediate Past President of the I.E.E. and consulting engineer and director of the Henley organisation, in thanking Mr. Woodhead for his interesting speech, said that the most important factor in the development of part-time education was the co-operation between education authorities and industry. For that reason they valued Mr. Woodhead's presence at the function and were glad to know that in not waiting for compulsion under the Act, Henley's were contributing to the progress of further education in Kent and were supported by the authorities.

Peter E. Bacon, on behalf of the Henley students, thanked the directors and officials for the educational facilities made available to juvenile employees.

Mr. V. B. Twiss, education officer to the associated companies, reported that this had been a record year in which more examination successes had been achieved than ever before. The Henley Scholarship awarded annually to the son of an employee attaining the highest place in the entrance examination of the Gravesend County Technical College had been granted this year to Alexander Simmons, son of Mr. Arthur Simmons, of the test department.

After an interval for tea, visitors were able to inspect a display of students' handicraft, and to witness demonstrations of scientific and technical apparatus arranged by Mr. H. C. Hoban, of the company's research laboratories, and Mr. J. H. Savage, of the test department at the North Woolwich works.



# INSTITUTION OF CIVIL ENGINEERS

PRESIDENTIAL ADDRESS BY SIR WILLIAM HALCROW

THE advantages of co-operation by the "Big Three" institutions were stressed by Sir William Halcrow in his Presidential Address to the members of the Institution of Civil Engineers on November 5. He urged the need for union, or, at least, co-ordination of effort, of the smaller institutions.

Reviewing the accomplishments of the institution, more particularly over the last 15 years, the President said that perhaps the greatest obstacle to-day to the presentation of the views of the profession as a whole on matters of general and public interest was the large number of existing institutions, the effect of which was to increase the number of voices to the detriment of unity and concerted action. If our predecessors had foreseen the effect of their policy they would no doubt have provided for sectional divisions of the institution specialising in the various branches of professional work. It was in an endeavour to check further growth in the number of engineering institutions that the Council had set up a number of engineering divisions of which there were now six.

## AMALGAMATION OF INSTITUTIONS

In his opinion the advantages of amalgamation of some of the smaller institutions, for which efforts had been made without success, were so great that it was difficult to understand what those who opposed practicable and equitable proposals to that end expected to gain by standing aside. Certainly members did not gain, because, if they belonged to two institutions they paid two subscriptions instead of one. He hoped that members would do all they could to encourage the effective union of institutions, or, at least co-ordination of effort.

After referring to the formation of the Engineering Joint Council in 1922, which now consisted of the four founder institutions, together with three co-opted societies, and to the fact that it was an advisory body without executive powers, and so had limited powers, he stated that in the last six years a much closer co-operation had been developed between the Institutions of Civil, Mechanical and Electrical Engineers, a group sometimes described as the "Big Three" and comprising about 40 000 qualified professional engineers and half that number again of student engineers in all stages of preparation for the engineering profession. The

Presidents of those three societies met from time to time and discussed matters of common policy, and it had been found that decisions could be reached and action taken with great promptitude and with that authority which was associated with the heads of the three leading engineering societies.

## VIEWS ON COMMONWEALTH CONFERENCE

He then referred to the successful conference which, on the initiative of the Council, had taken place during September between the three institutions and representatives of the leading Commonwealth engineering societies, when resolutions had been carried adopting *inter alia* proposals for the joint discussion and publication of papers about which advance information would be exchanged by the institutions; the co-ordination of abstracting services; the extension of public relations and publicity activities; privileges to be afforded to members of constituent institutions; and for greater uniformity in and co-ordination of standards of education and training.

Another advance which had been made was in the closer co-operation between the engineer and the contractor. That was shown by the organisation of a Works Construction Division, by the joint issue with the Federation of Civil Engineering Contractors and the Association of Consulting Engineers of a document entitled "General Conditions of Contract for Use in Connection with Works of Civil Engineering Construction," and by setting up with the Federation of Civil Engineering Contractors a standing joint committee for the initiation of a scheme for training young persons as contractors' engineers.

## EXAMINATIONS AND TRAINING

Similar committees had recently been set up to consider matters connected with examinations and training with the Institution of Electrical Engineers for the preparation of a joint examination syllabus covering certain subjects, and with the Institution of Municipal and County Engineers for the initiation of a scheme for training young persons as engineers to local authorities.

The President referred to the fact that as a result of the approach made by the Council to the Colonial Office in 1943, the Colonial Office had now organised a special service of engineers.

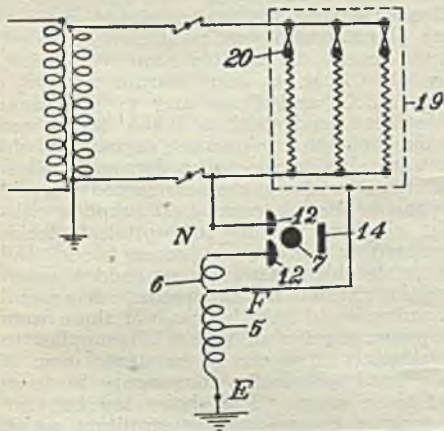


# ELECTRICAL INVENTIONS

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.

## Earth Leakage Trip

In order to provide a simple and relatively economical earth leakage protective device, sufficient to cause rapid operation of the protective fuse in the event of a dangerous leak, or give an audible indication of minor leakages to earth, an iron core is wound with a pilot coil (5) of many turns of fine wire and a current coil (6) of relatively few turns of heavy gauge wire. The terminal F is connected to the framework of a machine, the terminal E to an earth electrode and the terminal N to the neutral conductor of the supply system. A steel reed is placed in magnetic relation to the lower pole piece. In the event of a minor leakage between the load circuit and the framework (19), the current will flow from the point of fault via the framework and the pilot coil to earth. The field created will not normally be strong enough to operate the armature of the device, but



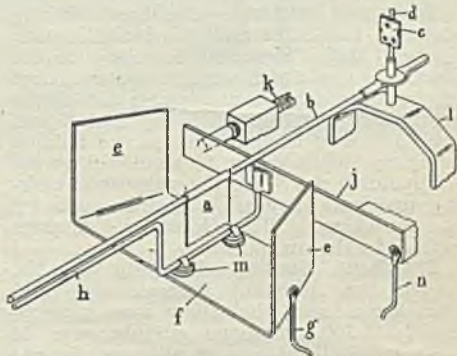
the reed will vibrate at the supply frequency, giving an audible warning. If a heavy leakage fault develops, the roller (7) will be pulled into engagement with the contacts (12). This has the effect of providing a low resistance path between the metal framework and the neutral line

and at the same time, by engaging the current coil, it holds the contacts in the closed position until the protective fuse (20) has blown. A flap (14) gives visual indication when the trip has operated.

S. J. Wimsett and Record Electrical Co., Ltd. Application date, July 25, 1944. No. 580 787.

## Variable Meter Sensitivity

The sensitivity of galvanometers and all associated electrical measuring instruments, magnetometers, etc., and in particular fluxmeters of the totally suspended Grassot type can be increased by a con-



struction which reduces the torque produced when the moving system is deflected.

The illustration shows the invention applied to a Grassot fluxmeter. A movable plate *a* is fixed rigidly on a suspended pointer element *b* and is maintained at earth potential. The moving-coil element *l* and mirror *c* are hung from a silk thread *d*, while current is led into the coil through ligaments. The distance between the fixed metal plates *e e*, which are connected by a wire *g* to a source of voltage, is made large compared with that through which the movable plate travels when the coil element is deflected.

The spring *j*, electrically connected to a source of potential (about 200 V) serves to adjust the zero position of the pointer. In operation, the voltage applied between the fixed and movable plates causes an electrostatic torque to be exerted on the plate *a*, which is approximately proportional to the angle of deflection of the coil element from zero and is always opposed to the torque imposed by the suspended element.

Cambridge Instrument Co., Ltd., and M. C. Marsh. Application date, July 25, 1941. No. 580 680.



# In Parliament

## Some Electrical Questions Asked and Answered

**Transmission Poles.**—The Minister of Fuel and Power was asked by Mr. Spence what percentage of the electric transmission poles imported from Germany were being allocated to Scotland. Mr. Shinwell, replying, said that the poles would require seasoning for six months before they could be used. No allocation had so far been made to the electricity supply industry. The needs of rural Scotland would be taken into account when the poles became available.

**Cable and Wireless.**—The Lords amendment to the Cable and Wireless Bill, Mr. Glenvil Hall (Financial Secretary to the Treasury) explained, would have the effect of providing for the reasonable use of the services of the cable company's staff and such access to their records as the holding company might desire to have, up to the "appointed day," for the purpose of making any claim they might wish to make for compensation. The House of Commons agreed to the amendment.

**Telephone Service.**—Replying to Mr. Erroll, the Assistant Postmaster-General (Mr. Burke) said that there were approximately 2 700 telephone circuits over 25 miles in length at present allocated for use of the three Services, and 700 in use by other Government departments and the B.B.C. A total of 12 850 circuits over 25 miles in length were available for the public service. Lines were being taken over from Government departments, with their co-operation, as fast as possible.

**New Generating Stations.**—Asked by Lieut.-Col. Sharp what progress had been made by the C.E.B. in arranging for the building of new power stations and extensions to existing plant, Mr. Shinwell replied that the Board had arranged for the construction of 45 new stations or extensions, with a total generating capacity of 3 209 000 kW. Fifteen of them, with a capacity of 521 000 kW, were nearing completion. He was not aware of any case in which completion was being delayed owing to shortage of materials.

**Peak Load Capacity.**—Lieut.-Col. Sharp asked the Minister of Fuel and Power what was the estimated peak-load capacity of the grid system during the coming winter and the estimated peak-load demand that would be made upon it. Mr. Shinwell replied that the maximum capacity of the generating plant operated under the control of the C.E.B. was 10 689 000 kW, but deductions had to be made for plant being unavailable owing to breakdowns, overhaul, etc. It was estimated, therefore,

that not more than 8 738 000 kW could be relied on for this winter. In severe weather it was estimated that the maximum simultaneous demand would be about 10 000 000 kW.

**Domestic Fittings.**—Asked by Mr. Robertson if the production of electrical fittings was adequate to meet the demands of the home market, particularly the building industry, and what proportion of electrical fittings for houses was being exported, the Minister of Works (Mr. Tomlinson) replied that production was in general, adequate for the demands of priority buildings, which included all new housing and other essential work. It could, however, meet only a proportion of the remaining requirements. No licence was required to export these goods, so that detailed figures of exports were not available, but it was estimated that 17 per cent. of production of electric lighting appliances, accessories and fittings, and 11 per cent. of production of electrical cooking and heating apparatus were at present being exported. These percentages mainly resulted from substantial exports of particular items which were not in short supply.

**Load Shedding.**—In replying to a question (by private notice) from Mr. Keeling, Mr. Shinwell (Minister of Fuel and Power) reiterated that interruptions of supply were due to shortage of generating plant, which was insufficient to meet peak loads. All possible steps were taken by the C.E.B. to issue warnings through the B.B.C. and Press and to individual electricity undertakings when there was a likelihood that generating capacity would not be able to meet the demand. Electricity undertakings were instructed to avoid as far as possible cutting off supplies without telephone warning to hospitals, factories engaged in continuous process work, and other establishments where sudden interruptions would be dangerous. A general warning could only be given if there were a prearranged plan to cut off supplies to particular areas on given days, even if it proved technically unnecessary to do so on those days. The choice lay between having a prearranged interruption which might have been avoided or a sudden interruption which occurred only when it became inevitable. The recent shedding of load had nothing to do with shortage of solid fuel, although it was quite possible that, during the winter period, there might be some occasional shortage of fuel.



# Electricity Supply

**Iford.**—The Electricity Committee is to provide a sub-station on the Oaks Lane estate, at a cost of £5 435.

**Seaham.**—Owing to the shortage of electricity meters, the Urban Council proposes to introduce a comprehensive electricity charge in new houses.

**Ealing.**—Sanction has been obtained to borrow £9 800 for mains, £27 300 for sub-station equipment, and £3 000 for transformer modifications.

**Morecambe.**—A proposal to increase the electricity charges, approved by the Town Council, is to be submitted to the Electricity Commissioners.

**Scarborough.**—A sub-station, costing £2 304, is to be built at Sandybed Crescent. The Electricity Committee has obtained sanction to borrow £18 203 for extensions.

**Bedford.**—Mains extensions costing £762 will provide supply to the rural areas of Shefford, Houghton Conquest and Renhold.

**Birkenhead.**—The Watch Committee has authorised the lighting of various main roads by the B.T.H. Dilen system, at a cost of £3 938, and has asked the electrical engineer to make a report on ripple control.

**Blackpool.**—Faults in an underground cable led to an electricity black-out recently. During testing, a high-tension cable broke down and burnt out. In Ashton Road, three paving stones were moved by the explosion.

**Brighton.**—In its proposed general powers bill, the Parliamentary Committee has included a clause for penalties for using false coins in electricity meters. The Electricity Committee is to provide equipment for eleven sub-stations, at a cost of £12 600.

**Hull.**—At a meeting of the Education Committee, it was reported that the cost of electricity installation at Courtney Street and Chapman Street schools was estimated at £3 040. The education director was instructed to report on the possibility of installing fluorescent lighting.

**Kidlington.**—Approval has been given to an improved scheme of street lighting for the district. The Parish Council, however, have stated that they are unable to entertain the suggestion, without financial assistance, of the Ministry of Transport that on the main Oxford-Bicester Road the lighting should be brought up to the

standard required for trunk roads. This, it is estimated, would cost a further £6 000.

**St. Pancras.**—Among the first supply undertakings to resume refrigerator hire trading is St. Pancras, where the Electricity and Public Lighting Department is



*The showroom display designed for the St. Pancras electric refrigerator hire scheme*

offering a refrigerator for hire at 16s. 3d. per quarter, or 1s. 3d. per week. In a showroom display arranged by the undertaking in connection with the scheme, the advantages stressed, as will be seen in the accompanying illustration, are safeguarding of health, low costs and saving of labour. The model at present offered is the Electrolux 1.6 cu. ft. type which is now being supplied for Government temporary housing schemes. During the first week of the scheme, the undertaking states, some 50 hire agreements were completed, and it is expected that a high rate of applications will continue.

**Leicester.**—A proposal to make all street lighting within a radius of half a mile from the Clock Tower, in the centre of the town, all-electric, is being considered by the City Council. Application is being made for sanction to borrow £20 000 for the carrying out of the conversion scheme and other street lighting plans.

**Conway.**—The accounts of the electricity department for the year ended March 31 last show a revenue surplus of £4 571, a general reserve fund of £6 000, and an income tax reserve of £2 150. The outstanding loan debt has been reduced to £34 260, against capital assets and outlay of £98 628.

**Blackburn.**—To warn local industrial consumers of a state of emergency and contemplated reduction of load, two automatic control devices will be operated at Whitebirk generating station. The reduction will vary from 10 per cent. to 15 per cent. Two red lamps, one labelled "warning"



and the other "reduce load," will be operated by rhythmic control equipment a few minutes before 8 a.m. and 2 p.m. in certain factories.

**Trading Results.**—Statements of accounts recently published show deficits, in the Stoke Newington and Southwark undertakings, of £3,881 and £14,378 respectively. Fulham Electricity Committee reports a surplus for the year of £62,419, and recommends a further discount of 5 per cent. on accounts.

**Mansfield.**—The Electricity Committee plan to connect the Goodacre sub-station to the 11 kV system and provide additional transformers and switchgear at a cost of £1,693; strengthen the low-tension cable system to Mansfield colliery at £2,578; provide a sub-station at Maltby Road at £1,988 and extend cables to housing estates at £1,685.

**Chesterfield.**—The local Water Board had made arrangements with the Derbyshire and Nottinghamshire Electric Power Co. to divert the high tension transmission line, which passes through the site of the Chandler Hill reservoir, at an estimated cost of £4,000. The Electricity Commissioners have refused to grant fringe orders to enable the Corporation to provide supply to Brimington and Calow, in view of the supplies at present afforded by the

Derbyshire and Nottinghamshire Power Co. in those areas. The Electricity Committee is to provide supply at a cost of £2,447 to a new housing estate at Whittington.

**Islington.**—After considering requests from tenants of requisitioned properties that they be afforded the same facilities as other householders in respect of the provision of electrical installations under the rental wiring scheme, the Housing Committee has arranged for this service to be so available, subject to agreement by the owners.

**Tynemouth.**—The new system of remote control for electric street lighting whereby all the lights can be switched on together, has been completed. The scheme covers 18 sub-stations, any one of which can be switched off from the electricity works at Tanners Bank, North Shields. The system was installed by Standard Telephones and Cables, Ltd.

**Mexborough.**—A reply to complaints by residents about sulphur fumes from chimneys of the Yorkshire Electric Power Company's generating station at Mexborough was made by an official of the company, who said that formerly they used a coal with a low sulphur content, but now they had to make do with whatever kind was directed to them.

## Electrical Statistics for September

THE weekly average consumption of coal by authorised electricity undertakings increased from 396,000 tons in August to 463,000 tons in September (over 5 weeks). The figure for the corresponding month last year was 404,000 tons. The distributed stocks held by authorised undertakings grew from 1,797,000 tons in August to 2,108,000 tons in September. The stocks held in September, 1945, amounted to 3,277,000 tons. Electricity generated during the month reached a total of 3,105 million kWh, compared with 2,847 million kWh in August, and 2,707 million kWh in September of last year.

Deliveries of British-built arc-welding sets in September numbered 483, value £67,000; and of resistance welding sets 151, value £42,000. The comparative figures for August were 327 arc-welding sets, value £46,000; and 210 resistance welding sets, value £47,000; and for September, 1945, 475 arc-welding sets, value £91,000; and 154 resistance welding sets, value £38,000.

The production of electric appliances classed as building fittings in September was as follows: cookers, 13.3 thousands; wash-boilers, 19.3 thousands; water heaters (immersion), 39.8 thousands,

and meters, 99.6 thousands. For August the totals were: cookers, 13.9 thousands; wash-boilers, 20.5 thousands; water heaters, 27.6 thousands; and meters, 96.1 thousands. These figures show an appreciable advance on those for September of last year, which were: cookers, 6.2 thousands; wash-boilers, 5.3 thousands; water heaters, 11.8 thousands; and meters, 39.1 thousands.

The value of electrical goods and apparatus exported as shown in the tables contained in the tenth Monthly Digest of Statistics, was £3,861,000, and the monthly average for the third quarter of this year was £3,257,000. The average for the first quarter was £2,453,000, and the second, £2,931,000. In 1938 the monthly average was £1,119,000. Exports of electrical machinery in September totalled 2.9 thousand tons, compared with 3.2 thousand tons in August, and 1.0 thousand tons in September last year. Wireless receiving sets sent overseas in September numbered 33 thousands, and valves 281 thousands, as against 33.3 thousands of sets and 424 thousands of valves in August. Last year the corresponding figures were 2.9 thousands of sets and 134 thousands of valves.



# Contracts Open

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

**Portsmouth**, November 9.—One three-phase 33 kV oil-immersed, natural cooled outdoor type reactor rated at 10 per cent. on 35 MVA, complete with cable boxes and fittings as specified. Particulars from Engineer and Manager, Electricity Undertaking, 111, High Street, Portsmouth. Deposit, £1 ls.

**Plymouth**, November 9.—Supply and delivery of 12 pit type 150 kVA three-phase auto-transformers. Specifications from Chief Electrical Engineer, Armada Street, Plymouth.

**Stoke-on-Trent**, November 11.—Supply and laying cable at Turnhurst Road Social Welfare Establishment. Particulars from Town Clerk, Kingsway, Stoke-on-Trent.

**Salford**, November 11.—Supply of 6 600/415/240 V three-phase power transformers. Specification from City Electrical Engineer, Electricity Department, Frederick Road, Salford, 6, Lancs.

**Southend-on-Sea**, November 11.—Supply and delivery of (a) 11 kV, 150 MVA, metal-clad switchgear; (b) e.h.t. cable (11 kV); (c) l.t. cable. Specifications, etc., from Borough Electrical Engineer, Electric House, London Road, Southend-on-Sea.

**Spalding**, November 12.—Supply, erection, setting to work and maintenance of centrifugal pumps to pump unscreened sewage, complete with electric motors and automatic switchgear. Two pumps to be capable of lifting 65 galls. per min. and two of lifting 45 galls. per min. Details from Council Offices, The Crescent, Spalding, Lincs. Deposit, £5.

**Farnworth**, November 13.—Tenders invited for (E.D.7) 1 000 kVA transformer, (E.D.8) e.h.t. switchgear. Specifications from Electricity Department, Electricity Works, Albert Road, Farnworth, Lancs.

**Manchester**, November 15.—Supply, delivery and erection of one motor-driven air compressor and receiver. Specifications from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester. Deposit, £1 ls.

**Colwyn Bay**, November 15.—Supply and delivery of two electrical centrifugal sewage pumps. Particulars from Borough Engineer, Town Hall, Colwyn Bay.

**Dublin**, November 18.—Supply of street lighting control equipment for the sending of control signals by means of audio fre-

quency impulses superimposed on normal supply over Dublin supply network. Area of control will comprise three 10 kV sub-station areas of the Board's networks, and will require approximately 445 relays. Particulars from City Engineer's Department, 28, Castle Street, Dublin.

**Formby**, November 18.—Supply and delivery of one 2 500 kVA transformer. Specification from Electrical Engineer, Council Offices, Formby.

**Birmingham**, November 18.—Supply of ventilating system at Anti-Tuberculosis Centre, 151, Great Charles Street. Particulars from Engineer and Surveyor, Council House, Birmingham. Deposit, £2 2s.

**Hepton**, November 19.—Supply and erection of two electrically driven pumping sets, each of 200 gall./min. capacity; one electrically driven pumping set of 100 gall./min. capacity, both sets automatically controlled, together with pipework, valves, etc. Particulars from the Consulting Engineer, A. Brooksbank, 14, The Exchange, Bradford, Yorks. Deposit, £2 2s.

**Barking**, November 22.—Supply, delivery and erection of 6.6 kV switchgear. Particulars from Borough Electrical Engineer, Ripple Road, Barking.

**Edinburgh**, November 22.—Supply of electricity supply meters, during year beginning May 29, 1947. Specification from Engineer's and Manager's Office, Dewar Place, Edinburgh, 3.

**Woolwich**, November 27.—Supply of electricity meters during year beginning January 1, 1947. Specification from Borough Electrical Engineer, Electric House, Powis Street, Woolwich, S.E.18.

**Woolwich**, November 27.—Supply of h.v. and m.v. cables during year beginning January 1, 1947. Specification from Borough Electrical Engineer, Electric House, Powis Street, Woolwich, S.E.18. Deposit, £1 ls.

**Woolwich**, November 27.—Supply of transformers required during year beginning January 1, 1947. Specification from Borough Electrical Engineer, Electric House, Powis Street, Woolwich, S.E.18.

**Great Yarmouth**, November 29.—Supply and delivery of domestic appliances during the period of 12 months ending March 31, 1948 (breakfast cookers, boiling rings, toasters, electric kettles, percolators, water heaters, wash-boilers, refrigerators, washing machines, irons, vacuum cleaners, fires, clocks, towel rails). Particulars for all or any items as listed from Chief Engineer and Manager, Yarmouth.



# Company News

**BRITANNIA ELECTRIC LAMP WORKS, LTD.**  
 Tradg. prft., after tax, for yr. to March 31, £29 952 (£17 372 for 11 mths.). To deprecn. £2 318 (£8 721), dirs.' fees £600 (£550), leavg. net prft. £27 034 (£8 101). To writing off goodwill and trade-marks £4 999 (£2 500), gen. res. £12 450 (nil), div. 7% (same), plus bonus 3% (nil), fwd. £12 650 (£12 690).

**CARLES INVESTMENT TRUST, LTD.**—Income for year to June 30 £359 772 (£341 983). Deduct exes. and deb. int. £133 099 (£121 404), net rev. £226 673 (£220 579). To div. 4½% red. pref. £90 000 (same), intm. 2% ord. £40 000 (same), fin. ord. 3% £60 000 (same), fwd. £325 402 (£288 729). Invests. stand in blee.-sheet £7 236 174 (£7 317 931), mkt. val. £8 471 322 (£7 811 244), cash blees. £303 461 (£47 449), cap. res. increased by £173 325 to £635 069 representing profits on sales of invests., less exes. of deb. stk. purchased during yr.

**MUREX, LTD.**—The further reduction in trading profits reflected the adverse conditions that had prevailed in industry generally during the past year, stated the Chairman (Mr. G. P. Joseph) at the annual general meeting. As the company was not a manufacturer of consumer goods, but was concerned mainly in the production of basic raw materials, it was in consequence among the first to feel the effect of any trade fluctuations. These adverse conditions were reflected also in the accounts of Murex Welding Processes, whose turnover and profits showed a substantial decrease over those of the previous year. The cancellation of war contracts had lessened the demand for electrodes, and this had been accentuated by reason of shortages of raw material and difficulties of labour recruitment. The decline in the demand for welding equipment had been less marked. The directors believed that the great war-time expansion in the application of welding would be reflected in peace-time activities as soon as circumstances permitted.

**J. AND F. STONE (LIGHTING AND RADIO), LTD.**—Speaking at the annual meeting, Mr. N. W. Wild (chairman) said that since the last meeting they had been able to reopen a number of branches which were closed during the war. The turnover of the retailing business had increased substantially and, if the difficulties of obtaining supplies for sale and licences for re-fitting had not been great, he thought it was fair to say that the turnover would have been larger. Returns for the current year continued to show an improvement, but those limiting features still existed. The

strength of the group was clearly illustrated by the consolidated balance sheet, which showed gross assets of over £1 150 000, of which over £1 000 000 was represented by current assets. These exceeded current liabilities by over £650 000, in fact, the current liabilities were more than covered by cash at bank alone. As and when the opportunity occurred to expand the company's business in the re-fitting and reopening of closed branches, and in the acquisition of new branches and stocks, these liquid funds would become more profitably employed than they were at the present time.

**CALCUTTA TRAMWAYS CO., LTD.**—Speaking at the annual general meeting, the chairman (Sir Geoffrey R. Clarke) after reviewing the course of negotiations between the company and the Corporation of Calcutta, referred to the declared intention of the Government of Bengal to form a Transport Board for the purpose, inter alia, of acquiring the company's undertaking. The only change in the position, he said, was that the Government of the Province had ceased to be that of the Governor, and a Provincial Government constituted after a general election was now in power. A draft Bill for the formation of the Transport Board had been prepared before the present Government took office, but, so far, no further steps had been taken. The company was, therefore, at present carrying on the undertaking under the provision of its several contracts, including that with the Corporation which granted the Corporation the recurring right of purchase of portions of the undertaking every seven years. The next date was January 1, 1952. Remarking that it was not easy to foresee what might happen in India in the near future, the Chairman said that during the recent riots there had been little interference with the company's personnel or damage to the plant. One of the results of the disturbances in the city was that tram drivers and conductors refused to go on duty at night, and in some dangerous areas the services had been temporarily withdrawn. This state of affairs was naturally having an effect upon revenues, and there was no counter-saving in expenses, but with the return of law and order, one looked forward to a re-establishment of all services.

**BRUSH ELECTRICAL ENGINEERING CO., LTD.**—Full accts. for 1945 show tradg. blee. £61 217 (£252 875), net adjustmts. to prices of contracts executed prior to December 31, 1944, £33 615 (£2 138), trs.



from gen. res. £170 000 (nil), misc. rev. £5 096 (£257), divs. and int. £587 (£438), and receivable under Break Clauses in respect of Govt. contracts ended in 1945 £72 964 (nil), mkg. avail. £343 479 (£255 708). Deduct fees £2 000 (£2 250), to turbine rectification £163 006 (nil), war risks, etc., £670 (£11 700), int. £33 524 (£25 713), losses sub. cos. £31 500 (£14 937), deprecn. £63 983 (£58 947), and A.R.P. £3 349 (£5 181), leavg. £45 447 net (£136 980). Brot. in £11 560 (£11 532), tax res. freed £32 088 (nil). mkg. £89 095. To taxn. nil (£50 000), off invts. £2 000 (nil), gen. res. nil (£40 000), welfare fund nil (£3 611). Prof. divs. £10 766 (same). Ord. intm. (there is no fin.) 4% £15 974 fwd. £56 744. Final div. for 1944 6%, mkg. 10%, less tax. Consd. blee.-sheet shows fixed assets £874 364 (£769 752) and current assets £2 876 567 (£2 306 913). Stk. and work £1 321 737 (£1 036 306), debtors £1 493 124 (£1 260 141), invts. £15 950 (£1 507) and cash £45 756 (£8 959). Liabs.—Iss. cap. £1 190 211 (£1 115 211), reserves £178 628 (£301 560), and current liabs. £2 382 092 (£1 577 394). Gen. res. £170 000, also inc.-tax fund £82 500, have disappeared. Creditors £1 106 651 compare with £904 325, and loans from bankers £1 170 038 with £575 474. Co.'s own blee.-sheet totals £3 456 856, agst. £2 959 378. Curr. assets £2 207 209 (£1 789 055) and hldgs. £437 776 (£472 068). Sums owing by sub. cos. £248 535 (£318 925). Stk. and work £1 311 114 (£1 025 996) and debtors £894 019 (£760 463).

**ELECTRICITY TRUST OF SOUTH AUSTRALIA.**  
—A letter to capital stockholders of the Adelaide Electric Supply Co., Ltd., announces that with the granting of Royal Assent to the Electricity Trust of South Australia Act, 1946, and the proclamation of the appointed day, the Adelaide undertaking, with the exception of its assets situated outside South Australia, has been vested in the Electricity Trust of South Australia. In accordance with the provisions of the Act, the statement adds, and subject to a certain deduction, each capital stockholder will be entitled to be paid by the Trust the market value of his stock (in Australian currency) as at August 1, 1945, together with interest thereon at the rate of 4 per cent. per annum from the day on which the last dividend or interim dividend on the stock became payable by the company, until payment.

**BRITISH ELECTRIC TRACTION CO., LTD.**  
—The directors have declared the following interim dividends on account of the financial year ending March 31, 1947, payable on December 7, 1946, to stockholders registered in the books of the company on

November 7, 1946: 6% cum. ptepg. pref. stock, 3% actual (same), less income tax; 8% non-cum. pref. ord. stock, 4% actual (same), less tax; def. ord. stock, 15% actual (same), less tax.

**ELECTRIC FURNACE CO., LTD.**—The statement by the chairman, Mr. D. F. Campbell, announced that the consolidated balance sheet and profit and loss statement of the company, and its wholly-owned subsidiaries, for the year ended March 31, showed a profit of £29 755 (subject to directors' remuneration) against £29 866 for the preceding financial year. This year's figures included a refund of £64 000 recoverable from excess profits tax paid in previous years, less income tax. During the four years 1940-43, the construction of war factories was at its highest level, and 1944-45 were years of low demand for the company's products. The orders for the last nine months, however, had shown marked improvement, both in the home and export markets. A department for research and development of induction heating had been established. Much useful work had been done on heat-treating, heating for forging, and brazing. In the metal-melting field, there was likely to be a reasonable demand for modern equipment from those countries which formerly obtained help from Germany.

## Metal Prices

|  | Monday,<br>Price   | November 4<br>Inc. | December<br>Dec. |
|--|--------------------|--------------------|------------------|
| <b>Copper—</b>   |                    |                    |                  |
| Best Selected (nom.)...per ton                                 | £82 10 0           | —                  | —                |
| Electro Wire bars ... ..                                       | £84 0 0            | —                  | —                |
| H.C. Wires, basis ... ..                                       | £86 15 0           | —                  | —                |
| Sheet ... ..   | £124 10 0          | —                  | —                |
| <b>Bronze Electrical quality</b>                               |                    |                    |                  |
| <b>1% Tin—</b>   |                    |                    |                  |
| Wire (Telephone) basis per ton                                 | £118 10 0          | —                  | —                |
| <b>Brass (60/40)—</b>  |                    |                    |                  |
| Rod basis ... ..   | 9% d.              | —                  | —                |
| Wire ... ..  | 1s. 1% d.          | —                  | —                |
| <b>Iron and Steel—</b>   |                    |                    |                  |
| Pig Iron (E. Coast Hematite No. 1) ...per ton                  | £8 19 0            | —                  | —                |
| Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... .. | £32 10 0           | —                  | —                |
| Mild Steel Tape (Cable Armouring) basis 0.04 in. ... ..        | £21 15 0           | —                  | —                |
| <b>Lead Pig—</b>   |                    |                    |                  |
| English ... ..   | £58 10 0           | —                  | —                |
| Foreign and Colonial... ..                                     | £55 0 0            | —                  | —                |
| <b>Tin—</b>  |                    |                    |                  |
| Ingot (minimum of 99.9% purity) ... ..                         | £384 0 0           | —                  | —                |
| Wire, basis ... ..   | per lb. 4s. 10% d. | —                  | —                |
| Aluminium Ingots ...per ton                                    | £72 15 0           | —                  | —                |
| Speller ... ..   | £50 0 0            | —                  | —                |
| Mercury (spot) ... ..  | per bott. £31 5 0  | —                  | —                |

Prices of galvanised steel wire and steel tape supplied by O.M.A. Other metal prices supplied by B.I. Gallender'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.

JOHNSON AND TACEY, LTD., Hull, musical instrument and radio dealers.—October 9, mort., to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on 726, Anlaby Road, Hull, and fixtures.

MAY-VALE ELECTRICAL MANUFACTURING CO., LTD., Leigh-on-Sea.—October 9, £1 000 (not ex.) debts; general charge (subject to, etc.); also October 10, £2 500 mort., to Kent County Permanent Build-

ing Society; charged on 155a, Southsea Avenue, Leigh-on-Sea, comprising 16 garages and workshops.

## Satisfaction

INDUSTRIAL ELECTRICAL CO., LTD., London, N.—Satisfactions October 8, £1 100 and £2 900, reg. July 17 and £500, reg. August 11, 1939.

## Winding-Up Orders

GREEN ELECTRICAL INDUSTRIES, LTD., 80, Wimpole Street, Cavendish Square, London, W.1. High Court of Justice. Order dated October 21, 1946. Petition presented, August 19, 1946.

HARRISON AND CO. (ELECTRICAL), LTD., 6, Broad Street Place, London, E.C.2. High Court of Justice. Order dated October 21, 1946. Petition presented, July 30, 1946.

## Coming Events

### Friday, November 8 (To-day)

I.E.E., N.E. CENTRE, STUDENTS' SECTION.—Newcastle-on-Tyne. Annual Dance. 8 p.m.

I.E.E.—London. Measurements Section. Discussion on "Current and Voltage Transformers for Protective Gear Purposes," opened by J. G. Wellings and F. J. Lane. 5.30 p.m.

ELECTRICAL INDUSTRIES BENEVOLENT ASSOCIATION.—London. Annual Ball and Cabaret at Grosvenor House.

EDINBURGH ELECTRICAL SOCIETY.—Joint Meeting with Illuminating Engineering Society. "Light and Interior Decoration." T. O. Freeth. 7.30 p.m.

INSTITUTE OF PHYSICS.—Manchester. "Contact Potentials." Dr. F. A. Vick. 7 p.m.

I.E.E., BRISTOL STUDENTS' SECTION.—Bristol. "The Design and Manufacture of Small Power Transformers for Use With Radio and Electronic Apparatus." F. B. Jordan.

### Saturday, November 9

I.E.E., N.W. STUDENTS' SECTION.—Manchester. Visit to Aerialite, Ltd., Stalybridge.

ASSOCIATION OF MINING ELECTRICAL AND MECHANICAL ENGINEERS.—Glasgow. "Lighting in Hazardous Situations." S. W. Richards. 3 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—London. Annual Dance. 7 p.m.

### Monday, November 11

I.E.E., WESTERN CENTRE.—Cardiff. Ordinary General Meeting. 5 p.m.

I.E.E., WESTERN CENTRE.—Cardiff. "Power Supplies to Generating Station Auxiliary Services." S. Szwander. 5 p.m.

I.E.E., N.E. CENTRE.—Newcastle-on-Tyne. "Engineering Principles Applied to the Design of Domestic Water-Heating Installations of the Solid-Fuel/Electric Type." R. Grierson and Forbes Jackson. 6.15 p.m.

JUNIOR INSTITUTION OF ENGINEERS, N.W. SECTION.—Manchester. "Modern Factory Lighting." J. W. Howell. 7 p.m.

### Tuesday, November 12

I.E.E., N.W. CENTRE.—Manchester. "A

Precision AC/DC Comparator for Power and Voltage Measurements." G. F. Shotton and H. D. Hawkes. 6 p.m.

I.E.E., SCOTISH CENTRE.—Glasgow. "Engineering Principles Applied to the Design and Construction of Domestic Water-Heating of the Solid-Fuel/Electric Type Installations." R. Grierson and Forbes Jackson. 6.15 p.m.

I.E.E., N. MIDLAND CENTRE.—Leeds. "Electrical Control of Dangerous Machinery and Processes." W. Fordham Cooper. 6 p.m.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—London. "Economic Telephone Exchange Area Planning." H. T. A. Sharpe. 5 p.m.

### Wednesday, November 13

I.E.E.—London. Transmission Section. "The Development of the Gas-Cushion Cable System for the Highest Voltages." T. R. P. Harrison. 5.30 p.m.

I.E.E., S. MIDLANDS STUDENTS' SECTION.—Birmingham. "Lightning Protection of High Voltage Systems." J. Mitchell. 6.45 p.m.

WOMEN'S ENGINEERING SOCIETY.—London. "The Engineer and the Crystal." Dr. K. Lonsdale. 7 p.m.

IRON AND STEEL INSTITUTE.—London. Film Show, including "The Control and Prevention of Distortion in Arc Welding." 8 p.m.

### Thursday, November 14

I.E.E.—London.—Installations Section. "Electrical Control of Dangerous Machinery and Processes." W. Fordham Cooper. 5.30 p.m.

I.E.E., WESTERN CENTRE.—Swansea. Chairman's Address. R. W. Biles.

I.E.E., WESTERN CENTRE, CARDIFF STUDENTS' SECTION.—Visit to Messrs. Guest, Keen and Baldwin's Steelworks.

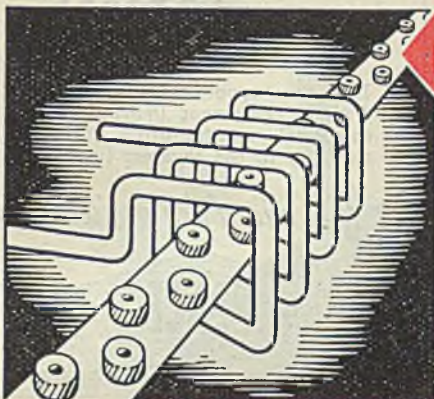
I.E.E., S. MIDLAND CENTRE.—Birmingham. Faraday Lecture, "Power and Supply." J. Hacking. 6 p.m.

### Friday, November 15

I.E.E., N.E. CENTRE, STUDENTS' SECTION.—Newcastle-on-Tyne. "Carrier Wave Telephony." F. Moor. 6.30 p.m.



# G.E.C. HIGH FREQUENCY HEATING

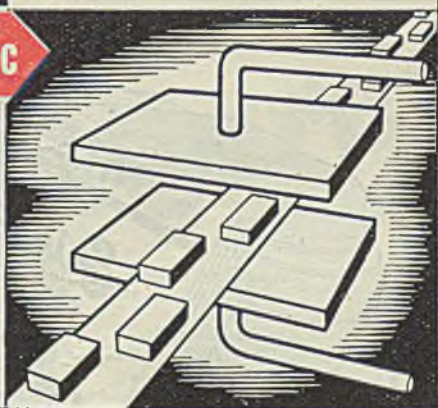


## INDUCTION

- BRAZING
- HARDENING
- MELTING

## DIELECTRIC

- GLUING
- PLASTIC HEATING
- DRYING



G.E.C. engineers are at your disposal to advise upon the applications of High Frequency Heating.

Generators range from 100 watts to 25 kW output.

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





Window  
Lights  
will  
go up  
soon!

WRITE FOR "HARCORAY" BROCHURE  
ILLUSTRATING COMPLETE RANGE OF  
REFLECTORS FOR SHOP, STORE AND  
SHOWCASE LIGHTING.

**Harcourts**  
LIMITED

STANHOPE HOUSE, KEAN STREET,  
ALDWYCH, W.C.2.

Telephone: TEMPLE BAR 9671/2/3.

**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



ERICSSON TELEPHONES LTD. 56, KINGSWAY, LONDON, W.C.2

Tele. — 101, 101A. Works: Sutton, Staffs.



# STUDDING?

## TELCO

TELCO LIMITED

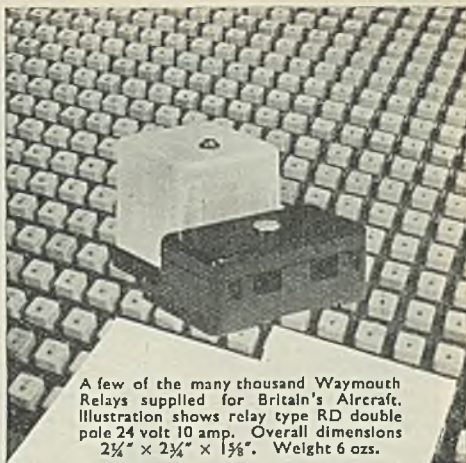
3 NEWMAN ST.

LONDON, W.1

MUSEUM 5701/4



℞ 93.43



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



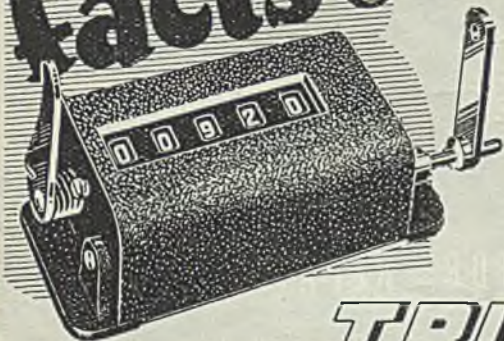
**WAYMOUTH**  
GAUGES & INSTRUMENTS  
LTD.

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

464-8, ALEXANDRA AVE., RAYNERS LANE, HARROW,  
MDDX.

Telephone: PINNER 7193

# Facts & Figures



Above is the TRUMETER Stroke Counter, for machines with oscillating or stroke movements.

There's no need for a machine operator to guess output, when a TRUMETER is fitted. Production can be seen at a glance, to the last unit of accurate measurement. Mistakes in over-production or under-production are impossible. There's a TRUMETER model for every requirement—counting up to seven figures in revolutions and stroke, and measuring in yards, feet or metres and fractions thereof and recording r.p.m. of shafts, etc.

We shall be glad to send details of the TRUMETER that will help YOU

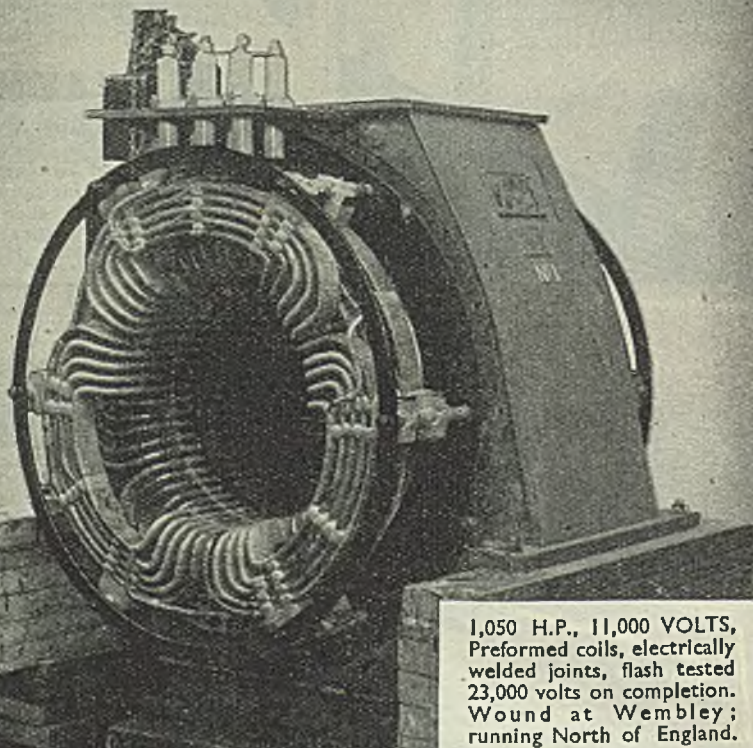
# TRUMETER

PROTECTS - - - - PROFITS.

TRUMETER CO. LTD., (Dept. E/6), SUNNYSIDE WORKS, LEICESTER RD., SALFORD 7  
(Associated with Measure-Meters Co. Ltd.)



REPAIRING                      REWINDING  
RECONDITIONING



1,050 H.P., 11,000 VOLTS,  
Preformed coils, electrically  
welded joints, flash tested  
23,000 volts on completion.  
Wound at Wembley;  
running North of England.

**DYNAMO & MOTOR REPAIRS LTD.**

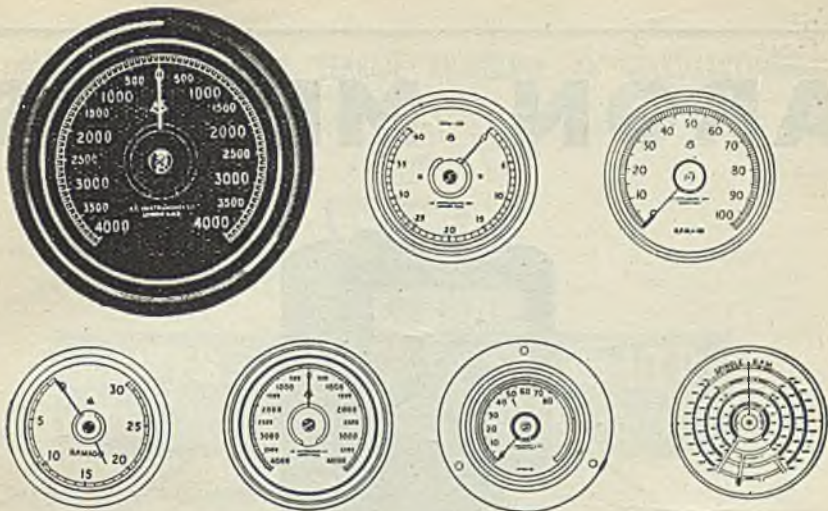
Wembley Park Works  
North End Road  
Wembley, Mddx.

Wembley 3121

Phoenix Works  
Soho Road  
Birmingham

Northern 0898





## ACCURATE SPEED INDICATION

*to suit the job . . . to suit the conditions*

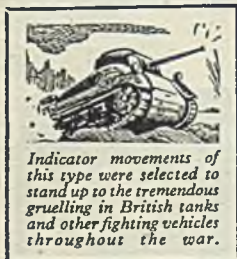
If an indicator movement can stand up to the gruelling conditions in tanks and other fighting vehicles it will stand up to practically anything else.

That is the movement in all A.T. Speed Indicators. These instruments are available for practically every form of speed indication and give steady and consistently accurate readings under the most exacting conditions. This unswerving reliability is made possible by a jewelled movement of simple design

and robust construction; by individual attention at every stage of making, testing and calibrating.

A.T. Indicators can be waterproofed and tropicalised for marine and oversea duty. All standard calibrations and special calibrations to meet particular needs.

Available with dials from 1½" to 9" diam., and revolution counters with or without trip mechanism may be incorporated in instruments from 4" diam.



*Indicator movements of this type were selected to stand up to the tremendous gruelling in British tanks and other fighting vehicles throughout the war.*



# INDICATORS



A PRODUCT OF

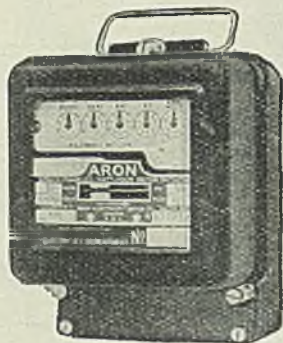
## SMITHS INDUSTRIAL INSTRUMENTS LTD.

CRICKLEWOOD WORKS, LONDON, N.W.2

THE INDUSTRIAL INSTRUMENT DIVISION OF S. SMITH & SONS (ENGLAND) LTD.  
ASSOCIATED COMPANIES: A.T. INSTRUMENTS LTD.; DAVID HARCOURT, LTD.



# ARON METERS



IN AS GREAT DEMAND AS EVER

*It's TIME for  
TEMCO again*

**N**OT to the same extent as in the good old days of course, but supplies are improving;

so by keeping in touch with your usual wholesaler you will occasionally be able to do some of your customers, and yourself, quite a good turn.



No. 630



No. 1402

**TEMCO** SYNCHRONOUS ELECTRIC CLOCKS  
The CURRENT way of telling the TIME

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.



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 7126

SOUTH  
AND CENTRAL  
AMERICA

EUROPE

AFRICAN  
CONTINENT

MIDDLE  
EAST

INDIA  
AND THE  
FAR EAST

BRANCHES AND AGENTS THROUGHOUT THE WORLD.

(Regd.)

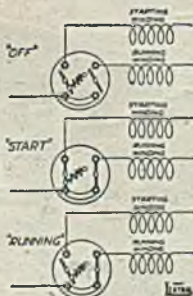
**"TWINOB" A.C. SINGLE-PHASE  
MOTOR-STARTING SWITCH**

Split-Phase Control

5 & 10 amps. at 250 volts



STANDARD  
(No. 19160)



ALL-INSULATED  
(No. 23990)

**A.P. LUNDBERG & SONS**  
LIMITED

TELEPHONE NORTH 3351 ELECTRICAL ACCESSORIES TELEGRAMS LUNDBERG LONDON

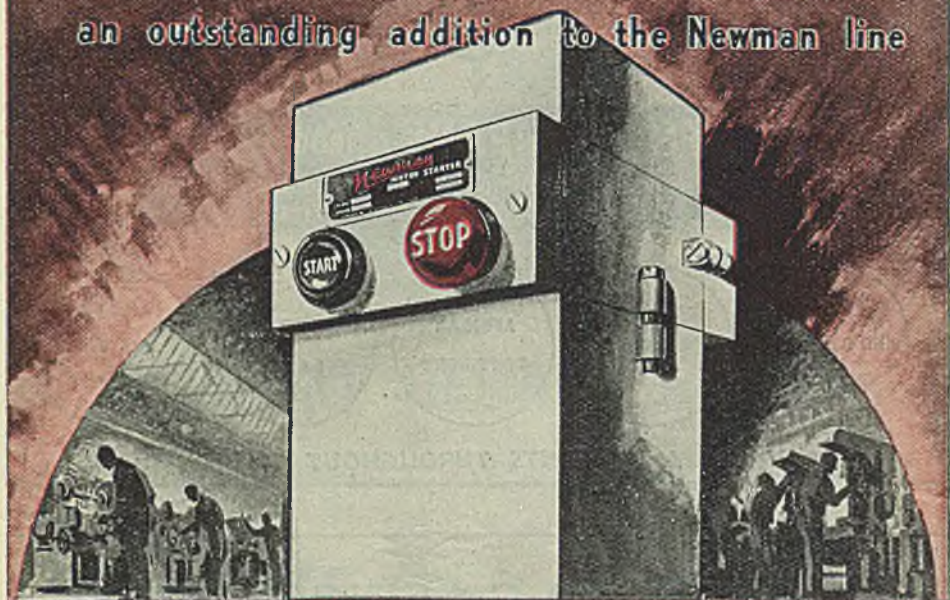
PIONEER ELECTRICAL WORKS

491 to 493 LIVERPOOL RD HOLLOWAY, LONDON, N.7



# Introducing

an outstanding addition to the Newman line



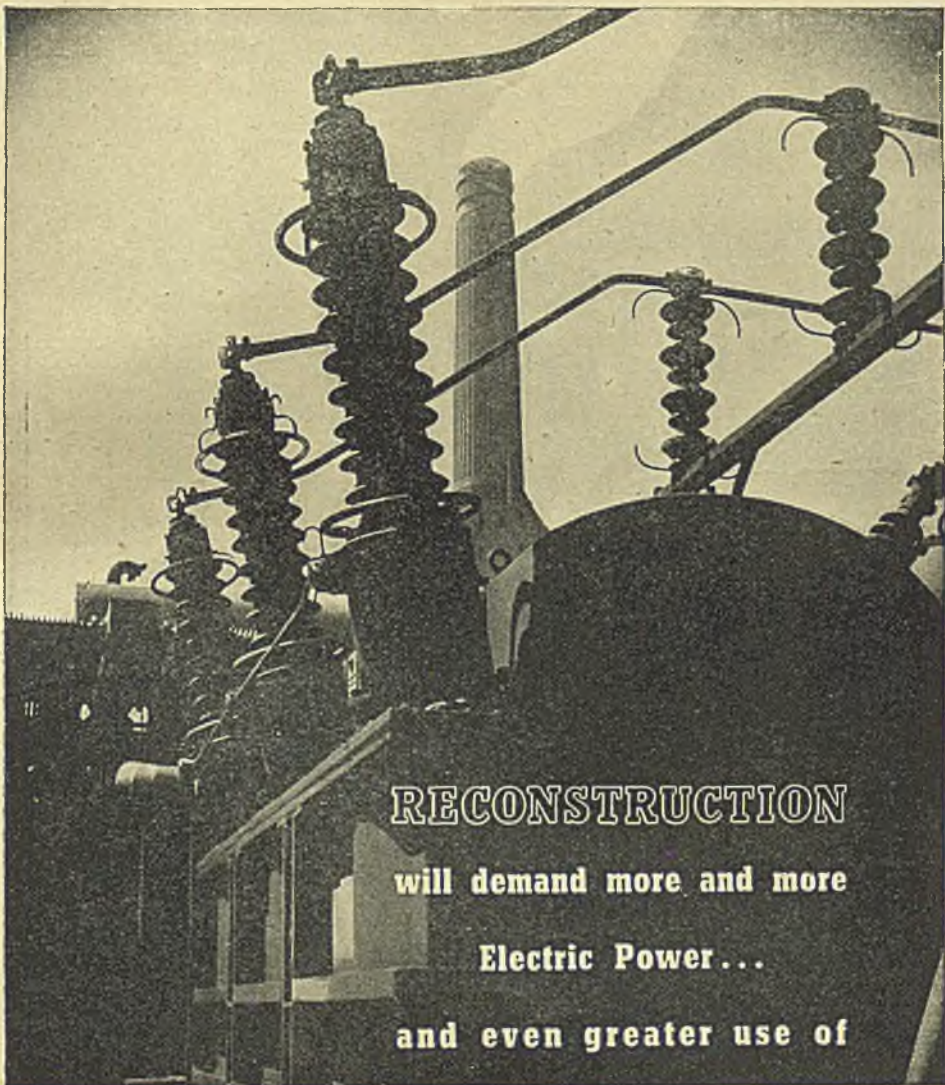
**Newman**

# STARTERS

NEWMAN INDUSTRIES LIMITED, YATE, BRISTOL. London Office: 32 Victoria St., Westminster, SW1

*Eigent*





**RECONSTRUCTION**

will demand more and more

Electric Power...

and even greater use of



# ROTHMILL

**CABLE INSULATING PAPER**

*Tullis Russell & Co. Ltd.*

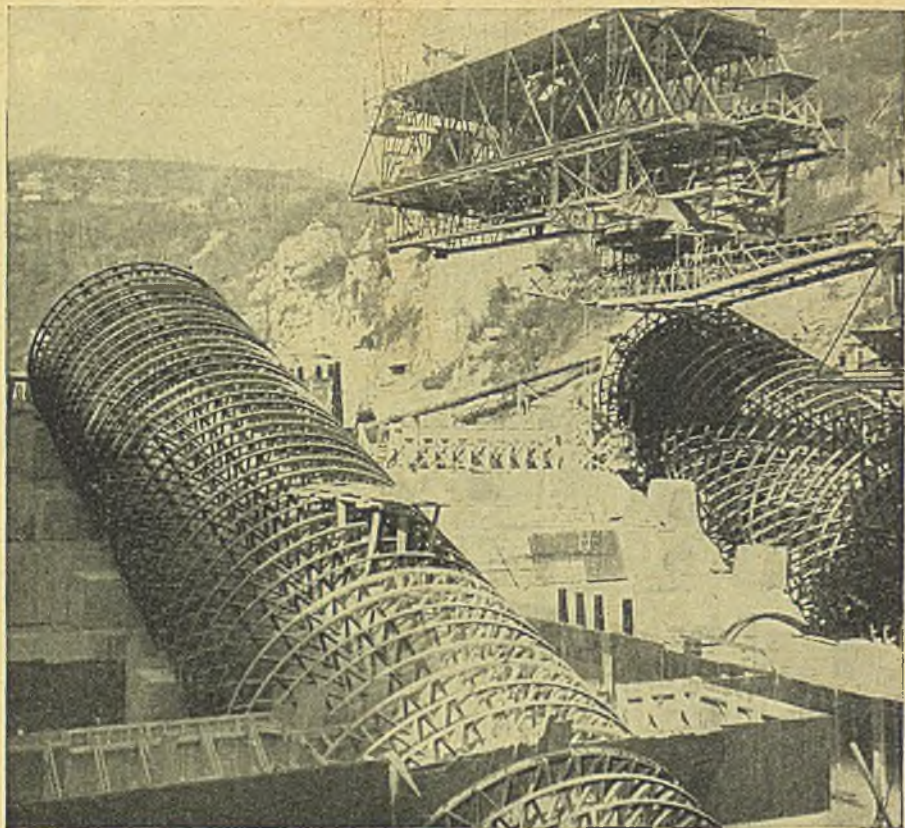
AUCHMUTY &  
ROTHES PAPER  
MILLS, MARKINCH  
SCOTLAND

LONDON  
1 Tudor Street  
E.C.4

MANCHESTER  
372 Corn Exchange  
Buildings  
Corporation Street

BIRMINGHAM  
116  
Colmore Row





### FAMOUS HYDRO-ELECTRIC STATIONS

*The dam at Genissiat, France, will be 130 yards long, 310 feet wide with a base width of 87 yards. More than 10,000 tons of steel and 750,000 tons of cement are required for the construction of the dam together with the factory at its foot. The turbines weigh 975 tons each and will transform the water power into 540,000 h.p. of electric energy.*



## MEASUREMENT LIMITED

*Electricity and Water Meters of Quality*

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

cm40

Printed in Great Britain by STRAKER BROTHERS LTD., 194-200 Bishopsgate, E.C.2, and published by BENN 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, November 8, 1946