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THE

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Wot me?

One of those two for any size of screw! You're daft. That's right, only two sizes of Philplug Adaptas, see! So Philplugs are miracles, eh? That's right.

Can change their shape, I suppose?

That's right. And fit exactly into any size hole? That's right.

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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.

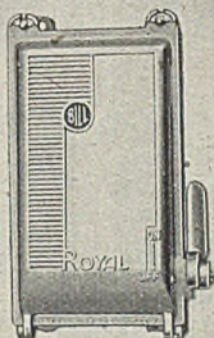
PHILPLUGS fill the hole


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

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THE ELECTRICIAN

28 MARCH, 1947



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 WE HOPE TO MORE THAN SATISFY EXISTING DEMANDS
 WHEN THE CERAMIC POSITION IMPROVES
 IN THE MEANTIME PLEASE REMEMBER THAT WE ARE
 DOING OUR BEST UNDER DIFFICULT CONDITIONS

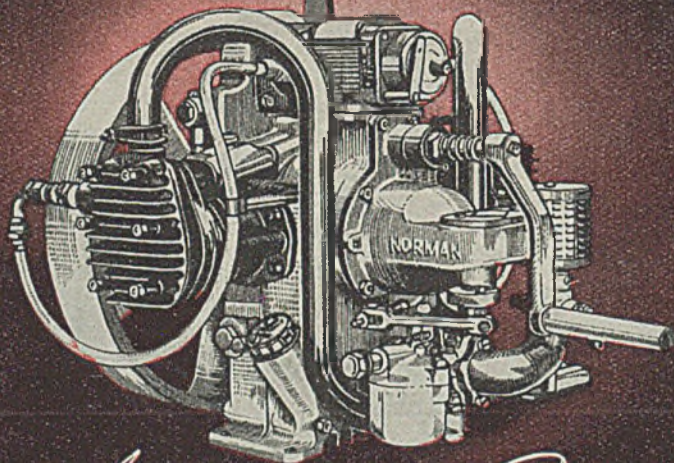
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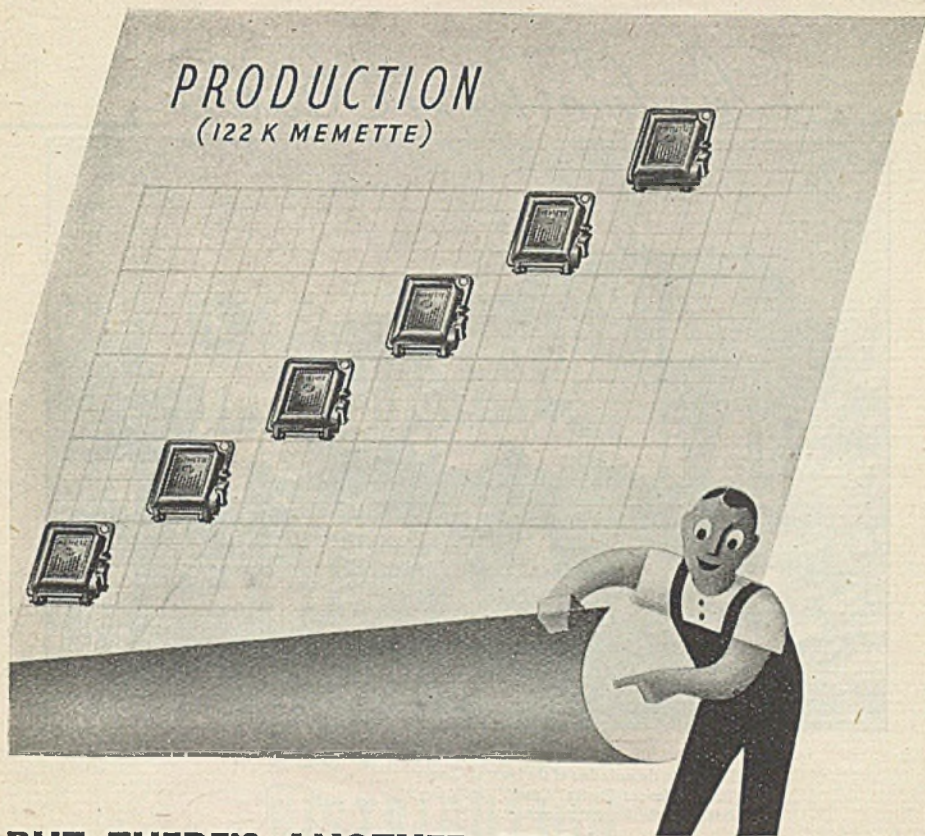
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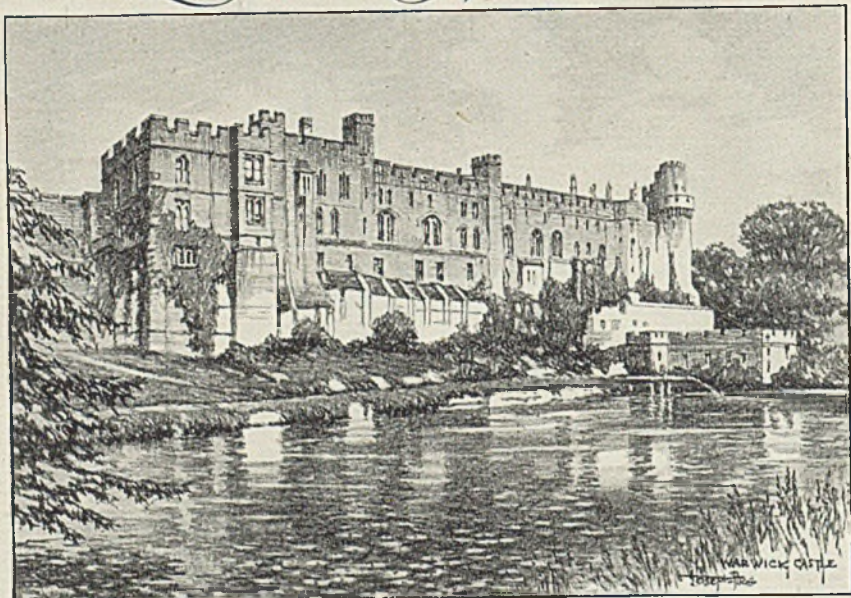
Tremendous demands are being made on the MEM factory output for housing and industrial requirements. Demand is still greater than supply. It is still the best plan to keep in touch with your wholesaler as this growing volume of MEM goods makes itself felt. You will be certain, then, of a fair share of such supplies as are available.

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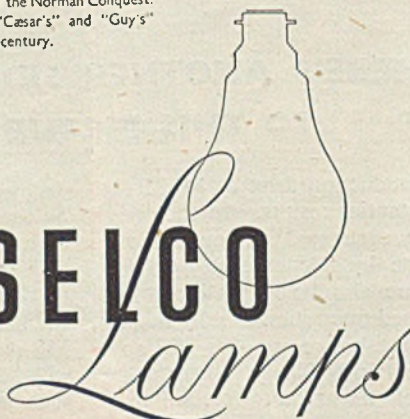


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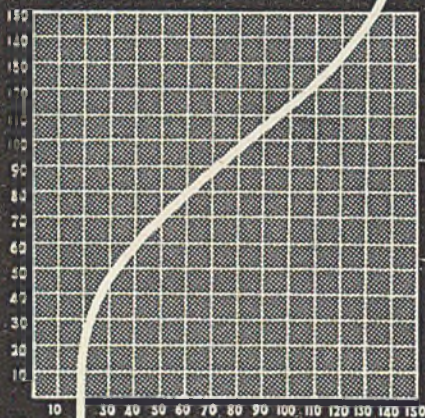
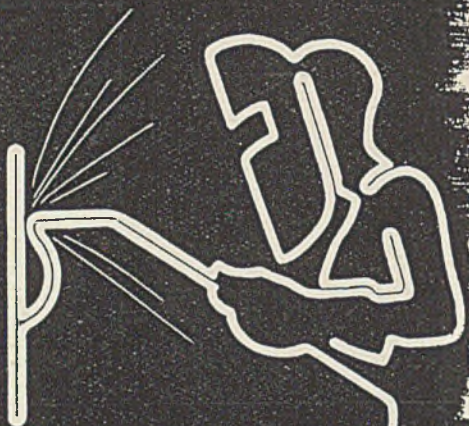
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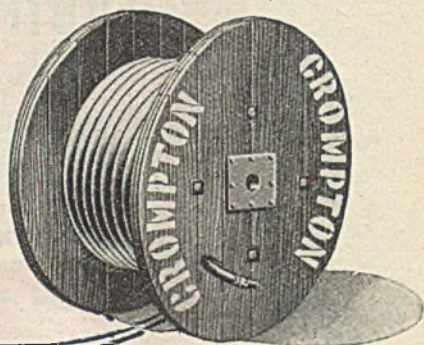
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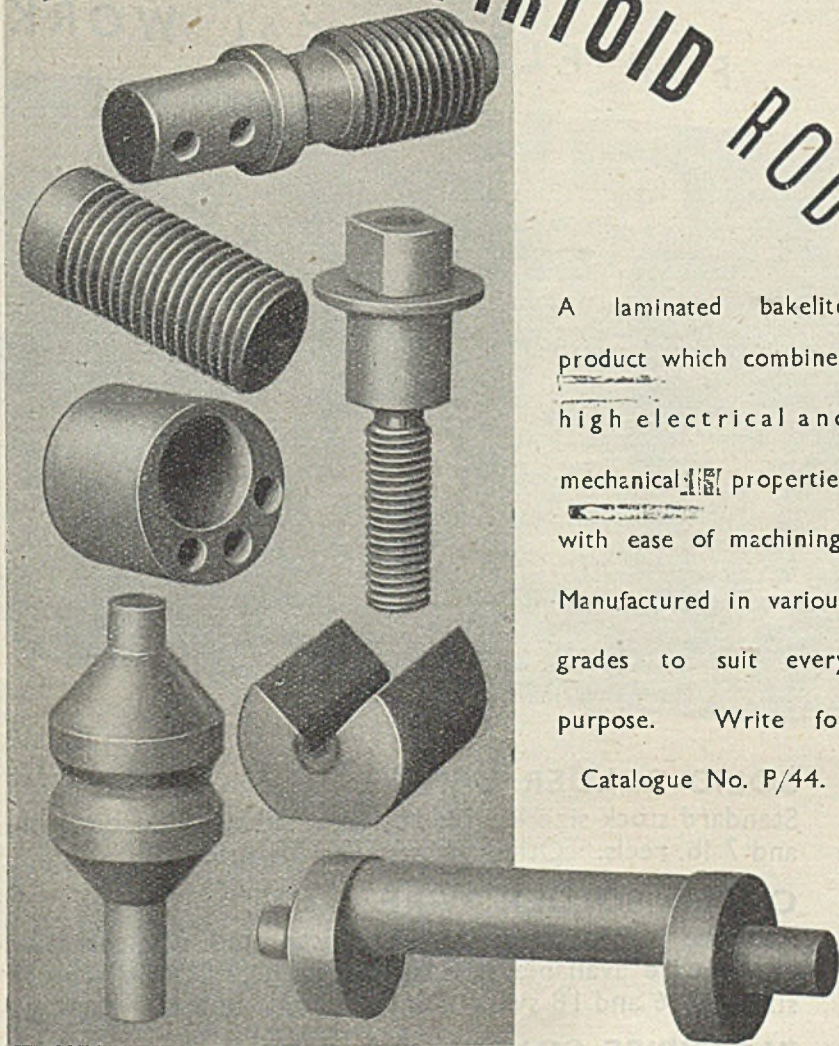


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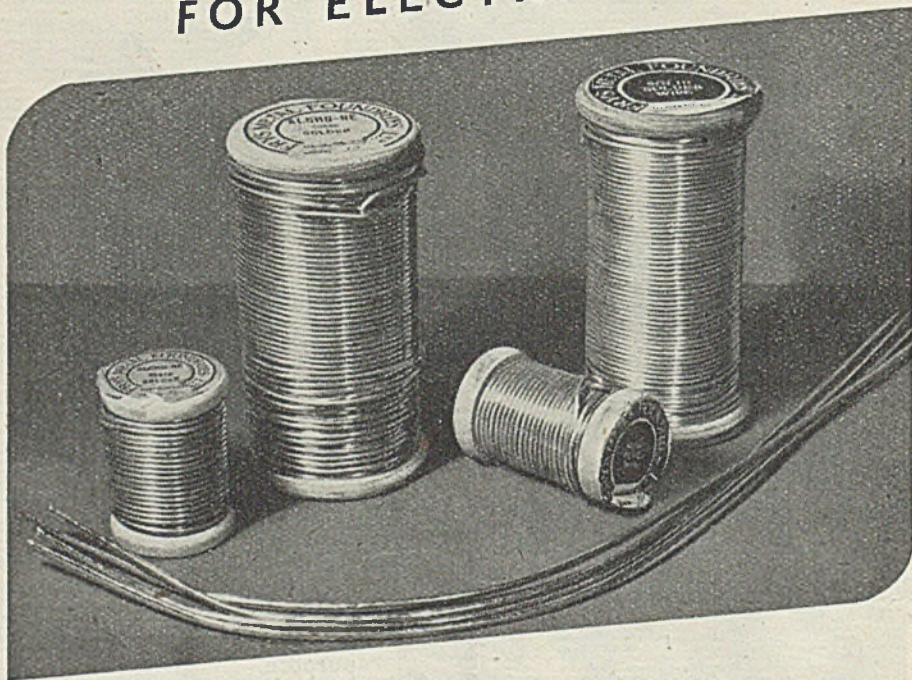
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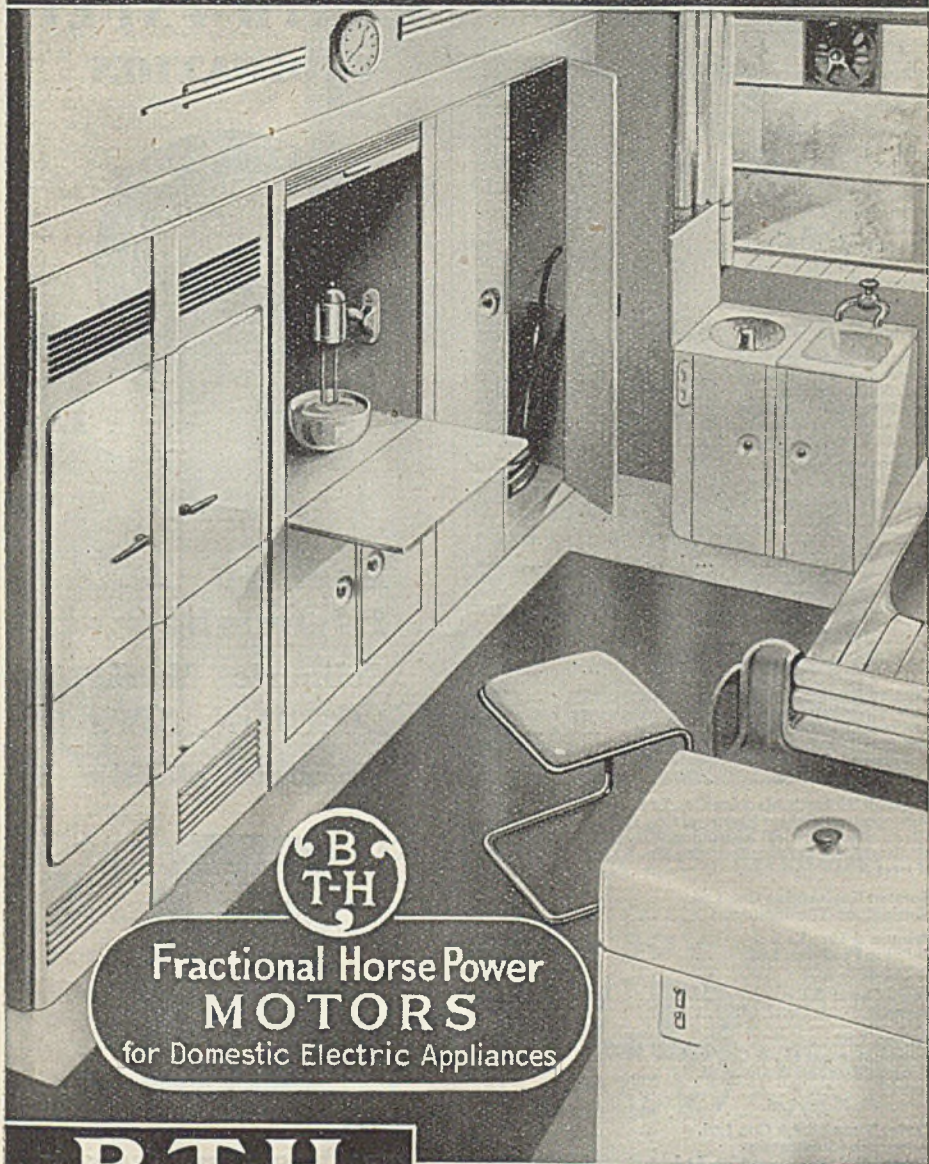
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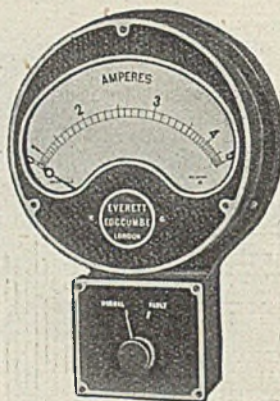
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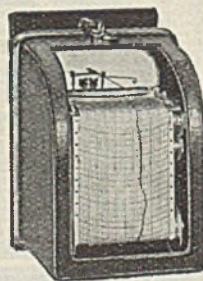
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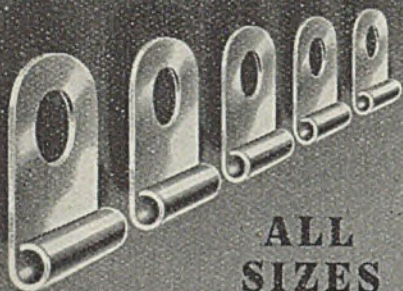
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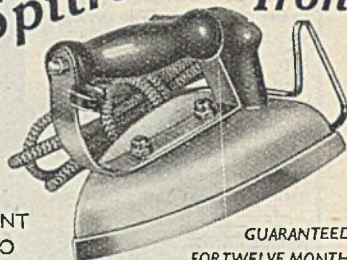
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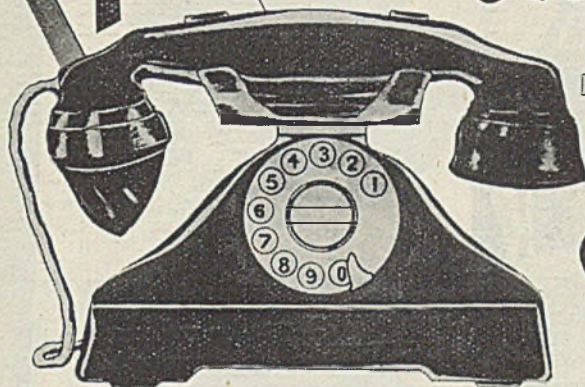
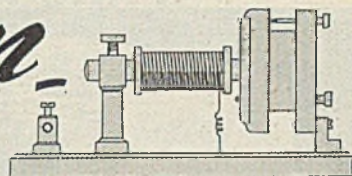
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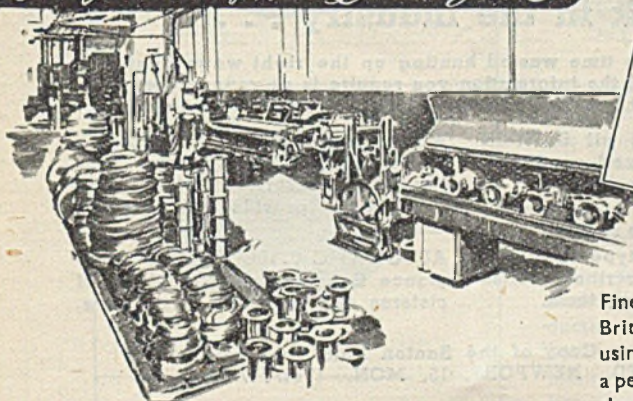
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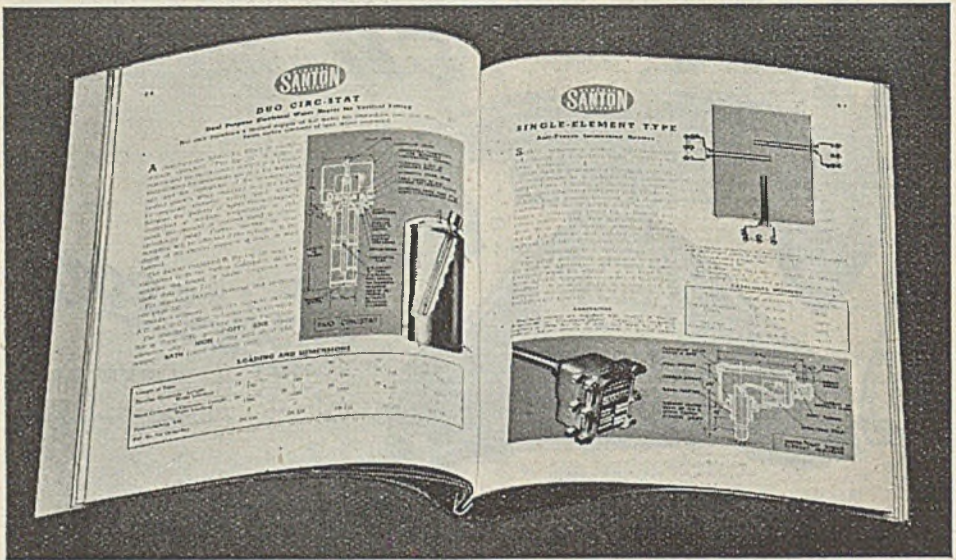
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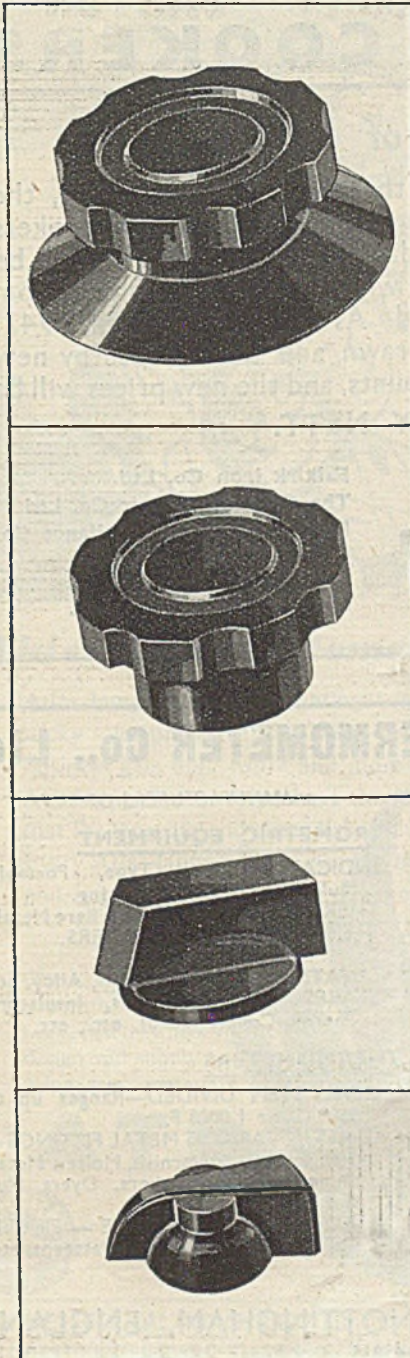
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THE ELECTRICIAN

28 MARCH 1947

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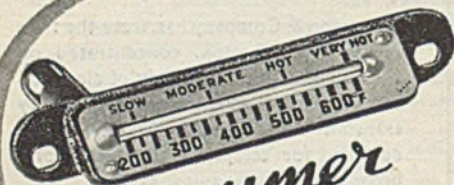
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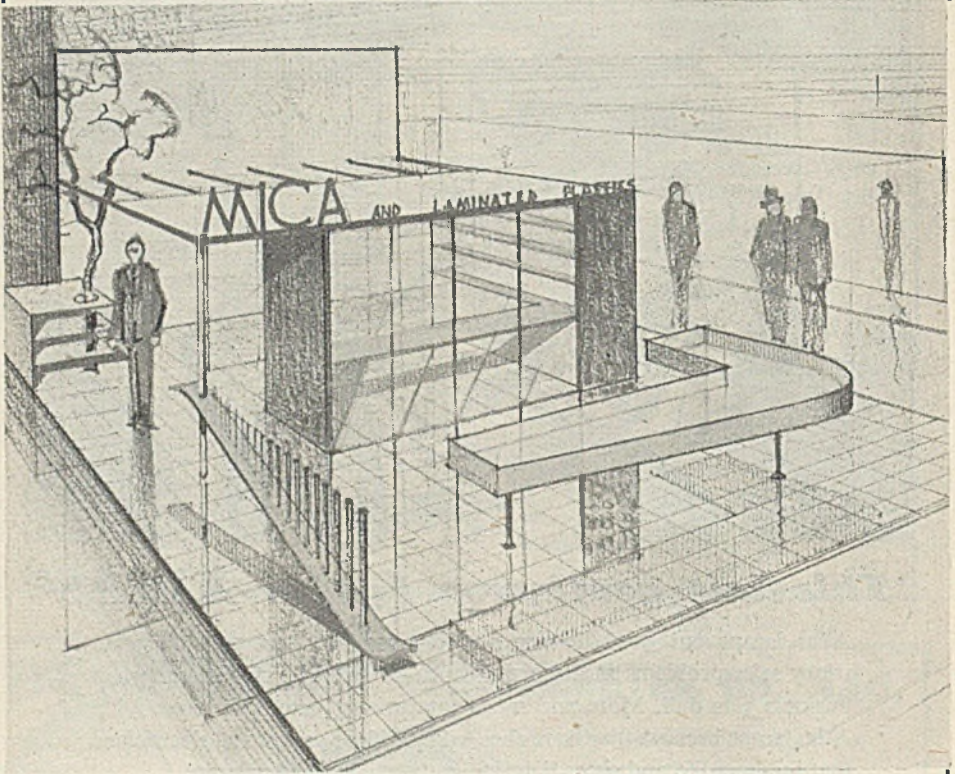
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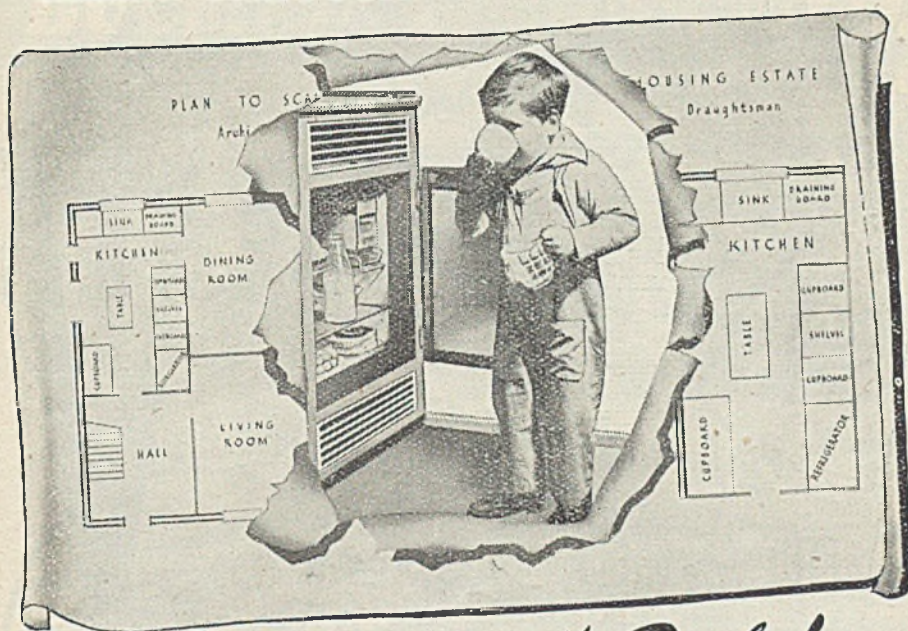
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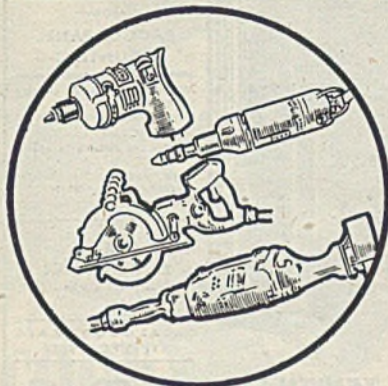
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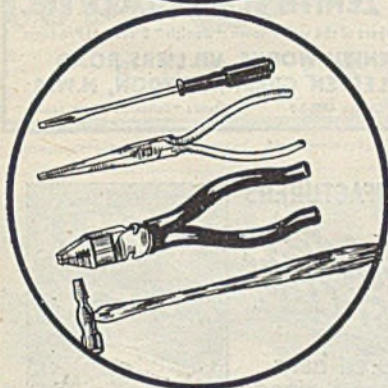
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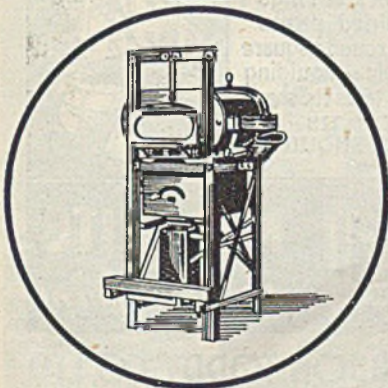
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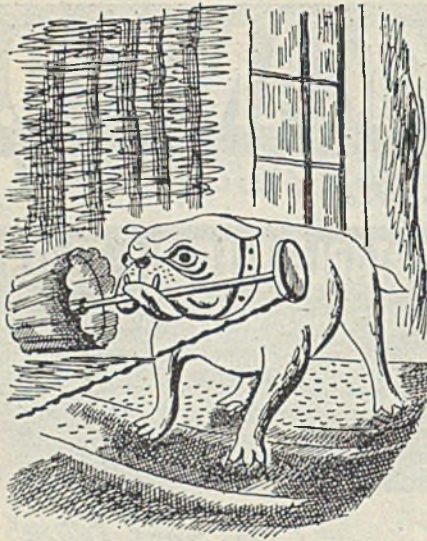
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It's better than a bulldog, the LUNDBERG 'GOTT' Interlocked Switch-plug. Once the plug is in the jaws of the GOTT and the switch is on, you can't take it out for love nor money. And, just as important, the switch won't budge until the plug is in the socket! No special plug required, it interlocks with any make of standard plug. Made with the famous LUNDBERG skill and craftsmanship, it is only one of nearly a thousand specialised accessory designs

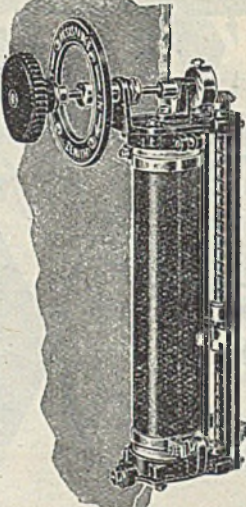
LUNDBERG



A  PRODUCT

A. P. LUNDBERG & SONS LTD (Established 1882)
491-493 Liverpool Road London N7





REGULATING RESISTANCES

FOR
BACK-OF-PANEL MOUNTING

All mechanical parts entirely insulated.
Simple construction.
Easy to fix.
Durable and reliable in operation.
Single and Double Tubular Types in various sizes.
Ample rating.

INSIST ON
ZENITH PRODUCTS
—It will pay you

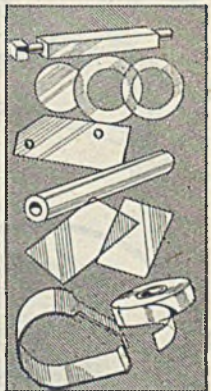
CATALOGUE OF ALL TYPES POST FREE

The ZENITH ELECTRIC CO. Ltd.
Sole Makers of the well-known "Zenith" Electrical Products
**ZENITH WORKS, VILLIERS ROAD
WILLESDEN GREEN, LONDON, N.W. 2**
'Phone: Willesden 4087-8-9 Grams: "Voltozhm," Phone, London."

MANUFACTURERS OF

*Absolutely
FIRST-CLASS*

covered bars
washers & rings
machined parts
tubes round & square
flexible & moulding
sheet tapes etc. shapes
SEND US
YOUR ENQUIRIES



GIBSON, TODD & CO, LTD

ALBERT MILLS · HOLLINWOOD · LANCASHIRE
TEL: FAILSWORTH 1520

ON ADMIRALTY LISTS



DS PLUG STYLE

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

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



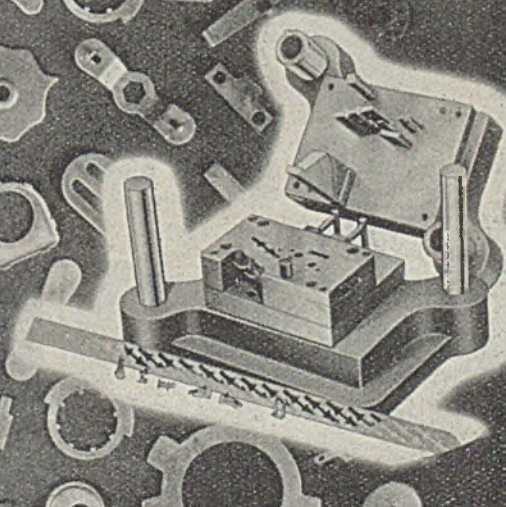
COOKER CONTROL

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

E 1046

UNIVERSAL TOOLS LTD

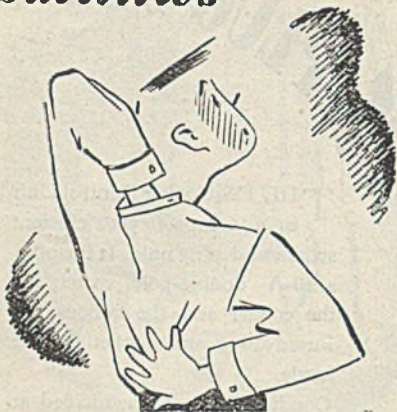
PRESS TOOLS
PRESSINGS
MOULDS
AND JIGS



TRAMWAY PATH · MITCHAM · SURREY

Fusing Facilities

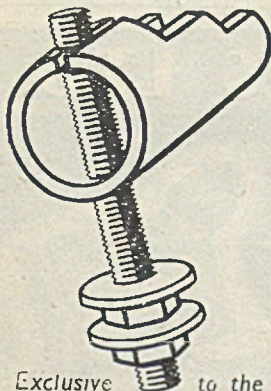
No. 5



BACK STUD ASSEMBLY

The bugbear of loosely fitting back studs generating unwanted heat is overcome in the New SLYDLOK Fuse by longitudinally slitting and inwardly re-forming the one-piece, tubular shaped base terminals, after tapping. The inherent circumferential pressure thus provides a "lock-nut" grip that the severest vibration

cannot disturb and makes unnecessary the tightening of studs against panel mountings to ensure adequate contact with the base terminals. Spreading of the latter is restricted by their circular housing in the base moulding, not shown in our illustration.



Exclusive to the New

SLYDLOK

5 to 100 amp. FUSES

EDWARD *Wilcox* & CO. LTD.

SHARSTON ROAD • WYTHENSHAW
MANCHESTER

dm EW 10

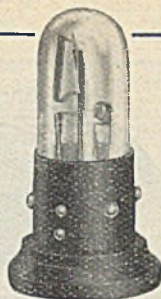


REPLACEMENT
**FLUORESCENT
STARTER SWITCHES**
(THERMAL TYPE)

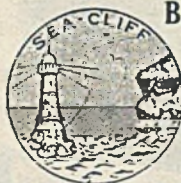
For use with B.T.H., Revo and
Metrovick Lighting Units
Early Delivery

**FLUORESCENT
SPARES**

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



C. Clifford & Son Ltd.
BIRMINGHAM



**PHOSPHOR
BRONZE**

"SEA-CLIFF"
Trade Mark. TUBES, SHEETS, RODS & WIRE

To the latest Air Ministry, Admiralty, War Office
and B.S. Specifications.

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.

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CENTRAL 2601-2-3-4.

GREY & MARTEN LTD.

for
SOLDER

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: Hon 044. 'Grams : Amalgam, Boroh
BIRMINGHAM : 11, James St.

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

SCREWS • TERMINALS • PRESSWORK



*If it's threaded
— we make it!*

DATIM

DAVIS & TIMMINS LTD
 Head Office: BILLET ROAD - WALTHAMSTOW - LONDON - E.17
 TELEPHONE: LARKSWOOD 3113 SIX LINES

TURNUED PARTS & INSERTS



1940
AND
STILL
LEADING

On
Active
Service

1947
LEADING
AGAIN

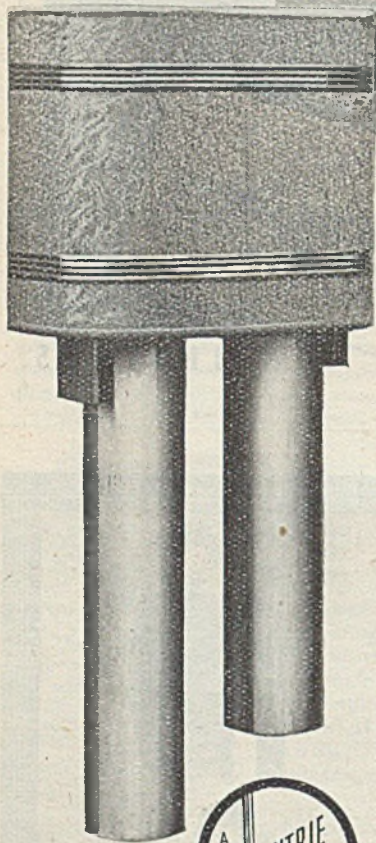
DURASTRIP

Sole Manufacturers: **DURATUBE & WIRE LTD.** FAGGS ROAD, FELTHAM, MIDDSX. Tele: Feltham 3332-3803

The Melo-chyme

DOOR CALL

-BRINGS HARMONY
TO THE *Home*



At each pressure on the door push the Melo-chyme emits a deep resonant note of two harmonious tones and is a delightful contrast to the irritating shrill of the normal door bell.

Exceptionally simple fitting. Operates from battery or mains.

PRICE

47/6

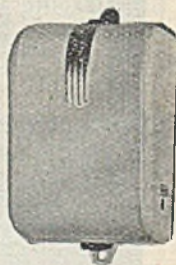
Transformers for use
with the Melo-chyme
door Call - - - -

15/6



BIRMINGHAM
ENGINEERING AND
HARDWARE SECTION
5-16 MAY

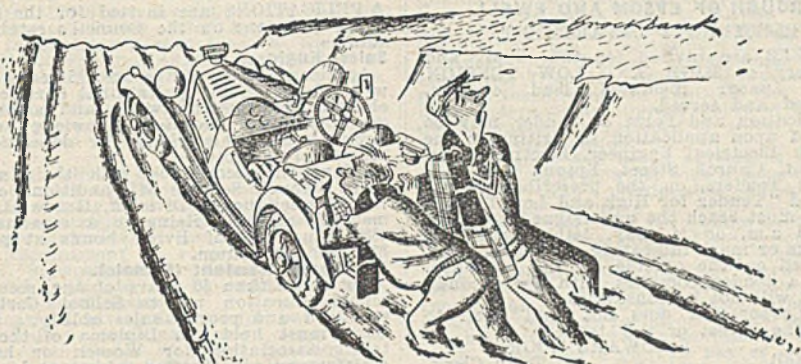
SEE OUR DISPLAY



Also at
BIRMINGHAM
MANCHESTER
GLASGOW
NEWCASTLE

For full particulars apply to
H. & D. CHURCHILL LTD.
(Wholesale and Export)
WALNUT TREE WALK, KENNINGTON, LONDON, S.E.11

A QUESTION OF RESISTANCE



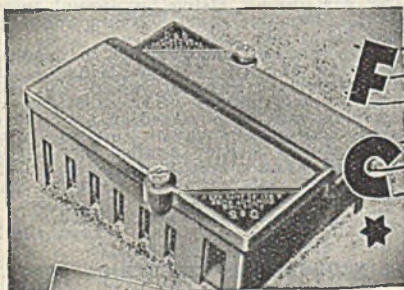
Rolling Resistance

—often one of the most tiresome forms. Electrical resistance, on the other hand, need not be tiresome, especially if you investigate the properties of the well-known

Brightray series of nickel-chromium alloys. It will save you much trouble. Write for a free copy of our booklet 'Electrical Resistance Materials.'

HENRY WIGGIN AND COMPANY LIMITED, WIGGIN STREET, BIRMINGHAM, 16

4B/W/2



FLOATING CONTACT

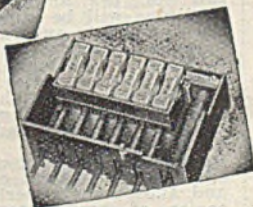
★ the *NEW* distribution



- Dimensions only $7\frac{3}{8}'' \times 6\frac{1}{2}'' \times 4\frac{1}{4}''$.
- Power Lighting and Heating "under one roof."
- Saving in wiring cost and space
- Each row of fuses a separate unit.
- Each fuse in its own compartment.
- Conforms to B.S.S. 88 and 214.

2 sizes—4 way and
6 way.
30 A. max. cap.

Write for F.C. leaflet



The NEW HOUSE will need it...!

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

EIF46

MISCELLANEOUS ADVERTISEMENTS

TENDERS

BOROUGH OF EPSOM AND EWELL. ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply and delivery of HIGH AND LOW TENSION CABLE, paper insulated, lead covered, armoured and served.

Specification and Form of Tender may be obtained upon application in writing to the Borough Electrical Engineer, Electricity Department, Church Street, Epsom.

Sealed Tenders, on the prescribed forms, endorsed "Tender for High and Low Tension Cable," must reach the undersigned not later than 10 a.m. on Monday, 14th April, 1947. No name or mark indicating the sender must be placed on the outside of the envelope. Unless a tender complies with these conditions it will not be considered.

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

EDWARD MOORE, Town Clerk.

Town Hall,
The Parade,
EPSOM.
24th March, 1947.

SITUATIONS VACANT BOROUGH OF NELSON. ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the following positions on the permanent staff of the Electricity Department:—

(a) **Relief Charge Engineer.**—Class "F." Grade 8a, on Schedule of National Joint Board. Candidates must have had sound experience in the operation of chain grate fired boilers, steam turbo generators (preferably Brush-Ljungstrom), auxiliary plant, E.H.T. and D.C. switchboards, rotary converters, and bulk supplies.

(b) **Switchboard Attendant.**—Applications are invited for the position of Switchboard Attendant at the Nelson Corporation Power Station. This Station is a Selected Station running in parallel with the C.E.B. system. Preference will be given to applicants who have had experience in parallel running with the C.E.B. Applicants should have had a recognised training and experience in similar duties.

Salary in accordance with N.J.B. Schedule, Class "F."

The appointments will be governed by conditions of service of the National Joint Board, subject to the provisions of the Superannuation Act and to the passing by the successful applicant of a medical examination, and to one month's notice on either side.

It is anticipated that the Station may be re-classified "G" during 1947.

Applications, stating age, qualifications, and experience, accompanied by copies of not more than three recent testimonials or the names of three persons to whom reference can be made, must reach the undersigned not later than Tuesday, the 8th April, 1947.

T. DAWSON MARTIN, A.M.I.E.E.,
Borough Electrical Engineer and Manager,
Electricity Works,
NELSON, LANCs.

SENIOR Draughtsman and a Junior Draughtsman required, experienced in the manufacture of radio components. Also a Draughtsman-Designer for press tools and estimates. Salary according to age and experience. Apply in writing to—The Personnel Manager, Philips Hamilton Works Limited, Wellhall Road, Hamilton.

SITUATIONS VACANT

METROPOLITAN BOROUGH OF FULHAM. ELECTRICITY DEPARTMENT.

APPLICATIONS are invited for the following positions on the Council's established staff:—

Sales Engineer.

Applicants must not be over 35 years of age with education up to National Certificate in electrical engineering, works and commercial experience and practical knowledge of the application of electricity for domestic and industrial purposes.

Salary in accordance with the National Joint Council Scheme of Conditions of Service, Miscellaneous Division, Grade II, commencing at £335, rising to a maximum of £380, plus cost of living bonus at present £59 16s. per annum.

Showroom Assistant (Female).

Not more than 30 years of age, secondary school education up to School Certificate standard and proved sales ability. Candidates must hold the Diploma of the Electrical Association for Women or have a satisfactory report after taking at least one year of the Diploma course.

Salary in accordance with the General Division of the National Joint Council, varying according to age from £60 to £264, plus cost of living bonus, at present from £20 16s. to £48 2s. per annum.

Lady Demonstrator.

Between 21 and 30 years of age, good general education and training, capable of organising and conducting lecture demonstrations, and advising in the Showroom and on consumers' premises on the selection and use of domestic electrical apparatus. Candidates must hold the Diploma of Electrical Housecraft of the Electrical Association for Women.

Salary, in the Clerical Division of the National Joint Council Scheme, commencing at £268 per annum, rising by annual increments to £304, plus cost of living bonus at present £48 2s. per annum.

The appointments are subject to medical examination and to the conditions of the Local Government Superannuation Act, 1937.

Forms of applications and conditions of appointment may be obtained on sending me stamped addressed envelope endorsed with the title of the position applied for.

Completed applications must be posted to reach me not later than 12 noon on 22nd April, 1947.

G. F. THATCHER,
Town Clerk.
FULHAM, S.W.6.

MID-LINCOLNSHIRE ELECTRIC SUPPLY CO., LTD.

FOREMAN FOR DOMESTIC APPLIANCE REPAIR WORKSHOP.

APPLICATIONS are invited for the position of working Foreman to take charge of the Company's Domestic Appliance Repair Workshop which is in the course of reorganisation. The salary for the appointment will be £344 10s. per annum, and the successful applicant will be required to participate in the Company's superannuation scheme.

Applicants must have had practical experience in the manufacture or repair of electric cookers, water heaters, wash boilers, etc. Experience in the operation of shot-blasting and tinning plant and the re-winding of spirals and elements will be an advantage.

Applications, endorsed "Foreman," giving age and particulars of education, training, and subsequent experience, accompanied by copies of recent testimonials, should be addressed to the Consumers' Engineer, Mid-Lincolnshire Electric Supply Co. Ltd., North House, Grantham, Lines., and should be received not later than April 14th, 1947.

SITUATIONS VACANT
MANCHESTER CORPORATION.
ELECTRICITY DEPARTMENT.

Principal Power Sales Assistant.

APPPLICATIONS are invited for the position of Principal Power Sales Assistant, at a salary in accordance with Class M, Grade 8, of the N.J.B. Schedule (which is equivalent to £635 per annum, rising by two biennial increments to £664 per annum).

The duties are of a technical and administrative nature, and involve negotiations and correspondence with industrial power consumers.

Applicants should be Corporate Members of the Institution of Electrical Engineers, and should preferably have had similar experience with an electricity supply undertaking or with a manufacturing concern.

The appointment is subject to the City Council Superannuation Scheme, and the successful candidate will be required to pass a medical examination.

Applications, giving age and full particulars of technical training and experience, together with copies of recent testimonials, should be endorsed "Principal Power Sales Assistant," and addressed to me, and not to any member of the Council, so as to be received not later than 10 a.m. on Monday, 31st March, 1947.

Canvassing, directly or indirectly, will disqualify.

PHILIP B. DINGLE,

Town Hall, Manchester, 2, Town Clerk.
 March, 1947.

THE SOUTH METROPOLITAN GAS COMPANY.

Applications are invited for the position of Foreman Electrician at one of the Works of the South Metropolitan Gas Company.

APPPLICANTS, who should not be more than 40 years of age, should possess the higher National Certificate, and should have experience in the operation and maintenance of turbine driven alternators, motors, hand operated and automatic control gear and ironclad switchgear, and should be familiar with the installation and maintenance of heavy armoured power cables.

The appointment will be subject to examination by the Company's Medical Officer and will carry the benefits of the Company's Copartnership and Superannuation Scheme.

Applications, together with details of qualifications and experience, should be sent to:—

SERVICE SECRETARY,
 589, Old Kent Road,
 S.E.15.

Applications are invited from qualified Electricians for employment with the South Metropolitan Gas Company.

APPPLICANTS, who should not be more than 40 years of age, should be experienced in the maintenance of turbine driven alternators, motors, hand operated and automatic control gear and ironclad-switchgear, and the installation and maintenance of heavy armoured power cables. Preference will be given to men with Mechanical as well as Electrical training.

The appointment will be subject to examination by the Company's Medical Officer and will carry the benefits of the Company's Copartnership and Superannuation Scheme.

Applications, together with details of qualifications and experience, should be sent to:—

SERVICE SECRETARY,
 589, Old Kent Road,
 S.E.15.

SITUATIONS VACANT
HIS MAJESTY'S COLONIAL SERVICE.

ELECTRICAL ENGINEER, GOLD COAST.—

Applications are invited from suitably qualified candidates between the ages of 25 and 35. Applicants must be British subjects and physically fit and possess Associate Membership of the Institution of Electrical Engineers, or degrees or diplomas giving exemption from the qualifying examination at that Institution. In addition they should have undergone an apprenticeship with subsequent practical experience of power generation and distribution.

Appointment will be on agreement for two tours of 18 to 24 months, with a possibility of permanent and pensionable employment. Salary scale inclusive of expatriation pay range from £660—£1 300 per annum by varying annual increments, point of entry depending upon age, qualifications and experience. Rent of Government quarters varies from £60 to £90 per annum according to salary. Income tax at low West African rates. Free first class passages for officer and, if married, for his wife, on first appointment and on leave. Home leave on full pay is normally granted on the satisfactory completion of each tour at the rate of seven days for each month of resident service.

Intending candidates should write at once to the Director of Recruitment (Colonial Service), 15, Victoria Street, London, S.W.1, stating age, qualifications and brief particulars of experience.

NORTH STAFFORDSHIRE TECHNICAL COLLEGE, STOKE-ON-TRENT.

Principal: H. W. Webb, O.B.E., D.Sc., F.R.I.C., M.I.Chem.E.

APPPLICATIONS are invited for a full-time Lecturer in Electrical Engineering qualified to take Electrical Measurements and/or Electrical Power to Final Degree standard, to commence in May or September, 1947.

Applicants should possess a degree or equivalent qualification. New Burnham scale of salary with allowance for industrial experience. Applications should be sent in to the Principal as soon as possible.

J. F. CARR,
 Clerk to the Governors.

B/OMC.
 March 13th, 1947.

THE JERSEY ELECTRICITY COMPANY LTD.

APPPLICATIONS are invited for the following posts:—

Junior Mains Engineer.

Candidates should be trained engineers with distribution experience, and should be used to compiling mains records. Age 21-24. Commencing salary, £300 per annum.

Installation Inspector.

Candidates must be experienced electricians, conversant with I.E.E. Wiring Regulations, and be capable of inspecting, testing, and connecting up A.C. installations, and attending to meter queries. E.T.U. rates and conditions.

Meter Repairer and Tester.

Applicants must be experienced in the repair of all types of watt-hour meters, indicating instruments, and time switches. E.T.U. rates and conditions.

Applications giving full details should be addressed to the undersigned, within three weeks of publication of this advertisement.

H. H. Longson, M.I.Mech.E., A.M.I.E.E.,
 Engineer and Manager,
 Electricity House,
 Broad Street, JERSEY, C.I.

FIRST-CLASS Electricians required. Used to all systems. Permanent posts to right men. Apply—R. J. Kemp and Co., Coalville.

SITUATIONS VACANT

COUNTY BOROUGH OF HUDDERSFIELD.
ELECTRICITY DEPARTMENT.

APPLICATIONS are invited from Engineers who are Graduates or Corporate Members of the Institution of Electrical Engineers for the position of "Mains Assistant."

Experience is essential in the design, erection, maintenance and operation of E.H.T. and L.T. Overhead and Underground distribution and protective systems up to and including 33,000 Volts; layout and development of Housing Schemes and general estimates.

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

The salary will be £429 per annum, in accordance with Class H, Grade 8b, Col. 1. of the N.J.B. schedule of salaries and conditions of service.

Forms of application can be obtained from the Borough Electrical Engineer and Manager, Market Street, Huddersfield, to whom they must be returned, duly completed and signed, not later than the first post on Friday, 11th April, 1947.

F. A. ELLIS, M.I.Mech.E., M.I.E.E.,

Borough Electrical Engineer and Manager.
22nd March, 1947.

POWER Station Engineer, maximum age 45, to supervise work of a team of specialists during construction of large power station in Near East. Applicants must have good engineering degree, and comprehensive experience of power station construction and operation. Plant includes 20,000 kVA turbo-alternators, 500 lb. w.p. water tube boilers, 11 kV switchgear, etc. Construction period would be for two years, with the promise of permanent employment as Power Station Superintendent if worth proved during construction period. Salary for construction period £1,260 per annum, with free accommodation and messing. Apply with fullest particulars to—Spearing and Co. Ltd., 3, Clements Inn, W.C.2.

BOROUGH OF DAGENHAM.

STREET LIGHTING INSPECTOR.

APPLICATIONS are invited for this permanent appointment. Grade IV, £440-£485 p.a., plus current bonus £59 16s. p.a. Applicants must have had experience in a similar capacity and possess either the A.P.L.E. or F.I.E.S. (by examination) qualifications.

Particulars and forms of application may be obtained from the Borough Engineer and Surveyor. Closing date, 14th April, 1947. The Council are unable to provide housing accommodation. Canvassing disqualifies.

KEITH LAUDER,

Civic Centre, Town Clerk,
DAGENHAM.

ELECTRICAL Draughtsman for layout of A.C. and D.C. power and lighting installations for power station and gas works handling plants. Experienced in circuit diagram work, inspection and listing of electrical installations, dealing with enquiries and ordering material. Permanent post, pension scheme and profit-sharing bonus. Give experience, age and salary required to—W. J. Jenkins and Co. Ltd., Beehive Works, Retford, Notts.

EXPERIENCED DRAUGHTSMEN required for the mechanical design of large D.C. and A.C. machines by Mather and Platt, Ltd., Park Works, Newton Heath, Manchester, 10. Write c/o Employment Department.

LADY Tracers, light electro-mechanical engineering work, Wembley district. Apply, giving age, experience and wage required, to—Siemens and General Electric Railway Signal Co. Ltd., East Lane, Wembley.

FOR SALE

CITY OF LINCOLN ELECTRICITY
DEPARTMENT.

OFFERS are invited for the purchase of all or part of the following 5 amp. 230 v., 50 cycle, Prepayment Meters which are surplus to the Undertaking's requirements—

- 160—Chamberlain and Hookham Type "BP" arranged for 1d. coins.
- 75—Ferranti Type "FLPO" arranged for 1s. and for 1d. coins.
- 39—Metro-Vickers Type "NE" and "NET" arranged for 1s. and/or 1d. coins.
- 26—Metro-Vickers "NA" arranged for 1s. coins.
- 20—Venner Type "AD" arranged for 1s. and/or 1d. coins.

- also
- 3 Ferranti D.C. 2-wire watt hour meters, 300 amp. 460 v. Type "FE."
- 1 Ferranti D.C. 2-wire watt hour meters, 400 amp. 470 v. Type "FR."

All the above meters are in good condition and can be inspected at the address given below.

F. NEWEY,

City Electrical Engineer and Manager.
Electricity Department,
Braxford Side North,
LINCOLN.

NEW Pelapone Diesel Generator, 230 volt 12 kW, £250. Newcase Generator by Nunn and Co. with Ford 10 power unit and 230 volt 5 kW dynamo, £75. One Dynamo by Scott Belfast, 110 volt, 7.5 kW, £25. One E.C.C. Dynamo, 110 volt 22 kW, £25. One Manual Woodfield Overhead Travelling Crane, 3 ton, 35 feet span, £250. Winches 5,000 lbs. capacity, with power input shafts, very compact, £25 each. Lister Petrol 12 h.p., 2 cylinder power unit, new, £75. Lancashire Dynamo Co. charging set, unused, with Lister engine and 7½ volt 400 amp. generator and Crypton switchgear, £100.—Arnot's Auto Spares, Guthrie Street, Dundee. Phone: 4068/9.

SWITCH BLOCKS, HARDWOOD, POLISHED
AND GUARANTEED.

3 in. by 3 in. by ½ in., 6s. doz.; 3 in. by 3 in. by ¾ in., 6s. 9d. doz.; 3 in. by 3 in. by 1 in., 7s. 6d. doz.; 6 in. by 3 in. by ½ in., 8s. 9d. doz.; 6 in. by 3 in. by ¾ in., 9s. 6d. doz.; 6 in. by 3 in. by 1 in., 9s. 6d. doz.; 6 in. by 3 in. by 1 in., 10s. 9d. doz. Post paid. Cash with order.—S.T.C. Manufacturing Co., 33, Grange Road, Ramsgate.

(i) MOTORS.—New B.T.H. ¼ and ½ H.P. Ind. 230/11/50. 1425 r.p.m. Cent. Sw. Start. In Stock.—Pearce, 66, Great Percy Street, London, W.C.1. Near Angel.

(ii) FLUORESCENT LAMPS.—New 40 watt complete in refl. with starter gear, 25 18s. 6d. Also some slightly used 80 watt in trough-type refl. complete with starter gear, 26 10s. each, 6 for £36.—Pearce, 66, Great Percy Street, London, W.C.1. Near Angel.

(iii) SWITCHBLOCKS.—Round 3 in. by ½ in. Wh. or I.W., 6s. doz. Same 3 in. by ¾ in., 7s. doz.—Pearce, 66, Great Percy Street, London, W.C.1. Near Angel.

FIRE manufacturers can offer regular supplies of electric fire refractories, boiling ring refractories and pencil bars; full list on request. E.E. and M. Co., 295, Staines Road, Hounslow, Middx.

LARGE G.E.C. D.C. fan motors, £1. plus 1s. postage; ex-Government microphones, 2s. 6d., post free; U.S.A. Government surplus lightweight headPHONE (10 ohms), 19s. 6d. pair; adjustable carbon microphones, with stand and switch, 8s. 6d.—Hay and Son, 129, North Street, Brighton.

TERMINALS.—200 gross plated, knurled screw type on ½ in. by 6 wood screw, 6s. gross. Sample 3d. stamps.—Gaydon, 21, High Street, Worthing.

FOR SALE

TELEPHONES, complete units in iron-clad cases, with CONTROL PANELS for 4, 8 and 12 stations. New HAND-SETS with and without press keys. JACK PLUGS 2 and 3 way, SWITCH KEYS, CARBON INSETS, all new surplus Ministry goods, suitable for ships, factories, mines, etc. Enquiries and inspection invited for home and export trade. Ebonite Rod, Sheet and Tube.—Jack Davis, 30, Percy Street, London, W.1. Telephone: Museum 7960.

DUPLICATE books, billheads, memos, etc.; estimates by return; prompt delivery.—Central Press, Pence, Burnley, 5.

ELECTRIC GENERATING PLANT—12 h.p. Austin Engine and 27 accumulators, complete with tanks and switches, 50-75 volts, 2 kW. Price at farm, £80.—Auchendennan Farm, Loch Lomondside, Scotland.

GLOW Type Starter Switches, for 80-w. or 40-w. fluorescent fittings—Parkinson and Worden Ltd., 49, King Street, Blackburn.

ONE Ericsson Internal Automatic TELEPHONE EXCHANGE with Mains Unit complete. Excellent condition—no instruments. Offers invited.—The S.U. Carburettor Co., Ltd., Shirley, Birmingham.

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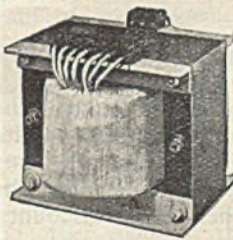
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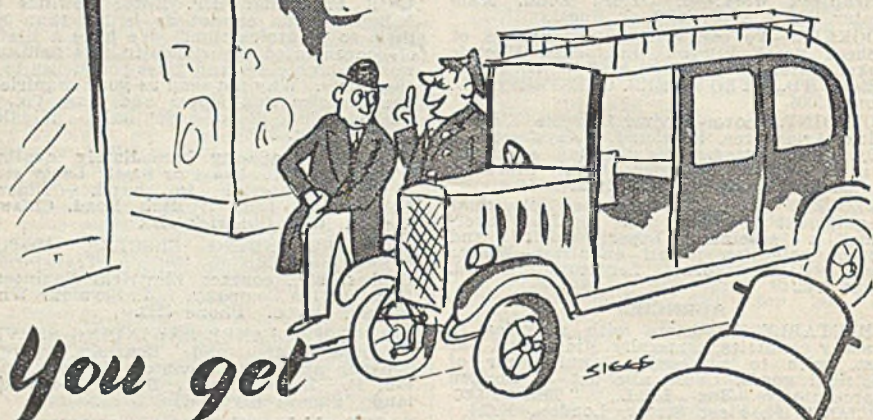


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THE

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Production and Coal

NO epitaph to the easy official optimism of last autumn could have been more ironically fitting than the facts given a week ago by the President of the Board of Trade at the first of a series of fortnightly Press conferences on the economic situation. At the peak count of February 22, unemployment had risen as a result of the power cuts to a figure six times that of mid-January, while on March 5 after all cuts had been restored, the total still stood at double the January level. Production figures fell during the month, and steel—which remained a favoured industry during the cuts, dropped to 86 per cent. of the January output. Nor is this the whole story. It has been reliably estimated that over one-third of the available man-hours in the manufacturing industries are still being lost through lack of fuel.

The limiting factor of recovery is still first and foremost shortage of coal. Here, Sir STAFFORD CRIPPS offers a grain of encouragement. Coal production during February, despite adverse conditions, reached a level exceeded only during three individual months of last year, and in recent weeks man-power at the coal-face has shown an upward trend. Conversion to oil-burning—estimated to bring about a saving of two million tons of coal this summer—and other economy measures, will help, but the prospects of stocking up to a total of 15 million tons and at the same time raising the industrial allocations to above two-thirds of requirements must

be regarded as slight. Whether industry can, as Sir STAFFORD thinks, "maintain, at a pinch, full production on 10 to 15 per cent. less than requirements," is doubtful. Possibly true six years ago, this argument is less compelling to-day, when most large consumers have already brought fuel economy measures to a high pitch.

First Things First

WITH the interlinked problem of generating capacity, Sir STAFFORD CRIPPS dealt only briefly, but reaffirmed that the utmost persuasion—compulsion he did not favour—would be exerted to divert domestic appliances into the export market. We could not, he said, contemplate a continuance of interruptions caused by unregulated load-shedding. So much for restrictive measures. On the positive side, it appears that the first outcome of the Prime Minister's talks with the makers of heavy electrical plant is that they are to be given a first priority, and that "better methods of progressing" are to be employed. The building, equipping and extending of power stations involve not one industry, but many; delays at any point in the complex sequence of deliveries can waste, and are to-day wasting, countless hours of work. If "better progressing" means that the requisite priority is to be extended to all aspects of plant manufacture and commissioning, it will be an immense task, but one which should be encouraged by all who rely upon electrical power for the efficient prosecution of their business, even though the extension of priorities in one quarter may mean their reduction in others.

Expansion Delays

A TYPICAL example of the delaying factors influencing the power station position was given by Mr. K. A. SCOTT MONCRIEF, at the annual meeting of the Northmet, whereat it was explained that the company had during 1946 been unable to carry out the programme's work due to shortage of materials and labour. The programme was prepared about the middle of 1944, was estimated to cost over £5 000 000, and was to have been carried out during the first five post-war years. Circumstances have made it impossible to carry out any but the most urgent requirements. The Station Com-

pany, which is proposing to spend nearly £3 000 000 in the construction and equipping of a new generating station at Rye House, Hoddesdon, is also experiencing materials and labour difficulties—to an extent which make the completion of the station speculative both as to time and cost.

Selected Station Extensions

THE arrangements made by the Central Board for increasing generating capacity by some 2 321 000 kW by 1950 at a cost of £100 000 000, make interesting reading, and if the Government promise, referred to above, of giving priority to the manufacture of heavy electrical equipment is realised, will too do much to relieve the restrictions now placed on consumption. Lest a too optimistic view be taken, however, it must be recalled that at this time last year some 2 000 000 kW of plant over twenty years old was still in use, while in January this year generating capacity available for output purposes was short by at least 1 500 000 kW. By the end of this year the volume of over-age plant may be still around the two million figure, for, due to circumstances beyond its control, the supply industry is not replacing its equipment at the rate scheduled in the extension programmes. Assuming as a rough estimate that something like 350 000 kW of new plant has been put into commission since the war, and that by the end of 1948 a further 600 000 kW of new generating capacity is installed, much of this will be replacement plant, adding little to the aggregate figure. The capacity of the 142 selected stations connected to the grid system at the end of 1945 was 11 315 931 kW, but since in January, 1946, the plant available was already short by 75 MW and by January, 1947, 1 500 MW, it will be appreciated that the extension programmes are far from that state of completion which the Control Board had hoped they would be.

Electrical Export Trade

THE decline in the value of electrical exports, which became apparent in December after a record aggregate of shipments in November, but was checked in January, showed considerable acceleration in February, when the total of £5 016 602 was £558 337 less than in January and £232 889 below the Decem-

ber figure. How far this was due to bad weather and loss of production resulting from power cuts and coal shortage it is too early to say. The decrease in exports was accompanied by a rise in imports from £138 021 in January to £161 376 last month. In February last year the value of electrical exports was £3 078 538 and imports £868 813. For the first two months of this year the aggregate value of electrical exports was £11 594 066, compared with £6 308 457 for the corresponding period of last year, and £3 658 296 for one-sixth of 1938. In contrast with decreases in shipments of other goods there were increases in the despatch of generators and vacuum cleaners.

Electrical Development

THE new Minister of Works, Ald. CHARLES KEY, who was the guest of honour at the annual luncheon of the E.D.A. last week, has had a long connection with the association, and as a result of this experience he was able to pay a well-deserved tribute to its work. If those present expected to hear any authoritative statement as to the part, if any, that the association is to play when the industry is nationalised, however, they were disappointed. The only crumbs of comfort offered were contained in a brief reference to the work the Minister felt sure the members would do under the new conditions. Lord BRABAZON, who enters upon his fifth term of office as president of the E.D.A., rebutted the suggestion, made in some quarters, that the E.D.A. is finished. Mr. H. J. RANDALL, the retiring chairman of the Council, is also optimistic, for at the annual meeting which followed the luncheon, he said that whatever changes might be effected as the result of the new legislation, in the constitution, functions and status of the E.D.A., the work of the association must go on. Whatever the future holds for the association, the fruits of its past labours, if nothing more, will be gathered by the industry and the community at large for many years to come. For the first time in its long history the association has been faced with the problem of dealing with the position in which the demand for electricity exceeds the supply, and with commendable adaptability the Council has adjusted its

policy to one whereby the public may be instructed in how to make the best and most economical use of available supplies so as to decrease or distribute the domestic load. The success which has attended these efforts is partly responsible for the new attitude of mind with which the Ministry of Fuel is now viewing the restrictions upon domestic consumers.

Radio-Communication Progress

THOUGH the radio-communication convention being held by the I.E.E. this week, perhaps lacks the public appeal of the radio-location convention of last year, it is every bit as important from the academic side and more so perhaps from the point of view of economics. Radio-location, as wide as its peace-time applications may be, must give way to the many uses to which radio-communication is put, while the industrial implications have a more direct bearing on the manufacturing prosperity of the country. This is due to the more universal use of radio equipment for communication than for navigation and other purposes, while the export opportunities judged from present shipments are substantial. The address of Sir STANLEY ANGWIN on Tuesday gave a clear indication of the rapid strides which were made under the impetus of war, while the valuable part played by industry has been marked throughout the convention.

Pointers to the Future

OF papers upon which the convention is based, 16 are main papers and the remainder supporting—and each may be regarded as a pointer to the future. Paper shortage makes it impossible to give to the convention the space in our columns which in other circumstances would be devoted to it, but sufficient will be found in this and next week's issue to assess the value of papers read. To-night, Friday, Sir CLIFFORD PATERSON will review the ground covered by the convention and indicate the direction in which future developments may be expected; as one largely responsible for organising the research which made the rapid advance possible, his words will command not only attention in the institution to-night, but throughout the communication world to-morrow.

A FIRST PRIORITY

PRODUCTION OF PLANT AND ERECTION OF POWER STATIONS

THAT the Fuel Committee of the Cabinet had decided that top priority should be given to the production of electrical generating plant and the erection of the necessary new power stations was stated by Ald. C. W. Key, Minister of Works, who was the guest of honour at the annual luncheon of the British Elec-



Left to right: MR. C. G. MORLEY NEW, MR. HAROLD HOBSON, SIR JOHN DALTON and CAPT. J. M. DONALDSON, among those present at the E.D.A. annual luncheon

trical Development Association, in London, on March 21. He had taken the place of Mr. Chuter Ede, the Home Secretary, a past president of the association, who was prevented from attending by Parliamentary duties. The president of the association, Lord Brabazon of Tara, occupied the chair and the attendance numbered upwards of 650.

In proposing the toast of the association, Ald. Key said that when the association had been so inordinantly successful in stimulating the public to demand more electricity, the Government, much to their sorrow, had been forced into the unpopular position of having to allot the people less. Whilst he could not pretend that the shortage of plant and coal would be easily overcome, they could be assured that the Government had every intention of doing all possible to forward the development of the supply industry by equipping it with the plant that it so badly needed. The Fuel Committee of the Cabinet had decided that top priority should be given to the production of electrical generating plant and it would be the responsibility of the Heavy Electrical Plant Committee under the chairmanship of the Minister of Supply to speed up production. The recent crisis had shown how serious were the effects of a shortage of electricity, and he felt sure the Government had the country in its entirety behind

them in their determination to organise for abundance.

Lord Brabazon, in reply, said that while they were engaged on development, they had been against waste as much as anyone else, because they had ever been keen advocates of efficiency, and efficiency meant economy. Naturally, they had followed the growth of the curve of electricity, and the Council in 1943 warned the Minister of the danger that was impending. It was good news indeed, though perhaps a little late in the day, that the Government had decided to put the greatest priority on the building of new stations. The industry consumed to-day 24 million tons of coal and their computationists told them that in 1957 they would be using 50 million tons and in 1967 100 million tons. He was told that if the railways were electrified throughout that would save seven million tons of coal and the conversion of the mines to electric power would save eight million tons. There were many other economies in coal possible.

Some were saying that the work of the E.D.A. was finished. He did not think that was true. If education in schools, in showrooms, demonstrations and



Left to right: MR. J. S. PICKLES, MR. H. F. CARPENTER, SIR JOHN DALTON and SIR LEONARD PEARCE

lectures and advertising, had ever been wanted, it was more wanted to-day than at any other time. He did not think there was any organisation that could do better than the E.D.A., and he did not believe that the industry itself could do what they had done. It was rather interesting that after all their efforts it had needed a national emergency to make the public really appreciate that electricity was the lifeblood of industry and that the grid lines were the arteries of our productive life.

E.D.A. Annual Meeting

Policy Adjusted to Meet Changing Conditions

THE annual meeting of the British Electrical Development Association followed the luncheon in London, on March 21, with Lord Brabazon, president, in the chair.

Capt. J. M. Donaldson, retiring chairman of the Finance Committee, in presenting the statement of accounts and balance sheet, said there was a balance of £1 337. Expenditure on advertising had gone up by £7 000 from £64 188 in 1945 to £71 175, and that for exhibition purposes had dropped from £18 660 to £3 878. The latter expenditure would increase considerably because they were staging a show at Olympia, among other places, while the figure for building centres would be higher than the £1 909 spent last year. Expenditure on publications and technical services increased from £6 895 to £14 746; lectures and demonstrations from £972 to £2 004; and contributions to other associations from £5,587 to £6 202. Expenditure on kitchen planning was reduced from £8 192 to £599, the reason being that in 1945 the association staged a special kitchen exhibition. The cost of the development of domestic electrical education fell from £1 090 to £684, largely due to the reduced grant to the Electrical School of Domestic Science, the association's interest in which had now been disposed of. On the other hand the association had undertaken to equip the domestic science training colleges, entailing a considerable increase in expenditure this year. That would be a very good investment.

The report of the Council for last year, stated that since the end of hostilities the demand for electricity had revived in an embarrassing way. More than ever before the public had become electrically minded, and this must be largely due to the educational and propaganda work carried on for 28 years by the supply industry working through the E.D.A. For the first time in the history of the industry the position had arisen when the demand for electricity had exceeded the supply, and until more coal and generating plant were available this position would continue. Faced with such a problem, the industry, still working through the E.D.A., had changed its advertising and educational policies. Advertising which urged the unrestricted use of electricity had given way to appeals for economy, particularly during peak periods: and efforts were now being centred on educational and other

schemes the beneficial results of which, might not be fully achieved for several years.

The total membership of the association was 434, compared with 414 in 1945. St. George County Council, Australia, and the



SIR S. L. PEARCE



MR. J. ECCLES

Central Bureau van de Vereeniging van Directeuren van Electriciteitsbedrijven, Arnhem, were enrolled as Dominion and foreign contributors, respectively. The total revenue from supply authorities, including the Central Electricity Board, was £145 877, compared with £138 584 in 1945.

Mr. H. J. Randall, the retiring chairman of the Council, in moving the adoption of the report, said the Council had started preparations for the production of another major film dealing with rural electrification. They had been fully conscious of the action which films would play in the future education of both children and adults. Film work must be regarded as work for the benefit of the community and of the industry in the years that lay ahead. They might get no immediate benefit, but it was further proof that the association could not be accused of lack of foresightedness.

Mr. Randall reported the re-election of Lord Brabazon as president for the year 1947-48—his fifth term of office—and the election of Sir Leonard Pearce, engineer-in-chief of the London Power Co., as a vice-president.

At the first meeting of the new Council Mr. H. F. Carpenter, clerk and manager of the West Midlands J.E.A. and president of the Chartered Institute of Secretaries, was elected chairman, and Mr. J. Eccles, Liverpool city electrical engineer and vice-president of the I.M.E.A., was elected vice-chairman. The E.D.A. Council for the year

1947-48 is as follows: Mr. H. F. Carpenter, Mr. H. J. Randall, Col. J. Rankin, Mr. F. Nicholls, Mr. R. A. S. Thwaites, and Mr. G. A. Vowles, appointed by the C.E.B.; Mr. R. Birt, Mr. J. Eccles, Mr. E. E. Hoadley, Counc. J. Selwyn Jones, and Mr. F. Newey, appointed by the I.M.E.A.; Mr. W. N. C. Clinch and General R. F. Legge, power company members; Mr. Clarence Parker, London

Electric Supply Association; Sir John Dalton, Provincial Electric Supply Association; Mr. J. Harwood Lumsden, Conference of Joint Electricity Authorities; and Messrs. R. Steel, E. Jones, A. Kelso, G. F. Peirson, H. I. Hulme, Lt.-Cmdr. E. J. Cook, H. H. Mullens, W. J. Girvan, J. R. Jones, G. P. Dixon and S. J. C. Ellis, representing area committees.

Generating Plant Extensions

Arrangements in 1946 for 2 321 000 kW Additional Capacity

THE Central Electricity Board made arrangements with authorised undertakers during 1946 for additions to be made to the generating capacity of the selected stations associated with the grid aggregating 2 321 000 kW and involving an expenditure of about £100 000 000. Provision is included for the first sections of seven further new stations. The

arrangements cover the greater part of the plant for installation under the programme of extensions for 1950, and also complete the provision for the new plant due under earlier programmes for commissioning by the winters of 1948 and 1949. Below is given a list of generating plant and boilers to which the arrangements refer.

AREA	STATION	OWNERS	Details of Extensions	
			Gen. Plant (kW)	Boilers (lb./hr.)
Scotland	Clyde's Mill	Clyde Valley E.P. Co....	2 × 30 000	4 × 180 000
	Portobello	Edinburgh Corp.	1 × 60 000	1 × 540 000
	Brachead... ..	Glasgow Corp.	1 × 50 000	2 × 300 000
N.W. England	Bromborough	Birkenhead Corp.	2 × 50 000	4 × 300 000
and N. Wales	Whitebirk	Blackburn Corp.	1 × 40 000	3 × 150 000
	Carrington	Manchester Corp.	2 × 57 000	4 × 360 000
Agecroft	Salford Corp.	2 × 3 000*	4 × 315 000	
	Hartshead	Staly., Hyde, Mossley & Duk. T. & E. B.		(a) 2 × 50 000
	Westwood	Wigan Corp.	2 × 2 500*	4 × 300 000
Mid-E. England	Grimsby... ..	Grimsby Corp.	1 × 30 000	
	Skelton Grange... ..	Leeds Corp.	1 × 1 500*	6 × 360 000
	Prince of Wales	Rotherham Corp.	3 × 60 000	2 × 200 000
Central England and E. England	Thornhill	Yorkshire E.P. Co.	(b) 1 × 50 000	2 × 200 000
	Staythorpe	Derby & Notts E.P. Co.	1 × 45 000	2 × 180 000
	Walsall	West Midlands J.E.A.	3 × 60 000	9 × 240 000
	Brighton	Brighton Corp.	2 × 30 000	4 × 150 000
	Bankside... ..	City of London E.L. Co.	3 × 52 500	6 × 320 000
	Barking	County of London E.S. Co.	2 × 50 000	4 × 300 000
	Beddington	Croydon Corp.	3 × 75 000	6 × 405 000
	Cliff Quay	Ipwich Corp.	1 × 50 000	2 × 320 000
	Rye House	Northmet Power Co.	1 × 2 500*	
	Peterborough	Peterborough Corp.	2 × 30 000	2 × 350 000
			2 × 2 000*	
S.W. England and S. Wales	Brunswick Wharf	Poplar Met. B.C.	2 × 20 000	6 × 320 000
	West Ham	West Ham Corp.	3 × 52 500	
	Poole	Bournemouth & Poole E.S. Co.	1 × 30 000	6 × 300 000
	Carmarthen Bay	Llanelli & Dist. E.S. Co.	3 × 50 000	
	Plymouth	Plymouth Corp.	2 × 52 500	3 × 320 000
Llynfi	South Wales E.P. Co....	2 × 30 000	2 × 1 500*	

- (a) Cancelling a previous direction for :—
2 × 50 000 kW sets and 4 × 300 000 lb./hr. boilers
- (b) Cancelling a previous direction for :—
1 × 30 000 kW set and 1 × 200 000 lb./hr. boiler

	} —130 000	—1 400 000
Net additional plant for which arrangements were made	2 321 000	27 540 000

* Auxiliary sets.

Telecommunications in War

Opening Speeches at the Radiocommunication Convention

BEFORE a large audience, which included representatives from many European countries, the Dominions, U.S.A. and the U.S.S.R., the Radiocommunication Convention of the I.E.E. was opened, on Tuesday night, with addresses by Sir Stafford Cripps and Col. Sir Stanley Angwin. The president, Mr. V. Z. de Ferranti, was in the chair.

Recalling that a year ago the Radiolocation Convention had been held, Sir Stafford said that to-day the other half of the story was to be told. There were obvious differences between the two branches. Radiolocation was secret, spectacular and produced entirely new results. Radiocommunication, however, had been well developed before the war, and its practical results were a commonplace.

Few realised, however, what developments had taken place since before the war. The war-time achievements of communications were no less valuable, from the viewpoint of future use, than those of radar. One branch was the discovery of a new technique: the other, the development of an old one.

After paying tribute to the methods evolved during the war of reducing the weight of equipment—as in one Army set which was finally reduced to only one fifth of its original weight but retained the same output—and the technique of weatherproofing and packing, Sir Stafford said that there had been perfect co-operation between Government research establishments and industry. Knowledge had been increased in many branches of radio engineering, and one could look forward to better and more efficient radiocommunication networks throughout the world.

British engineers, he concluded, were second to none in their achievements, and there was no other field in which our national leadership was more ably demonstrated than that of telecommunications.

Col. Sir Stanley Angwin then delivered his address on "Telecommunications in War."

Following the invasion of Czechoslovakia, Sir Stanley said, preliminary plans were prepared by the Post Office, so that the necessary line communications would be available for national defence as soon as required. By August, 1939, arrangements were in hand for some 500 long-distance emergency circuits, with a much greater number having a radius of under 25 miles. After the declaration of the war, many of

these were converted into private wire networks and during the flying bomb attacks on London, the number approached 10 000. The total equivalent of single conductor used in the defence of the country and the assault on the Continent could be taken as four million miles.

Immediately following the enemy occupation of France, Sir Stanley went on,

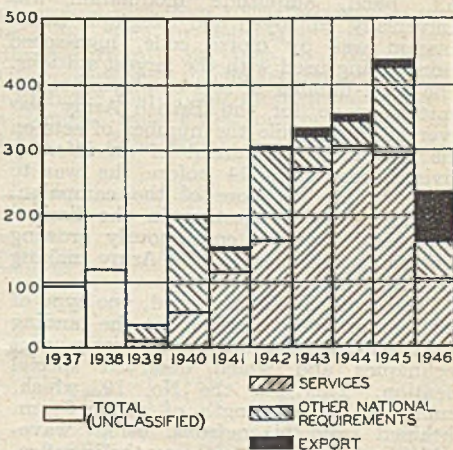


Fig. 1.—Production of high-power transmitters

steps were taken to provide telegraph communication by radio between important centres throughout the country as a precautionary measure. A total of 32 emergency stations, most of which had a power of 0.2 kW or lower, were set up, and in addition, facilities were provided at nine of the coast stations for co-operation in this scheme. In addition mobile links were provided.

The changes brought about by the war in long-distance telegraph services to ships were mainly in methods of operation. It was important that ships at sea should not disclose their positions to the enemy, so that all radio signalling had to be reduced to a minimum. The world was divided into areas, in each of which was situated an area transmitting and receiving station. Messages for ships were broadcast from the appropriate area stations at scheduled times but no acknowledgement of receipt was given by the ships. A network of point-to-point communication channels was set up between the area stations, so that

messages originating anywhere in the world could be routed to the appropriate area station. At the end of the war it was decided to retain the broadcast method of passing traffic to British ships and to ships of such foreign countries as wished to take part in the scheme. This long-distance service, evolved as a war-time requirement and now expanded, Sir Stanley said, was now proving most efficient for normal ship-shore communication.

Sir Stanley next turned to military communication equipment. The types in use ranged from infantry pack-sets, equipped with dry batteries, to the long-range 5 kW "Golden Arrow," used by Royal Signals. The whole range of military sets used the h.f. band, amplitude modulation was universally employed and telegraph transmission was by morse code, high-speed morse being used with the largest stations. The total number of sets employing transmitters made for the British Army was over 600 000, while the number of sets on the normal establishment of an infantry division rose from 74 before the war to over 900 at the close of the campaign. The frequency congestion in the limited h.f. band was a continuously growing problem, others besides the Army making increasing use of this band.

There was, Sir Stanley said, one type of field set produced in time for the landing in France in 1944 which used entirely novel techniques and which deserved special mention. This was the No. 10, which, employing a wavelength of about 6 cm. obtained from magnetrons, using waveguide feed to aerials with parabolic reflectors on high steel towers and making use of time pulse modulation giving eight speech channels, exemplified a very rapid introduction of modern techniques into military field wireless equipment.

WORLD'S LARGEST TRANSMITTER

After describing the useful work performed by the monitoring and interception services, Sir Stanley turned to the war-time activities of the B.B.C. The necessity for guarding against the use of broadcasting stations as beacons by enemy aircraft involved changing over immediately to a single programme for the whole country, radiated by a number of very accurately synchronised stations. The magnitude of this task, he said, should not be under-rated. During the course of the war, the most powerful broadcasting transmitter in the world was erected at Ottringham for medium- and long-wave transmissions to occupied Europe, and the largest short-wave broadcasting station in the world was built in Cumberland.

Perhaps one of the most important war-time developments in long-distance point-

to-point radio telegraph technique, Sir Stanley continued, was the operation of multi-channel voice-frequency telegraph channels on single-sideband radio-telephone equipment. Multi-channel telephone links had been developed by associating coaxial-cable terminal equipment with wide-band v.h.f. radio transmitters and receivers. Use was made of such links by the Army and the Post Office, the latter introducing highly developed systems of this type as an integral part of the telephone and telegraph network.

VALUE OF STANDARDISATION

By standardisation of components, Sir Stanley said, it was possible to bring about substantial increases in production. Valves were dealt with first, and a list of approved types was quickly issued. There were also "restricted" types, which were more difficult to manufacture and could only be used for special circuits, and "black list" types, which were very difficult to make and had to be avoided. By 1945, the production of valves in the United Kingdom was well in excess of 30 millions.

Later, other components were standardised wherever possible. A preferred list of carbon resistors reduced the number of values made from 4 000-odd to 255, whilst the number of transformer laminations fell from 560 to 32. In addition, to meet the needs of tropical conditions and light weight, entirely new ranges of hermetically sealed and miniature components were developed, most of which were capable of operating at 100° C.

One of the most spectacular effects of the mobilisation of production was in the manufacture of quartz crystals, which had previously been made only on a very small scale as a highly specialised laboratory process. From an annual production rate of 5 000 in 1937, output was stepped up to over a million in 1944. In addition, the quality of the product was progressively improved.

At this point, Sir Stanley showed a slide (Fig. 1) which illustrated the trend of transmitter output during the war years. The output over the whole period, he explained, was estimated in terms of a common unit representing the production effort involved in the manufacture of a 3.5 kW transmitter. The levels for the last six months of 1944 reflected the damage and interruptions caused by flying-bomb attacks.

In conclusion, Sir Stanley referred to the problem of meeting war-time requirements from a nucleus of peace-time production, and thought that in this respect, in order to obtain a rapid change-over if necessary, peace-time sets and components should be kept in line, wherever possible, with those used in the Services.

ELECTRICAL OVERSEAS TRADE

VALUE OF FEBRUARY EXPORTS £558 337 BELOW JANUARY TOTAL

ALTHOUGH the full effects of the industrial close down due to the fuel crisis will not be evident for several months, there was a fall in the value of electrical exports from £5 574 939 for January to £5 016 602 for February—a difference of £558 337. The aggregate for February, 1946, was £3 078 538, and the monthly average for 1938 was £1 829 198. The value of electrical imports rose from £138 021 for January to £161 376 last month, the balance of exports over imports being £4 855 226 for February as against £5 436 918 for January.

The number of domestic radio sets despatched to overseas markets fell from 41 011, value £429 144, in January, to

32 952, value £360 587, in February. In February last year the figures were 10 919 sets, value £97 518, and the monthly average in 1938 was 7 053, value £36 755. Electric lamps shipped showed a decrease from 3 010 552, value £108 764, in January, to 2 730 712, value £86 516 last month. In February, 1946, the number was 2 704 540 and the value £115 192, against a monthly average for 1938 of 1 638 099, value £49 440. Purchases of generators rose from 1 863 tons in January to 2 583 tons in February, but motors dropped from 1 324 tons to 1 154 tons. Other electrical machinery, transformers, switchgear and so on, despatched showed a decrease from 2 274 tons in January to 1 629 in February.

	IMPORTS			EXPORTS		
	Monthly average 1938 £	Month ended February 28 1946 £	1947 £	Monthly average 1938 £	Month ended February 28 1946 £	1947 £
Submarine cables				17 289	15 343	40 382
Other telegraph and telephone wires and cables				71 803	104 697	178 740
Electric cables, wires, &c.—						
Rubber insulated	31 246	9	6 582	{ 117 533 153 256	203 751	297 858
With other insulation					291 197	288 580
Radio transmitters and (and radar) equipment			15 543	28 296	35 643	85 398
Radio receiving sets	10 148	7 514	6 089	36 755	97 518	360 587
Radio long distance telegraph and telephone equipment	9 243	75	2 330	242 716	345 512	560 945
Other descriptions	47 870	759 714	4 596	57 848	98 005	184 494
Transmitting and industrial valves	10 893	38 700	19 573	41 272	{ 20 688	23 060
Other valves					{ 60 591	81 858
Furnace carbons, electric	4 054	1 320	25 359			
Other electric carbons	2 301	5 137	2 917			
Electric lamps	10 265	53	3 343	49 440	115 192	86 516
Other lighting appliances, fittings &c.	38 662	584	4 307	48 565	128 221	189 363
Batteries and/or cells, primary	3 549	23	1 239	13 572	37 206	34 569
Accumulators				48 647	79 908	134 853
Parts and accessories					55 113	47 555
Heating apparatus and elements				14 064	50 914	125 831
Other heating equipment				16 600	17 801	60 442
Electrical instruments and parts	32 057	16 375	11 986	15 878	36 201	61 601
House service meters				15 791	35 656	52 445
All other descriptions				9 612	34 898	28 114
Electrical electro-medical apparatus				3 038	6 763	9 660
X-ray and other valve and vacuum tubes	9 734	6 692	7 857	4 881	21 905	34 741
Insulating cloth and tapes				7 038	40 949	26 078
Other insulating materials				12 305	40 549	66 403
Generators and parts				157 150	96 350	791 504
Motors and parts	26 033	4 174	11 303	145 045	219 550	321 378
Other descriptions of electrical machinery	14 455	7 437	6 865	355 663	420 387	459 508
Vacuum cleaners and parts				26 662	28 015	121 364
Other portable appliances	24 627	1 197	6 424	10 394	21 308	15 313
Welding machinery (including electrodes) other than tube making	—	5 584	8 111	—	111 986	95 270
Other articles	52 980	14 225	16 970	108 083	206 721	152 182
Total	328 117	868 813	161 376	1 829 198	3 078 538	5 016 602

INSIDE OF ELECTRICAL MACHINES

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

IN this final article, Part XXII*, of the series an account is given of the effect of corona upon insulation. Various methods for the elimination of discharges in high voltage alternators are described; and, in conclusion is a brief review of the trend in insulation practice with reference to machines.

High Voltage Phenomena.—When windings are undergoing their high voltage tests, certain manifestations occur which are apt to alarm those who only occasion-

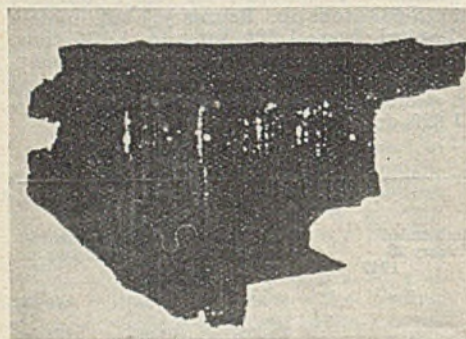


Fig. 1—Effect of corona on 0.010" presspaper, removed after 15 years in an 11 kV stator

ally witness such tests. These may be streamers extending from the winding to prominent points in nearby metal, there may be brush discharges from slight prominences on the coils, or there may be intense corona at certain places, particularly where the coils leave their slots.

These phenomena are not present at normal voltages in well designed machines for 11 kV and below, and since it would be rather expensive to eliminate them, no attempt is made to do so beyond taking care that points and rough places are made fairly smooth.

Those who are responsible for supervising tests of this nature in the works are fully aware of the implications of such phenomena, and whether or not they indicate future trouble. It is quite safe in case of doubt for a visiting inspector to be guided by the opinion of the supervisor in charge of the test, since the latter has nothing to gain, and usually much to lose, by giving incorrect advice. Firms

which make large and expensive machines do not like the expense and worry of defects developing in them after delivery.

In alternators for higher voltages these phenomena would occur at working voltages if steps were not taken to eliminate them. These will shortly be described.

Corona and its Effect upon Insulation.

—Reference was made in Part XX of the series to corona occurring in the slots of machines. In general it cannot be seen, but may be indicated by a slight hissing sound if the voltage is switched on to a winding in a perfectly quiet building. If the machine is running, its presence may be indicated by a faint smell of ozone.

Corona destroys vegetable matter, such as paper, tape, etc., upon which it impinges. This destruction is a slow process, and it may take many years for its effect to be of serious consequence, although its presence may be suspected long before positive evidence is found. On this account the photograph which is reproduced in Fig. 1 is of special interest. It is of a piece of 0.010 in. presspaper liner removed after fifteen years' service in the slot of an 11 kV generator. The parallel, irregular, white lines show where corona has completely destroyed the material, the white being due to illumination at the back showing through the holes.

Fortunately, corona has no effect upon mica so that the destruction ceases as soon as the outer layers of vegetable matter have disappeared and the corona contacts the mica splittings in the micaite tubes. It is no doubt because of this that machines made as long ago as 25 years are still functioning perfectly, and seem likely to continue doing so, in spite of the smell of ozone which they continually emit. Incidentally, the machine from which the sample was taken had not broken down because of the corona, but, from a totally different fault.

As stated in Part XX, the elimination of corona in slots is a simple matter. The outside of the tubes may be taped with asbestos tape which is thoroughly impregnated with graphite, or the outer wrap may consist of presspaper coated with graphite, or colloidal graphite may be painted on the outside of the tubes.

Turbo-Alternators for 22 kV and 33 kV.

—Unless special precautions are taken intense corona, and perhaps streamers, will be present in these machines. Whilst it is not convenient to disclose details of the methods employed in every case for

* Parts I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX, XX, XXI, appeared in THE ELECTRICIAN of April 26, May 10, May 24, June 7, June 21, July 5, July 19, August 2, 16, 30, September 20, October 4, 18, November 1, 15, 29, December 13, 27, 1946, January 10, 24, and February 14 respectively.

their elimination, it may be of interest to describe the details as far as possible, and for the rest to indicate the problems that have to be solved.

For 33 kV alternators two manufacturers have adopted circular conductors, made up in the form of a three-core cable, and circular slots. The insulation between each core, and between the outer core and the slot is of mica paper, the thickness of each dielectric being ample for one-third the voltage between line and

by confining the explanation to one voltage and type. Consideration will, therefore, be given to a 22 kV stator having a diamond type of coil. Such a stator is depicted in Fig. 3.

One of the most important points to remember is that sharp corners produce a concentration of electric stress and must be avoided. For this reason, the top and bottom sub-conductors in the coils are provided with ample radii, and the corners of the micanite tubes are well radiused.

Electrical insulation is a poor conductor of heat, and it has been necessary to improve the quality of that used in high voltage machines, so that the thickness for say a 22 kV machine is much less than double that employed for 11kV.

The prevention of corona in the slots, as has been stated, is a simple matter. However, the elimination of discharges from the ends of the slots, and other parts of the windings, is not so easy.

The state of things at the ends of the slots, before precautions are taken, may be pictured as at *a* in Fig. 2 where corona is shown extending from the ends of the slots for some distance along the tubes. It also fills the space between the tubes and the clamping fingers. By extending the earthing shields on the slot portions of the tubes the discharges may be removed from the ends of the slots, and the spaces between the coils and the fingers. The condition will then be as shown in Fig. 2*b*, the corona then being at the end of the earthing shields.

The presence of discharge is an indication that the air is overstressed. It is not possible here to analyse fully the conditions existing in Fig. 2*b*, they are too complex. However, an elementary consideration of the problem may be of interest.

Suppose *a* is a point on a conductor which is connected to one of the line terminals; then the voltage drop between *a* and *c* through the insulation to *b*, and through the air from *b* to *c* will be $L/\sqrt{3}$, where *L* is the line voltage. Since the earth shield is of low resistance it may be assumed that the potential at *c* will be the same as at *d*, namely, earth potential. If it could be arranged for some of the drop in voltage to occur between *c* and *d*, it might be possible to reduce that between *b* and *c* to below the gradient at which any sort of discharge would occur.

Now, the current *I*, which charges the stressed air to the right of *c* flows through the earth shield from *c* to *d*. If this part of the shield could be made to have a resistance *R*, the voltage drop *V* from *c* to *d* would be *IR*. Hence, by making *R* suitably large the voltage at *c* may be raised

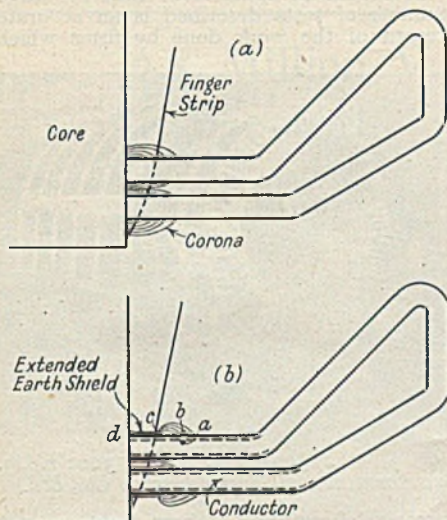


Fig. 2—Elimination of corona

neutral. Thus the innermost core, or "bull" is insulated from earth by a total thickness of insulation which is adequate for the full voltage to earth.

In connecting up this winding all the bull conductors in a phase are connected in series, all the intermediate or "inner" cores in a phase are also connected in series, and so are all the "outer" conductors of a phase. The appropriate ends of the bull and outer conductors are connected to the line and neutral terminals respectively. The other ends are connected to the free ends of the "inner" conductors in such a manner that there is a uniform drop in voltage throughout the phase. By this means the electrical conditions between coils and slots are made equivalent to those obtaining in an ordinary 11 kV alternator.

Other makers have retained one or other of the orthodox types of winding, i.e., they have either used the diamond type of winding, or the concentric type. In most respects both types experience similar electrical conditions, and it may simplify things

to such a value that the drop between a and c (viz., $L/\sqrt{3-V}$) would be too small to cause overstressing.

There is another method of re-distributing the stress so as to avoid discharges. This is by the use of capacitance shields. These are the same in principle as condenser bushings. They must be applied to the outside of the tubes and extend from the slot ends for a suitable distance towards the end winding.

In the end winding the full line voltage is present where phases are adjacent. Here it is necessary to employ suitable reinforcement to prevent failure of the insulation, at the same time taking care to ensure that the distance between phases is too great for discharges to occur. It should be noted that if sparking is occurring between two insulated conductors, which have an air space between them, adding more insulation will not prevent the trouble, unless the whole of the space is made up solid with insulation. If the effect of adding insulation is merely to reduce the air space between the conductors, the discharge in the smaller space will be much greater than across the original.

The increase in the discharge across the shorter air space is explained in this manner. Between the two conductors there are several dielectrics in series, those on the conductors having a fairly high permittivity (dielectric constant), and the air with a permittivity of 1.

When a stress is applied to dielectrics in series, the voltage distribution is governed by the permittivity and the relative thickness of each dielectric—it is inversely proportional to the former and directly proportional to the latter. Thus, if the conductor insulation is increased at the expense of the air, the voltage across the latter will certainly be reduced, but not in proportion to the reduction in thickness, owing to this difference in permittivities. The stress in the air will actually be increased and the discharge will be fiercer.

Fig. 3 is reproduced from a photograph of a 22 kV stator in which all the necessary precautions have been taken. It does not look any different from a normal 11 kV stator, and only an expert looking at such a winding would notice anything out of the ordinary.

Windings of this type have given complete satisfaction for many years. There is no doubt that effective precautions against discharges can be taken. A stator of this kind was recently thoroughly examined after arduous service throughout the war. A long and careful inspection failed to disclose the slightest sign of deterioration due to electrical discharge or other action.

As a concluding remark, when the

author undertook to write these articles, he assumed they would be completed in about six contributions. This estimate would have been correct if the articles had been confined to the windings and the uses of insulation. It was realised, however, that most people had no idea how the products they specified and used were made, still less how their quality is assessed and tested. Therefore it was decided to extend the series to make it a record of information of a kind that is seldom published.

It should be appreciated that the large number of tests described is an accurate record of the work done by firms which

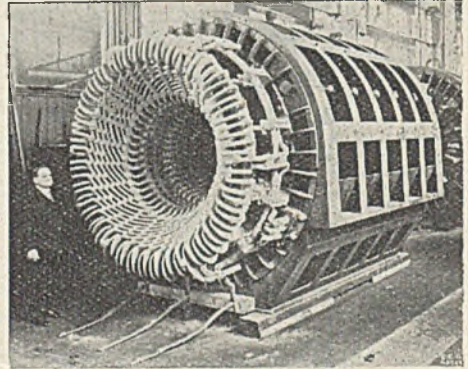


Fig. 3—A 27 500 kVA, 22 kV, 3 000 r.p.m. stator winding (General Electric Co., Ltd.)

possess laboratories. These tests are not merely of academic interest, they are daily routine work in many factories. It is because of the careful testing and selection of the materials, and the great skill of the British workman that our products are so much sought after in many parts of the world.

An endeavour has also been made to show that insulation is not so uninteresting as most people imagine. For example, such dead, dull looking material as bitumen has a life history many millions of years longer than that of man. Shellac, one of the mainstays of the industry, is the produce of a parasitic insect. Other interesting cases have been cited.

Perhaps the most outstanding features are the indications that the windings of machines are undergoing a revolution. Synthetic enamelled wire is superseding textile covered wires. Glass covered wire is being more frequently used. Varnishes have been enormously improved, and some of the latest products will no doubt replace the older types for normal purposes. In the special varnishes for high temperatures, Silicones will no doubt become prominent, though at the moment they are far too expensive. Thus, the time is

approaching when the poor heat resisting properties of insulations will no longer be obstacles to further advances. The temperatures at which the stampings and mechanical parts may be run with safety and economy may soon be the limiting features in the design of machines.

After many years during which the only real progress was in the constantly increasing size of machines, it is pleasing to know that new ideas are taking shape and that old ones will, in time, disappear.

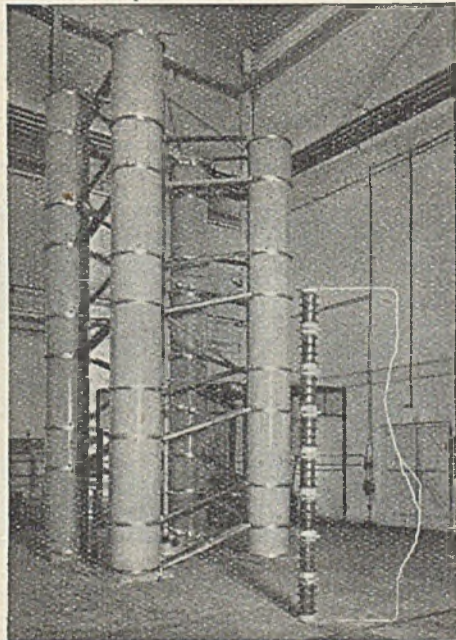
The author wishes to thank the B.T.H. Co., Ltd., and the English Electric Co., Ltd., for the provision of photographs and data. Last, but not least, he wishes to acknowledge with gratitude the freedom with which he has been able to use the specifications and data of the General Electric Co., Ltd., with which firm he has been associated for many years. To his colleagues there he wishes to express his grateful appreciation of their generous assistance.

2.5 Million V Surge Generator

FOR the purpose of extending research in connection with voltage surge conditions and the commercial testing of insulating materials, the surge generator in the high voltage laboratory of the G.E.C. Witton Works has recently

unit has a maximum charging voltage of 160 000 and a capacitance of 0.2 m.f.d. All resistances are of clip-in type and can be readily changed for any particular investigation.

An improvement in operating technique is the employment of a modified Marx circuit which incorporates a damping resistance in each stage, thus more effectively preventing spurious high frequency oscillations from appearing on the peak of the output voltage wave. The standard voltage wave shape is 1.50 microsec., i.e., the voltage rises to its peak value in 1 microsec., and falls to one half the peak voltage in 50 microsec. Waves of 1.5, 1.10 and 10.20 microsec. can be produced by clipping in the appropriate tail resistances.



2½ million V laboratory flash across 8ft. gap in the high voltage testing laboratory at the G.E.C. Engineering Works, Witton

been doubled in output and now generates a maximum of 2.5 million V with a stored energy of 40 000 W sec.

The generator consists of four columns, each comprising four interspaced condenser units. The wave control and charging resistances and the inter-stage sphere gaps are connected between the columns. Each

Kent Branch of the E.I.B.A.

A REPRESENTATIVE gathering of electrical engineers and contractors, at Maidstone on March 19, unanimously resolved to form a Kent branch of the Electrical Industries Benevolent Association, and elected officers and a committee.

Mr. E. E. Hoadley, borough electrical engineer of Maidstone and a past president of the E.I.B.A., presided, and Mr. H. S. Fothergill, secretary of the E.I.B.A., outlined the aims and objects of the association and also gave details of the scope of its work and emphasised the need for greater support.

The officers elected are: Mr. E. E. Hoadley, chairman; Mr. T. W. Dann (borough electrical engineer, Tunbridge Wells), vice-chairman; Mr. S. Wernham, hon. secretary; and Mr. E. E. Pope, hon. treasurer. The Committee is composed of the following: Messrs. H. T. Laslett (Ramsgate), H. Featherstone (Tunbridge Wells), T. R. Hills (Ashford), H. F. Knell (Rochester), H. F. Gill (Sevenoaks), L. C. Bond (Gravesend), P. G. Wallis (Maidstone), A. Pearson (Tankerton), and R. D. Reynolds (area officer of the E.D.A.).

• Electrical Personalities •

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.

MR. G. G. L. PREECE, sales manager to Bruce Peebles and Co., Ltd., is retiring on March 31. Born in 1880, he is the son of the late Mr. G. E. Preece, at one time secretary to the Society of Telegraph Engineers before its incorporation into the I. E. E., and a founder of the Northern Society of Electrical Engineers, and nephew of the late Sir William H. Preece. He was educated at the Manchester Grammar School and Manchester School of Technology. In 1896 he entered into the service of W. T. Glover and Co., Ltd. He became chief electrician in charge of the test department and, with the late Mr. C. J. Beaver, was responsible for the design and specifications of all types of cables. Later, he acted as special technical outside representative, dealing particularly with electricity supply and mining work. He was a founder member of the A.M.E.E. and a member of the Institution of Mining Engineers for 40 years. In June, 1910, Mr. Preece joined Bruce Peebles and Co., Ltd., and was specially associated with mining work. In the following year he was appointed branch manager of the Manchester district. He served with the Forces as an officer from 1915-1919, including two years in France, and, after resuming his work in Manchester, he became sales manager for the North of England. In 1935 he was appointed general sales manager to the company in Edinburgh. Mr. Preece has been an active member of the I.E.E., chairman of the North-Western Centre in 1933-34 and a member of the Committee of the Scottish Centre.



MR. G. G. L. PREECE

MR. R. A. S. THWAITES, chief engineer and manager of the Manchester electricity department, has been nominated as chairman of the North-West Centre of I.E.E. for the next session.

MR. FRANK STEPHENSON TAYLOR, deputy general manager of Newcastle-on-Tyne transport and electricity undertaking, has been appointed general manager in succession to the late Mr. H. C. Godsmark. Mr. Taylor joined the undertaking in 1931

as assistant accountant. In 1933 he became personal assistant to the general manager and 10 years later was made commercial assistant. Since last July Mr. Taylor has been in control of the department owing to the long illness and death of Mr. Godsmark.

SIR MILES GRAHAM, Mr. J. S. Clark and Mr. S. S. Gibbins have been appointed to the board of A. C. Cossor, Ltd.

MR. E. C. BAILLIE has resigned from the boards of the Radio and Television Trust and its subsidiary companies. He is, however, remaining available in an advisory capacity.

MR. G. LESLIE WATES, chairman of Johnson and Phillips, Ltd., and Sir Geoffrey Clarke, chairman of the Telegraph Construction and Maintenance Co., Ltd., made a formal exchange of share certificates at a dinner of directors and executives of both companies, held at Manetta's Restaurant on March 19. With a view to



MR. G. LESLIE WATES, chairman of J. and P., Ltd., and SIR GEOFFREY CLARKE, chairman of T.C. and M. Co., Ltd., exchanging share certificates at a dinner of directors and executives of both companies

securing closer business association and technical collaboration between the two companies, who had already been associated by mutual trading interests, it was agreed earlier in the month that there should be a financial link by the exchange of a substantial block of shares in each company.

MR. S. J. C. ELLIS (Canterbury) has been re-elected chairman of the South-East and East England Area (Southern) of the

E.D.A. and Mr. G. M. Daniels (Sussex E.S. Co., Ltd.), vice-chairman. The following have also been re-elected:—South-East and East Area (Greater London): chairman, Mr. J. R. Jones (Battersea); vice-chairman, Mr. A. W. Bonell (County of London E.S. Co., Ltd.); South-East and East Area (Eastern): chairman, Mr. G. P. Dixon (Colchester); vice-chairman, Mr. G. Christy (Aldeburgh E.S. Co., Ltd.).

MR. F. C. GILL, whose book, "The Vector Operator J," is reviewed on page 791, is deputy manager of Chesterfield electricity department. He went to Chesterfield from Bradford in 1943 as technical assistant.

SIR STANLEY ANGWIN (chairman) and the directors of Cable and Wireless on March 20 entertained members of the New Zealand delegation to the Commonwealth Communications Council at luncheon at Electra House, Victoria Embankment.

MR. C. R. WESTLAKE, general manager and engineer, Finchley electricity depart-

ment, returned by air from Uganda last week. At the request of the Secretary of State for the Colonies he has been carrying out, on behalf of the Uganda Government, a survey of potential demands in the Protectorate and of possible hydro-electric resources to meet these demands.

MR. J. TATTERSHALL, who for some time has been deputy mains engineer at Barnsley, has now been appointed mains superintendent to the Cleethorpes (Lincs.) electricity undertaking.

Obituary

MR. ALEXANDER TULLIS, partner in the Jarrow Welding and Boilermaking Co., Ltd., aged 39 years. He was formerly manager of the British Arc Welding Co., Ltd., South Shields.

MR. D. C. McLENNAN, late manager of the Birmingham branch of Johnson and Phillips, Ltd., on February 28. Mr. McLennan was appointed manager of the Birmingham branch in 1932, and in July, 1945, he resigned his position on account of bad health.

Electrical Housecraft

THE Caroline Haslett Trust held a reception at the E.A.W. headquarters, 35, Grosvenor Place, London, on March 20, to welcome the return of Miss Joan Whitgift from the United States, where she spent three months as the first holder of the Caroline Haslett Travelling Exhibition in Electrical Housecraft.

The Caroline Haslett Trust which made the award was, it will be remembered, established to commemorate the 21st birthday of the E.A.W. and to honour its Director. It is administered by a Committee consisting of representatives of the electrical industry and of the E.A.W., and the industry guarantees an income of £2 000 a year, while the E.A.W. branches have to-date raised £1 650. The Trust has already awarded 11 scholarships tenable at domestic science colleges.

Miss Whitgift's programme of study was prepared by a committee of leading American home economists, Miss Mac Woods of the Edison Electric Institute, Miss Ada Bessie Swann of the "Woman's Home Companion," Miss Eloise Davison of the "New York Herald Tribune," and Miss Katharine Fisher of the Good Housekeeping Institute. The representative nature of this group enabled Miss Whitgift to pursue her investigations in manufacturing plants, in the home economics departments of leading magazines, newspapers, and national universities.

The following places which were visited indicate the scope of her study: Teachers' College, Columbia University; Rutgers

University; Syracuse University; public utility companies at Newark, Jersey City, Passaic, Philadelphia, New Brunswick; Sylvania Lighting Co.; Adequate Wiring Bureau; Westinghouse lamp department; General Electric lighting department; Lightolier Fixture Manufacturers; Electrical Testing Laboratories; Edison Electric Institute; National Electric Manufacturers' Association; General Electric Co.; Proctor Electric Co.; Hotpoint Home Institute; Electric Institute, Chicago; Fozen Food Foundation; Good Housekeeping Institute; Woman's Home Companion, Home Service Centre; and New York Herald Tribune Home Institute.

Miss Whitgift was impressed by the success of women in the field of home economics in the U.S.A., and in their far-reaching influence; it was in analysing the reasons for this that she felt she could be of most help to women in Britain. In talking to women in home economics, in commerce and in journalism, she found that these jobs were interchangeable, and the reason lay in education. Accordingly she visited various universities, where a 4-year course of training in home economics was given, and often a subsequent 3-years' training. American women could afford to spend time and money on such training because of the well-paid jobs which awaited them.

The electrical housecraft adviser, particularly in Britain to-day, should in Miss Whitgift's view, be as much concerned with everything relating to the house as is her counterpart in America.

H.V. Pole Lines

Comments by a New Zealand Engineer on B.S. 1 320

THE specification B.S. 1 320, 1946, is of considerable interest to distribution engineers in New Zealand in that many of them have had very many years' experience in the design and operation of lines of the type covered in the specification. Comments from that country upon its recommendations are given below.

Though the use of unearthed pole tops has been general practice in New Zealand for the past twenty years, and has given every satisfaction, it has the disadvantage that flash-overs tend to be concentrated at air-break switches and transformer poles, where repairs are both difficult and take a long time.

The use of flat spacing with the middle insulator on alternate sides of the poles has been common practice during the past ten years in New Zealand and is to-day considered to be the best practice for lines in this class.

With respect to poles, it is interesting to note that a factor of safety of 2.5 has been adopted, and that this is also the same safety factor used for steel work. General practice in New Zealand is to adopt a considerably higher factor of safety in the case of poles than for steel but if a safety factor of 2.5 is considered satisfactory, then it would not be unreasonable to have a factor of safety for steel work of 2.0, and 2.5 for wooden cross-arms.

In New Zealand, Jarrah is usually not considered a satisfactory timber for cross-arms, because of its liability to be brittle. The omission of tallow-wood and iron bark (first-class New South Wales timbers) from the specification is noticeable.

The twisting of tie-straps seems to be unnecessary and adds a small amount to the cost. The dimension of 1 ft. 11 $\frac{1}{8}$ ins. is an odd dimension and one would have expected it to have been 2 ft.

Again, it is noted that cross-arm struts are dimensioned to $\frac{1}{16}$ of an inch. The effectiveness of these struts will depend on the lengths being accurate and it is doubtful whether they will be truly effective due to inaccuracy in length, and particularly as time goes on, due to the ends rotting where they are boxed in. Why not use a flat strap as has been suggested for the steel cross-arms? It is also noted that the second strap or strut has been omitted on the angles; it is considered that these should be used to give additional security to a linesman working on the cross-arm.

The adoption of ball and socket insulator units is noted, and presumably the

device type would be approved. With this type it is possible, by using a light-weight strain clamp, to reduce the number of fittings from four per insulator to two, viz., the clamp and a twisted flat strap for connecting to the cross-arm. The use of chafers and stirrups for binding-in appears to be unnecessary, particularly in view of the relatively low tensions adopted. The spacing of the insulators on the cross-arm makes the middle insulator too close to the top of the pole, resulting in the wire being too close to any bird which may perch on the top of the pole.

The use of the simple line connector on wires in tension (Fig. 8 in the specification) may result in trouble due to slackening-off by vibration. The use of a curved washer where a flat washer and a gain on the pole would take its place, appears unnecessary. Flat washers under the insulator pin and insulator pin nut on intermediate poles would appear to be unnecessary, in view of the hard nature of the timbers specified. The use of wooden stay insulators is noted with interest, but they have not been used on similar voltage lines in New Zealand to any extent. By using wooden rods on air-break switches the necessity for elaborate carthing may be avoided.

Floods at Stourport

OWING to unprecedented flooding, the Stourport generating station of the Shropshire, Worcestershire and Staffordshire Electric Power Co., was shut down from 11 a.m. on Friday, March 21, until 9 a.m. on the following Sunday, but supplies to consumers were maintained from the grid, South Wales and from the West Midlands J.E.A. In February of last year when the district was flooded to a depth greater than had been known up to the time when the station was built, the basement was flooded to a depth of 30 in. which put the auxiliaries out of action and shut down the station. The auxiliaries were subsequently raised to 6 in. above flood level, but last week the water rose above what was then estimated to be the safety level. Wearing waders and using a boat in the basement, the staff were able to dismantle the auxiliaries affected and dry them out in readiness for use as soon as the flood water subsided.

Future of International Telephony

Problems of Growing Traffic—Voice-Frequency Signalling

A CALL for the expansion of international communications in the interests of peace was made at the I.E.E. on March 20, in a paper on "The Modernisation of the International Service, and Its Reaction on National Telephone Systems," by Mr. E. P. G. Wright (Standard Telecommunication Laboratories, Ltd.).

The present state of the international service, the author said, was of interest, because pre-war techniques were in many cases obsolete, while the dislocations caused by the war necessitated some revision. The paper went on to give general information about foreign telephone systems, with outlines of Continental networks and their interconnection, and described future planning procedure and the progress already made. Specialists in international telephony, the author said, believed that the traffic would expand quickly with a rapid and efficient service. To provide higher speed, manual operation had to be replaced by semi- or fully-automatic methods. Consequently, existing national services needed reviewing and, if necessary, replanning as integral parts of the international system.

There was striking evidence, Mr. Wright contended, that harmony between nations was likely to be obtained only by mutual understanding, and that international communication should form one of the principal ties upon which the future of civilisation would depend. It was probably unavoidable that national and international projects would be needing expenditure simultaneously, and it would be a tragedy if the expansion of the international service were stifled in order to allow a disproportionate effort on the national services.

Capt. J. LEGG (Post Office), opening the discussion, said that under the proposed cable plan for the international telephone service it was hoped by the provision of modern rapid switching to avoid the use of small direct groups, and so give facilities which would lead to a healthy growth of traffic. In asking the administrations to give up their direct lines to other countries and entrust their traffic to automatic transit centres, engineers knew that it was possible to provide switching with such accuracy and speed as to make the interposition of transit centres of little moment, but they must be careful to be in a position to deal with cable faults or other breakdowns. Direct routes could suffer from cable

failure, but if an administration lost, say, four circuits out of six, it could still pass selected portions of its own traffic, whereas if failure occurred on the far side of a transit centre it would be in competition with other administrations for the use of the circuits which remained, and might prefer to have the matter in its own hands. He felt that on national networks there was room both for the voice channel system, which had the great advantage that it could be used anywhere where one could speak, and also for the development of a separate channel system, which could be arranged to go in with the wide-band transmission equipment.

Dr. W. G. RADLEY (P.O. Research Station), dealing with delays to international calls, said that as long as circuits had to be provided on a four-wire audio basis and in comparatively small groups it was possible to tolerate some delay due to cumbersome operating and signalling procedure; but we were now passing into an era when the multi-channel carrier and coaxial cables were becoming the primary means of providing large groups of circuits on important long-distance routes, and the subscriber wishing to make an international call should not have to wait many minutes before a circuit became available. The principal disadvantages of voice-frequency signalling over the speech path were associated with interference either from echo suppressors or from speech. To obtain information on signal imitation—the operation of the signal receiver by the frequencies used for signalling when they occurred in speech—the P.O. Research Station had developed equipment to measure signal imitation corresponding to the use of different frequencies for signalling purposes. The data showed that with normal telephone line speech signal imitation decreased as the signal frequency was increased, but while there was a decline in signal imitation at 2 000 c/s, as the frequency was increased above that there was no further decrease; there was, in fact, an indication that it might increase, and, in view of the progressive improvement of telephone speech, that might be important. It seemed probable that the signalling frequencies of the future would lie between 2 000 and 2 500 c/s.

Mr. J. D. H. VAN DER TOORN (Director-in-Chief of Telecommunications, Netherlands P.T.T.) mentioned that in Holland the national telephone system

was laid out in such a way that within the next five or six years the country would be converted to full automatic working. About two-thirds of the programme had already been completed. The district centres were all linked up by four-wire lines, so that four-wire working was introduced on a large scale in the national system. That simplified several signalling problems, as the signalling equipment could be put into the four-wire circuits instead of in the two-wire terminating equipment.

Sir FRANK GILL (Standard Telephones and Cables) pointed out that there had never been in Europe an international telephone system designed for that purpose. In October, 1945, however, the C.C.I.F. got back to work in London, and things began to happen. At the same time new apparatus was becoming available, including what might be called "instrumentalities," which had the advantage of very considerable economy in first cost and operating cost, and of flexibility, with the possibility of adding circuits quickly if necessary. One of the troubles about switching circuits was the time taken up in going through a manual exchange, but with automatic switching those delays were cut down, and it was possible to go through more exchanges. If automatic switching could be worked in Europe—and there was no doubt that we should come to it in the end—it would be possible to go through many more exchanges and still get speed. He knew of no case where a service had remained good when circuits had been added. At the time that they were added there was, of course, an improvement, but the traffic increased at once and choked the improvement. With the instrumentalities now coming into existence, however, it was possible to get new circuits very quickly. The cost of international telephony would not be great compared with the service rendered, and he thought that the evidence went to show that it would pay handsomely. The C.C.I.F. had done very fine work, and he wondered whether their method might be useful in other problems of international standardisation. There was no rigid standardisation of the actual physical things to be used, and each nation could do what it liked there, but there was fairly close standardisation in the essential clauses of the specification by which results of the same kind were to be achieved, even though different things were used.

Mr. T. S. SKILLMAN suggested that there were many instances in engineering to-day of people finding something new and looking round for an opportunity to use it, even though nothing was gained by

so doing. He thought that that might apply to subscriber-to-subscriber dialling. The assumption that it was desirable to standardise, and to do so quickly, might be wrong and handicap growth.

Mr. E. P. G. WRIGHT, replying to the discussion, gave as an example of the rapid growth of long-distance traffic some figures from the U.S.A., where the number of long-distance telephone conversations grew from 50 million in 1938 to 110 million in 1942 and 200 million in 1945. The time of setting up connections rose from 1.8 minutes in 1938 to 2.1 minutes in 1942 and 5.1 minutes in 1945. In view of the fact that the continent of Europe was about the same size as the U.S.A., that went to show what might happen if money were spent in putting in equipment to allow the service to grow. The cost of the average long-distance call in the U.S.A. went down to 1½ dollars at the present time from 5 dollars in 1920. The Americans had planned a big programme for the construction of coaxial lines, entailing some 7 000 miles of new coaxial circuits in the next few years. On the question of administrations being willing to give up their direct lines and rely on transit centres, he suggested that in future 25 or even 50 per cent. of the traffic would pass over direct circuits, the remainder going through transit centres. He agreed that adequate arrangements must be made for dealing with breakdowns, but there was always a chance of having additional means of reaching the terminating country if going through a transit centre which would not be available with direct lines, which were fairly vulnerable, especially if they passed through a number of intermediate points where one carrier system terminated and a new one began. Reference had been made to the fact that the C.C.I.F. favoured voice-frequency signalling as opposed to the use of separate signalling channels. It looked as though the simplicity obtained by separate signalling channels would be largely lost by the additional complexity at the transit exchange, but those conditions did not apply to the same extent in national switching, where there was more scope for signalling on a separate channel.

The Government has accepted an invitation from the United States Government to send delegations to attend at Atlantic City an International Radiocommunication Conference, to open on May 15; an International High-Frequency Broadcasting Conference, to be held immediately following; and a Plenipotentiary Conference of the International Telecommunication Union, which will begin on July 1.

New Electron Microscope

I.E.E. Discussion on Merits and Limitations

AT a meeting of the Measurements Section of the I.E.E. on March 21, Mr. M. E. Haine (Metropolitan Vickers Electrical Co., Ltd.) read a paper, "The Design and Construction of a New Electron Microscope." In this an introduction to the electron microscope is given. Starting from the limitations to the resolving power of the optical microscope, the discovery of de Broglie concerning the wave aspect of moving particles and the derivation of the electron lens by Busch are described. The limiting action of the spherical aberration of the electron lens is discussed and the theoretical resolving limit set by this and diffraction effects is evaluated as 10 Angstrom units. A brief historical outline of early work is given. The functions and requirements of the various parts of a practical instrument are discussed and a description is given of the new instrument designed by the author and his collaborators. The description includes details of the mechanical construction of the tube and its accessories, as well as general notes on the vacuum system, circuits and operation of the instrument. Finally, a few examples of results obtained on the instrument are given.

MR. F. W. CUCKOW (N.P.L.) said that although the emphasis in electron microscopes was usually placed upon extremely high magnification, they also had a wide field of utility at relatively low magnifications. Most of the instruments could work directly on their screens at magnifications of between 20 000 and 40 000, but much useful work could be done at magnifications of as low as 1 000 to 3 000. This was particularly true in the metallurgical field. In Germany recently he saw some of the German instruments. Extreme precautions were taken to eliminate the possibility of building vibration getting through to the microscope and completely independent foundations for the instruments were installed.

MR. F. E. OCKENDEN (Everett Edgumbe and Co., Ltd.) said the general tendency seemed to be to increase the resolution of the microscope by pushing up the voltage. By doing so, the wave-length was decreased, and the difficulties which this type of lens introduced were thereby minimised. But already the Americans were talking of going up to 300 kV to obtain the theoretical resolution, and the advantages accruing from devoting atten-

tion to the correction of the magnetic lens were well worth-while, in that by that means, not only could greatly increased resolution be obtained but at the same time the necessity for using very high voltages in the anode gun was reduced. In that connection, the greater the voltage used and the shorter the wave-length employed, the greater was the transparency of most specimens. The result was that one had only to use a sufficiently high voltage and every specimen became transparent to the bombardment. All the electronic microscopes designed to date agreed with the standard optical device in so far as there were only two stages of magnification employed. The reason for that had been in the past, that no optical microscope lens could be made which would justify more than two stages of magnification. The idea of the uninitiated that by taking one microscope and using it to look down another would result in an enormously increased magnification, was not correct. With the resolutions possible with the electronic microscope, however, there was no reason why a third, and even a fourth, stage of magnification should not be added.

DR. J. A. DARBYSHIRE (Ferranti, Ltd.) asked why a vertical rather than a horizontal arrangement had been adopted for the apparatus?

DR. V. E. COSSLETT (Cavendish Laboratory, Cambridge) said that one of the most difficult features of the electron microscope was to align the optical axis to a precision of the order of a small fraction of one-thousandth of an inch. In the American instrument that was a very painful task, but the method evolved by the author was more direct and certain. This was particularly important because we were just beginning to realise that to make the best use of the existing types of lens, with all their imperfections, was largely a matter of correct alignment. It was, in the first place, a matter of aligning the individual lenses on the same axis and then of seeing that the individual components of the lenses had no astigmatism. The method of alignment developed by the author made the procedure simple. Beyond that, it was necessary to consider whether the spherical aberration of the lenses could not be corrected in some way. The optical microscope was about 300 years old and was now practically per-

fect as far as the lenses were concerned. It might take, not 300 years but quite a long time before that could be said of the electron microscope. In America the electron microscope had become in some fields the ordinary routine testing instrument, and as its use was likely to be considerably extended in this country it was helpful to the country as a whole to have an instrument produced here which was cheaper than the American.

MR. C. BOWDEN (Northampton Polytechnic), referring to the viewing screen, asked whether any use had been made of the dark trace screen, in which a material such as potassium chloride became differentially transparent under the influence of electron impact? With such a screen it would be possible to project a picture on to an external screen, and in that way objects could be viewed by a number of people sitting in comfort instead of by one person looking down narrow apertures.

The author, in reply, said that vibration was an important factor and its effect on the performance of an instrument depended largely upon the mechanical stability of the specimen supporting mechanism and its relation to the objective lens. He could not claim that the operation of his instrument was independent of vibration; it should be installed upon a solid concrete foundation.

With regard to Mr. Ockenden's suggestion that resolution was increased by pushing up the voltage, that was not altogether true. The position, roughly, was that if the voltage was increased the diffraction error was reduced, but then the spherical aberration increased since the spherical constant increased. An analysis by Cosslett had shown that, in fact, the resolution improved as the voltage was pushed up, but only very slightly. For instance, if at 80 kV the resolution was limited to seven Angstrom units, at 1 000 000 V the resolution would be only about three Angstrom units. In this connection it was to be remembered that even if the spherical aberration were completely corrected, we should not get resolutions of 0.01 Angstrom units. Such dimensions were well down within the atomic dimensions and could never be reached by any type of microscope. At a resolution of one Angstrom unit, the scattering of the electrons by individual atoms would not be sufficient to give enough contrast in the final image, and other factors limited the resolution to something below one Angstrom unit.

With regard to magnification, it was usually desirable to keep the electronic magnification down to a fairly low value, and there were several advantages in doing that. As to the use of two stages of magnification, that, he now admitted, was

a mistake. All other constructors of instruments had used two stages and that was accepted as being the optimum number. The early constructional work was rather hurried because the use of the instrument was urgently desired. Shortly after the first instrument was constructed, it was realised that three stages should have been used, and most of the instruments now being constructed included three or more stages of magnification. As to Dr. Darbyshire's question about why the vertical arrangement was chosen, the difficulty with the horizontal arrangement was that it was rather long and took up a lot of floor space.

Radio Interference

IN 1933 the E.R.A. embarked on investigations of radio interference from electrical plant and apparatus, including motor vehicle ignition systems. With the outbreak of war, this service was suspended, but the problem of ignition interference then became of paramount importance to the Fighting Vehicles Design and Development Department of the Ministry of Supply and to the Admiralty Department of Electrical Engineering, in connection with radio communication systems in armoured fighting vehicles and small naval craft. Apart from interference, other problems arose in connection with ignition which were of importance and the E.R.A. was called upon to make a major contribution to their solution.

At the end of the war the need for the continuance of such contribution was appreciated, but as the E.R.A. had to assume its full responsibilities on behalf of industry it was considered that the best course was to constitute an E.R.A. Committee, in which the cost of research would be paid partly from association funds and partly by the Ministry of Supply as special contributors. A scheme was approved by the Ministry and the E.R.A., resulting in a new Sectional Committee whose terms of reference are the study and development of electrical equipment of automotive systems with particular reference to electrical ignition systems, radio interference suppression devices and electric accessories. The Committee comprises representatives from the Ministry of Supply, the Admiralty, the Motor Industry Research Association, the British Internal Combustion Engine Research Association, the Department of Scientific and Industrial Research and most of the leading manufacturers of automobile electrical components. Further representation may be invited with the growth of the committee's activities. The chairman is Dr. E. A. Watson, of J. Lucas, Ltd.; secretary is Mr. W. Nethercot.

Book Reviews

The Vector Operator j .—By F. C. GILL, A.M.I.E.E., A.M.I.Mech.E. (London: Sir Isaac Pitman & Sons, Ltd.) Pp. 61. Price 7s. 6d. net.

The value of the operator j in electrical calculations is well-known and complex numbers are in general use among those electrical engineers who have much mathematical work to do. There are many electrical men, however, particularly among those of the older school, who were not taught the use of complex numbers in their student days and who have not grasped the beauty and simplicity of this method from the references which have come to their notice in general technical reading. It may safely be said that the advantages of using the operator j in electrical calculations are so great, and the mastery of its use is such a simple matter—provided the right instruction is available—that it should be considered as one of the essential mathematical tools of the electrical engineer. This little book provides just the instruction required.

The subject matter is well arranged and commences with a clear and concise explanation of the fundamental idea of the representation of vector quantities by means of complex numbers, and the conception of the operator j . Detailed instructions are given in this first chapter in the methods of addition, subtraction, multiplication and division of complex quantities, such operations forming the basis of all calculations. The author has very sensibly included in this chapter, as "a good example of the compounding of addition, subtraction, multiplication, and division of complex numbers," a description of the extremely useful conversion of a delta-connected group to an equivalent star-connected group of impedances.

In further chapters practical electrical circuits are dealt with, and problems are solved involving single-phase series and parallel circuits, followed by two-phase three-wire and three-phase systems. Pages 34 to 41 should, strictly speaking, be headed "three-phase systems," but the actual heading is "two-phase three-wire systems." These pages form the three-phase section of the chapter on two-phase three-wire and three-phase systems.

Up to this point the simpler and most commonly used forms of representation, namely, the Rectangular and Trigonometrical forms, have been used. It is essential, however, if the fullest use is to be made of j , that the Exponential form should be understood. This has been

clearly dealt with in a final chapter, which also includes a useful summary of the conditions obtaining for every form of representation in each of the four quadrants of a vector diagram.

Throughout the book numerous worked examples are given, supplemented by exercises for the reader to work out for himself. Answers to the exercises are given at the end of the book.

Any reader who carefully studies the text and systematically works all the exercises will attain a facility in solving everyday electrical problems almost unbelievable to anyone who is not familiar with this method. The author is to be congratulated upon compressing such a thorough treatment into so small a space. The book may be thoroughly recommended.—T.A.L.

Electronic Developments.—By K. G. BRITTON, D.Phil. (London: George Newnes.) Pp. viii + 208. Price 7s. 6d. net.

The slimmness of the present text is misleading because the author has packed into its pages a very wide panorama of the applications of electronics in scientific, technical and medical fields. The material is entirely up to date, the original discoveries and developments being brought up to apparatus which is in practical use for both war-like, research, and industrial applications. Needless to say, no section is treated in detail, but it is most valuable to have such a review at the present time so that important developments are not overlooked for their want of tabulation.

L. E. C. H.

"Overhead-Line Charts." By J. S. FORREST, M.A., B.Sc., F.Inst.P., A.M.I.E.E. (London: Electrical Review, Ltd.) Pp. 20, 2s. 6d. net.

This booklet is based on a series of articles which appeared in the "Electrical Review" from June to September, 1945. Charts are given which are directly applicable to the 132 kV and 33 kV lines of the grid network, while a number of charts for voltages of less than 33 kV are also included, and are applicable to lower voltage transmission and distribution systems. A few charts are given for typical 220 kV and 264 kV lines likely to be of interest in this country. In cases where a chart is not included for the desired conductor size or line voltage, it will usually be found possible to select one of the series which fulfils the terms of the problem closely enough to enable a solution of sufficient accuracy to be obtained.

The Electricity Bill in Committee

TWO Opposition amendments, one seeking to fix the vesting day under the Electricity Bill at July 1, 1948, and the other laying down that the Minister must give six months' notice of the date, were rejected by the Government during discussion in Standing Committee.

The issue was raised by Sir Arnold Gridley, who complained that the Government by its refusal to lay down a date or a definite period of notice was causing great uncertainty, which was doing no good either to the Government, the industry or consumers. He suggested July 1, 1948, as a suitable date. There were many matters to be wound up and it was only right that the directors should have some notice as to when they were going to be dismissed.

Mr. Gaitskell (Parliamentary Secretary, Ministry of Fuel and Power) admitted there would inevitably be some uncertainty during the transitional period, and he agreed that it was desirable to shorten the period as much as they could. But he could not be "tied down" to giving six months' notice before the vesting date and he would only promise to give "as long a notice as possible."

Putting forward what he called "a powerful argument" against fixing a definite date, the Parliamentary Secretary said they did not know when the Bill would be through Parliament, or when the Central Authority and the Area Boards would be set up. They did not know how long the Area Boards would take to make up their plans and arrangements, and the Government would be influenced by what they had to say on the vesting date.

After a prolonged legal argument on Clause 10, which deals with the powers of the Boards to promote and oppose Bills, Mr. Gaitskell declared that the effect of the clause was that the Boards would have to get the consent of the Minister to promote Bills in Parliament, but not to oppose them. He agreed to look again at the drafting.

On Tuesday, Opposition members welcomed a concession by Mr. Shinwell, when he admitted that the term "authorised undertakers" as used to define concerns to be taken over under the Bill was "perhaps too wide." The Minister of Fuel stated that he would consider either an alternative form of words or some other device, and suggested the method of individual notice or, perhaps, the provision of a new schedule in the Bill. The latter course, he thought, was open to objection.

An Opposition amendment to exclude holding companies was then put forward.

Lord Hinchinbrooke thought that holding companies with overseas investments should be able to remain as investment trusts with their non-electrical assets and overseas investments intact, and Mr. Nigel Birch considered that the Government would be giving themselves a lot of unnecessary trouble if they tried to liquidate them and even greater trouble if they tried to manage them.

Mr. Gaitskell promised he would consider introducing an amendment which would in effect limit the definition of a holding company to one which had 75 per cent. of its assets in controlled undertakings.

When the question of composite companies was raised by the Opposition, Mr. Gaitskell said it was not intended that the Area Boards should permanently run other undertakings, such as gas, water and transport. In view of the coming nationalisation of the gas industry it was necessary to make a double switch. In other cases they would probably have to make some arrangement in advance of the vesting date. There was nothing to prevent the companies splitting up; such negotiations were going on with one company.

In answer to a suggestion that companies should be allowed to distribute their E.P.T. funds before the shares were taken over, Mr. Gaitskell said he could see no reason for picking out any one asset for such treatment. All the companies' assets and liabilities were being taken over.

In Parliament

Matters of electrical interest raised during question time or given written answers included the following:

Fluorescent Lighting.—Replying to Maj. Poole, the Minister of Fuel said that in view of the substantial saving effected by the use of fluorescent lighting he would, in consultation with the Minister of Supply and the President of the Board of Trade, give every assistance and encouragement to manufacturers of the necessary components.

Outworn Generating Plant.—In answer to a question by Mr. Marples, Mr. Shinwell stated that in 1947 and 1948, 91 000 kW of outworn generating plant, which was over 25 years of age, would be taken out of commission in order to make way for new plant. No removals of plant were at present envisaged, he added, for the years 1949-51.

Electricity Supply

Cardiff.—The Electricity Committee has protested against a proposal to make a contribution of £32 000 in aid of rates.

Cheltenham.—A scheme of fluorescent street-lighting, prepared by Revo Electric Co., Ltd., is to be installed experimentally on the Promenade. The cost is £255 and a saving in energy consumed over the existing method of 68 per cent. is expected.

Newport (Mon.)—Plans for the £15 000 000 generating station have now been drawn up by the Borough Electrical Engineer (Mr. T. H. Wood) and the Borough Architect is assisting with the design of the building exterior. The first section is scheduled for completion by 1950. Built on a 600 acre site opposite the entrance to Newport docks, close to a G.W.R. branch line and the grid, the new station will be equipped, as a first instalment, with three 60 000 kW turbo-alternators and six p.f. boilers, rated at 365 000 lbs. per hr. at 900 lbs. sq. in. and 900° F. The coal handling plant is to be capable of dealing with 400 tons per hour and the ash will be used to raise the level

of the land surrounding the station, which is at present subject to flooding at high tide. Railway sidings to accommodate 6 500 tons of coal a day will be provided. Cooling water will be drawn from the river, at the rate of eight million galls. per hour. In the pumping station, seven vertical pumps will be employed. As the river at this point has a tidal range of 40 ft., the design of this plant raises special problems, and will be based on experience gained at the East power station, Newport.

Hull.—The Electricity Committee is seeking sanction to borrow £163 437 for mains, £24 575 for sub-station buildings and £204 698 for sub-station equipment.

Ilford.—An order for 600 radio sets, at an estimated cost of £12 000, has been placed by the Electricity Committee. They will also purchase testing equipment at a cost of £500.

Colwyn Bay.—Because of difficulty in obtaining switchgear and transformers, the electricity department has decided not to sanction supplies to new consumers until the required apparatus has been installed.

L.E.P.'s 100 000th Meter

At a dinner, followed by a concert, given by the Lancashire E.P. Co., on March 19, to mark the testing and issue of the 100 000th meter by the testing and meter department, at Walkden, Mr. W. D. Sutcliffe, superintendent, mentioned that although the 100 000th meter was an important stage in the development of the company it was neither a true indication of the scale of the work of his department nor of the size of the company, in that a big portion of the latter's business was power for industry and bulk supplies.

Mr. M. H. Adams, chief engineer and manager, expressed appreciation of the work of Mr. Sutcliffe, particularly in past months. The testing department had a fine war record in so far as no less than 40 per cent. of the staff had been in the Forces or transferred to other essential work, in spite of which those remaining had been able to carry out an important contract for the Admiralty.

Mr. E. Roscoe, assistant superintendent, testing department, welcomed the guests, making special reference to Mr. Hamer, area meter examiner for the Electricity Commission. Mr. J. W. Jones, Chorley

district manager, then suitably responded.

Mr. S. M. Rix, secretary and assistant manager, then presented a wristlet watch



A view of the L.E.P. Company's No. 2 meter testing laboratories

to Mr. O. Howarth, chief technical officer and sales manager, in appreciation of his work for the department. The testing department was largely designed by Mr. O. Howarth, Mr. R. C. Leslie being mainly responsible for the building work. Mr. O. Howarth responded.

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:—

Dundee, April 3.—Supply, delivery and erection of 33 kV, three-phase, metal-clad switchgear at Clepington static sub-station; also, 33/6.6 kV, three-phase 10 000 kVA outdoor type "on-load" tap-changing transformers, and liquid type 6.6 kV neutral earthing resistances at the same sub-station. Specifications from City Electrical Engineer, Dudhope Crescent Road, Dundee; deposit, £1 ls. each.

Dewsbury, April 4.—(a) Supply, delivery and laying of approx. 6 000 yds. of 11 kV cables; (b) supply and delivery of four 500 kVA, 10 000/400 V, three-phase, 50 cycles transformers. Specifications from Borough Electrical Engineer and Manager, Electricity Department, Bradford Road, Dewsbury; deposit, £1 ls. each.

Birkenhead, April 5.—Supply and delivery of transformer kiosks. Particulars from Borough Electrical Engineer, Craven Street, Birkenhead.

Bury, April 9.—Supply and delivery of one 5 000 kVA, three-phase, 50 cycles, oil-immersed naturally cooled transformer for outdoor installation, 6 600/11 000 V. Particulars from Engineer and Manager, Electricity Department, Market Street, Bury.

Dundee, April 10.—Supply, delivery and erection of 33 kV, three-phase metal-clad switchgear, for extensions at Carolina Port generating station; also, supply, delivery and jointing, supervising the laying of three-core and one-core, 33 kV cables for Carolina Port/Clepington feeders. Specifications from City Electrical Engineer, Dudhope Crescent Road, Dundee; deposit, £1 ls. each.

Plymouth, April 12.—Supply and delivery of: (a) one 30 in. bore, double-flanged c.i. circulating water inlet valve; (b) six ash conveyor belts. Specifications from City Electrical Engineer, Armada Street, Plymouth.

Bolton, April 12.—Supply for twelve months of three-phase, 50 cycles, 6 600/422 V, naturally cooled transformers, of various sizes ranging from 100 kVA to 1 500 kVA, with extra prices for automatic "on load" tap-change equipment on certain of the larger sizes. Specification from Borough Electrical Engineer, Back o' th' Bank, Bolton; deposit, £1 ls.

Erith, April 14.—Supply and delivery, during 12 months ending March 31, 1948, of various materials and apparatus, including distribution equipment, domestic appliances, switchgear and instruments. Particulars from Borough Electrical Engineer and Manager, Electricity House, Erith, Kent.

Heston and Isleworth, April 14.—Supply, delivery and erection of one 500 kW rectifier equipment, comprising transformer, voltage regulating equipment, rectifier cubicles and d.c. control panel, for 11 kV, three-phase input, 480/240 V d.c. output. Particulars from Borough Electrical Engineer and Manager, 11, Staines Road, Hounslow.

Newark, April 21.—Supply and delivery of: (a) 11 kV ring main unit; (b) l.t. switchboard. Specifications from Borough Electrical Engineer, Municipal Buildings, Baldertongate, Newark.

Bradford, April 22.—(a) Supply and delivery of three-phase static transformers; (b) supply, delivery and erection of two 350 kW glass-bulb type mercury arc rectifiers, etc., for Barkerend Road sub-station. Particulars from Electrical Engineer and Manager, Sunbridge Road, Bradford.

Bradford, April 22.—Supply, delivery and erection of two 350 kW glass bulb type mercury arc rectifiers. Particulars from Electrical Engineer and Manager, Sunbridge Road, Bradford.

Middlesbrough, April 26.—Supply and delivery of: (a) one 11 kV, three-phase oil-immersed and compound filled metal-clad ring main tee-off unit, comprising two oil-break isolators and one circuit-breaker; (b) one 250 kVA, 11 000/440/250 V three-phase oil-cooled indoor transformer; (c) one meter testing set, single-phase, 0/500 V, 0/100 A, unity/zero power factor, complete with voltmeter, ammeter and power-factor meter and suitable for use on 240 V, single-phase supply or a three-phase four-wire 415/240 V, 50 cycles supply. Specification for items (a) and (b) from Borough Electrical Engineer, Corporation Electricity Department, Snowdon Road, Middlesbrough, deposit, £1 ls. each.

Madras, May 1.—Supply, delivery, erection and commissioning of transformers having the following ratings, for the Basin Bridge "B" power station, Madras: Two of 7 500 kVA, 11/5 kV; two of 1 750 kVA, 11 000/415 V; one of 1 250 kVA, 11 000/415 V and two of 200 kVA, 415/415 V. Copies of form of tender and specification from Merz and McLennan, Milburn, Esher, Surrey; deposit, £5 5s.

Industrial Information

U.S.S.R. Delegation at Hebburn Works

A delegation from the U.S.S.R. toured the Hebburn works of A. Reyrolle and Co., Ltd., on March 19. They were welcomed by Mr. Harry Towers, director and general manager, who stated that the company had been trading with the Soviet since 1931. It was mentioned that the company had recently received a £100 000 order for 700 flame-proof coal-mining type circuit-breaker panels for Russian mines. The party saw a demonstration of testing equipment. Mr. N. Bazhan, expressing the delegation's thanks, said that the name of Reyrolle was already well known in Russia, and in the future Russia would require still more of the company's equipment.

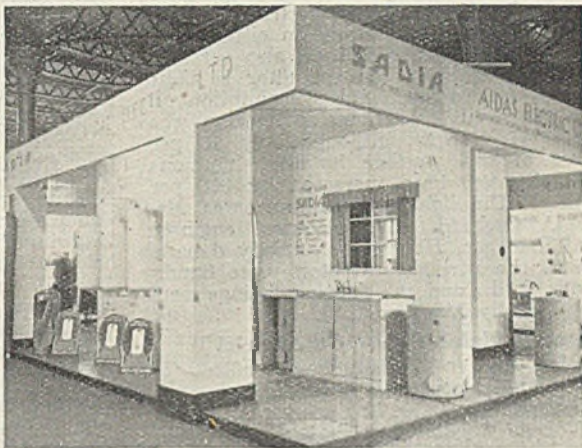
Reports from Germany

Further reports on German industry now available at the Stationery Office sales offices include the following: B.I.O.S. 866, High Frequency Heating (3s.); B.I.O.S. 980, Electro-Acoustics in Germany (1s.).

L.M.S. Diesel-Electric Locos.

The L.M.S. Railway is to introduce Diesel-electric locomotives capable of 100 m.p.h. on its main line services, including the London-Glasgow expresses. These locomotives will be of 3 200 h.p., composed of two 1 600 units coupled together. The English Electric Co., Ltd.,

are providing 16-cylinder Diesel-engines and electrical equipment for each unit. An 800 h.p. Diesel-electric locomotive is



View of part of the stand of Aidas Electric, Ltd., at the Ideal Home Exhibition, Olympia

to be built suitable for branch and cross-country passenger and freight services. The 16-cylinder Diesel-engine, generator, traction motors and control gear will be provided by the B.T.-H. Co.; the engine will be built by Davey Paxman as subcontractors to B.T.-H. and will be of a design developed for the Admiralty.

Fluorescent Lighting in a Church

St. Paul's Church, Haringay, has been entirely re-lit with 5 ft., 80 W, Osram "warm-white" fluorescent lamps. The fittings at the nave and altar are ceiling type with curved reflectors, sprayed with plastic material and then colour sprayed ivory and silver. The mounting height in the nave is 15 ft. There are five two-tube fittings on each side. The average luminous intensity is about 3 ft. candles. The war memorial screen at the back of the font is illuminated by a double-tube fitting standing out 9 in. from the wall, the upper tube illuminating the roof and the lower tube the memorial screen. The focal point of interest is the altar. By placing some



Thirty-four 5 ft. 80 W, Osram "warm-white" fluorescent lamps are used in the lighting scheme just installed at St. Paul's Church, Haringay

of the lamps vertically, the light source is completely invisible. Two lamps without fittings have been mounted horizontally along the top of the chancel screen and give relief to the roof of the church, as well as outlining the carving of the screen itself. At each side of the chancel, and behind the corner pillars, two single-tube fittings have been placed vertically. Eight feet in front of the altar, on either side, are two double-tube fittings, also vertical. The light intensity on the altar is eight to ten ft. candles. The consumption on the old system of tungsten lighting was 4 800 W. Now, although only 15 per cent. of this wattage is used, luminous intensity has been increased by 300 per cent. The lighting consultant was Mr. F. C. Orchard, chief electrical engineer and manager, Hornsey electricity department, the wiring contractors were Sandilands, Ltd., and the lighting fittings were supplied by Linealux, Ltd.

Floating Exhibition—"St. Merriel"

Mr. Mervyn Talbot, press officer of Associated British Oil Engines, Ltd., and the Brush Electrical Engineering Co., Ltd., has been appointed to handle the publicity in connection with the first post-war "floating exhibition" ship, the M.V. "St. Merriel," due to sail for South American ports at the beginning of next month. Exhibitors include British Electrical Engineering Co., Ltd., Enfield Cables, Ltd., Enfield Rolling Mills, Ltd., Erinoid, Ltd., Heenan and Froude, Ltd., the Plessey Co., Ltd., De la Rue Plastics.

Introducing "Electrotors"

An exhibit likely to attract an unusual degree of attention at the Birmingham Industries Fair is a type of miniature electric motor, confidently claimed by its inventors to be "the smallest in the world," measuring, overall, $\frac{7}{8}$ in. in diameter by $\frac{3}{8}$ in. wide. Invented during the war by two brothers, Messrs. J. V. and J. E. G. Eurich, of Bolton, these motors have been named "Electrotors," to distinguish them from conventional patterns, and it is planned to make five million in 1948. The smallest model, which requires an input of $1\frac{1}{2}$ V and develops an off-load speed of 7 000 r.p.m. weighs less than 1-28th of an ounce; three larger patterns, the biggest measuring $1\frac{1}{2}$ in. by $1\frac{1}{4}$ in., and running from 6 to 24 V batteries, are also being made. Suggested uses in-

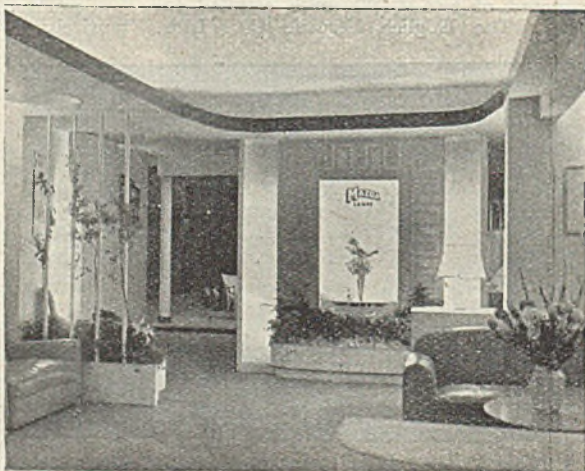
clude precision instruments, windscreen wipers, cine-projectors, mechanical toys and automatic razors. A representative of THE ELECTRICIAN, who recently witnessed a private demonstration, reports that the "Electrotors" are of extremely unorthodox construction, contain very few precision parts and are without commutator or soldered joints. A complete description will appear in a subsequent issue.

I.E.S. Annual Meeting and Dinner

The annual meeting of the Illuminating Engineering Society will be held at 6 p.m. on May 13 at the Institution of Mechanical Engineers, following which an address will be given by Dr. N. A. Halbertsma, of Holland, president of the International Commission on Illumination. On the following day the annual dinner will be held at Grosvenor House, London. Tickets, 32s. 6d. each, should be applied for not later than April 19. Initially, members will be limited to one guest only, but additions will be considered later if conditions permit.

Three Companies Amalgamate

It is announced that a scheme of amalgamation has been effected between the Hackbridge Electric Construction Co., Ltd., Hewittic Electric Co., Ltd., and the New Switchgear Construction Co., Ltd. With a capital of £750 000, the amalgamated company has taken over the assets, liabilities, and functions of the three companies, and will operate under the title of Hackbridge and Hewittic Electric Co., Ltd. The directors of the three companies are continuing with the amalgamated company and all business will continue to be carried out in the same



The stand of the British Thomson-Houston Co., Ltd., at the Ideal Home Exhibition

factories as hitherto and under the same management.

Fuel Economy Conference

Papers to be submitted by the British National Committee of the World Power Conference to be held at The Hague, from September 2 to 9, include "The Co-ordination of Electricity Supply—The Grid in War-time," by Sir Johnstone Wright, general manager, Central Electricity Board; "The Possibility of Industrial Applications of Atomic Energy," by Dr. J. D. Cockroft, F.R.S., Director of Atomic Energy Research Establishment, Ministry of Supply; "The Recovery of Industrial Low-Grade Heat," by W. A. Macfarlane, Director of Fuel Efficiency, and J. B. M. Mason, acting Chief Fuel Engineer, both of the Ministry of Fuel and Power.

Bowen Trust Papers

Under the terms of the Bowen Trust, the Council of the Scientific Instrument Manufacturers' Association have decided to award five prizes to an approximate total value of £125 for the best five papers, submitted by employees of members, on a new invention, an improvement in design, an improvement in manufacturing technique, a new development or new process arising from research as affecting or relating to a scientific instrument. Entry forms can be obtained from the secretaries, S.I.M.A., Messrs. Binder, Hamlyn and Co., River Plate House, 12-13, South Place, London, E.C.2.

Copper for Overhead Lines

The British standard for copper and hard-drawn copper conductors for overhead power lines (B.S. 125), first published in 1924, has been revised as B.S. 125:1947. In the revision the tables of secondary standard sizes are omitted, and the number of primary sizes included in the 1930 issues has been reduced. A table of standard lay ratios has been added and Clause 14 which deals with "stranding" has been modified to bring the specification into line with B.S. 837, Steel-cored Copper Conductors for Overhead Transmission Purposes. Copies may be obtained from the B.S.I., 28, Victoria Street, London, S.W.1. Price 2s., post free.

R.C. Engineering Society's Centenary

The centenary of the foundation of the Engineering Society of King's College is to be marked this year by special celebrations. There will be a centenary service, followed by a reception and an address by the Dean of the Faculty, at which the guests will include leading members of all branches of the engineering profession. The annual dinner becomes the Centenary Dinner and will be on an appropriately larger scale. Finally, a history of the

engineering society will be published during the session. It is, as far as is known, the oldest students' engineering society in the world.

E.A.W. Certificate Examination

The E.A.W. will now revert to its pre-war practice of holding certificate examinations twice yearly. By special request on December 19 last, examinations were held at the Domestic Science College, Glasgow, and the E.L.M.A. Lighting Service Bureau, London, when 19 candidates qualified for the certificates, three gaining distinction. The total number of certificate holders is now 1 064.

New Transmitter for Athlone

Marconi's Wireless Telegraph Co., Ltd., are to supply a powerful modern short-wave broadcasting transmitter with a special aerial system to the Eire Posts and Telegraph Department for Radio Athlone, to enable that station to extend its programmes to Canada and the U.S.A.

Filling and Sealing Compounds

We have received from Berry Wiggins and Co., Ltd., 86, Strand, London, a copy of a new illustrated publication giving details of Kingsnorth compounds, issued by them to meet the need for a reliable guide to the correct choice of compound for all modern electrical fitting and sealing requirements.

Aluminium Wire and Cable Company

The Aluminium Wire and Cable Co., Ltd., which was formed recently by the British Aluminium Co., Ltd., Hawker Siddeley Aircraft Co., Ltd., and Tube Investments, Ltd., has arranged to purchase premises at Port Tennant, Swansea, from the Ministry of Supply and will enter into occupation as from May 1. It is anticipated that some production will start towards the end of the year. The company has offices, temporarily, at Salisbury House, Circus Place, London Wall, London, E.C.2.

Transrector Auto-Chargers

The current "Engineering Bulletin," issued by Siemens Brothers and Co., Ltd., Woolwich, London, S.E.18, describes and illustrates their transrector auto-chargers and mains units. A range of units incorporating transformers, rectifiers and the associated subsidiary gear was designed and marketed by the company originally for use with its own telecommunications equipments. A considerable demand from other sources arose later and now large numbers of these units are in service, providing the a.c./d.c. converter for a wide variety of purposes.

Modern Homes Exhibition

The theme of the "Daily Herald" Modern Homes Exhibition, opened at

Dorland Hall, Regent Street, on Tuesday, is how the furniture, decorations and domestic appliances now available can best be utilised in the small flat or converted house, and it is complementary to the Ideal Home Exhibition in the sense that many of the appliances there shown can now be seen in their correct setting. This is particularly true of the E.D.A. exhibit, which shows what can be done, in the small kitchen, with electric labour-saving appliances. Designed with a view to flexibility, so that whatever the position of doors, etc., the basic layout can remain unaltered, the room contains an electric cooker, refrigerator, water-heater, washing-machine, a built-in extractor fan and a fluorescent lighting unit. Among the portable appliances are an electric iron, coffee percolator and kettle, while the wiring is taken to a readily accessible shoulder-height house-service unit. The room was designed for the association by Mr. A. L. Osborne. On other stands, household cleaners, various washing machines, television sets and space-heaters are to be seen, and there are, in fact, few exhibits in which some form of electrical appliance is not used.

Radiolympia

The Radio Industry Council advise that plans for the forthcoming National Radio Exhibition to be held at Olympia, October 1 to 11, are now well advanced.

Rail Facts and Figures

A multitude of interesting facts and figures about the railways, their equipment, traffic and special features, is contained in a booklet, "British Railways, Facts and Figures," just published by the main line railway companies and the L.P.T.B. During 1945, passenger miles covered numbered 35 248 000, the average distance per journey being 26.85 miles. In the same year there were 2 697 miles of electrified single track railway, 65 706 000 passenger and 92 000 freight train miles were covered and the amount of electricity used was 1 147 567 000 l.t. units.

Women in Electrical Industry

At a time when the problem of attracting more women into industry is engaging the attention of the Ministry of Labour, the publication by the Metropolitan-Vickers Electrical Co., Ltd., of an illustrated brochure, entitled "Opportunities for Young Women," is opportune. It directs attention to the fact that electrical engineering presents a variety of attractive openings to girls and young women, and gives an indication of the wide range of opportunities offered by the company. In their works may be found occupations and careers suitable for school leavers of

various ages and attainments, and also for those who have acquired more advanced general and specialised training. At the Trafford Park works about 20 per cent. of the 15 000 works and staff employees are women and girls.

Widow's Compensation Claim

A settlement for £1 600 of a claim brought against Balfour Beatty and Co., Ltd., of Derby, by Mrs. Annie Elizabeth Cook, of Ockbrook, Derby, for the loss of her husband, was agreed by Mr. Justice Morris at Derbyshire Assizes. Mr. William Cook died after being electrocuted while working at the Derbyshire and Notts Electric Power Company's sub-station at Shardlow.

Electrical Statistics

THE February number of the Monthly Digest of Statistics, just issued, shows that the weekly average consumption of coal by authorised electricity undertakings in January was 642 000 tons, compared with 626 000 tons in December, and 588 000 in January of last year. Stocks of coal held by the undertakings in January amounted to only 1 254 000 tons, as against 1 610 000 tons in December and 2 077 000 in January, last year. Electricity generated increased from 4 372 000 000 kWh in December to 4 671 000 000 kWh in January. For January, last year, the figure was 4 142 000 000 kWh. Deliveries of British-built arc-welding sets in December numbered 715, value £174 000, compared with 362, value £38 000, in December, and 520, value £96 000, in January, last year; and resistance welding sets numbered 56, value £27 000, contrasted with 161, value £38 000, in December, and 160, value £38 000, in January, last year.

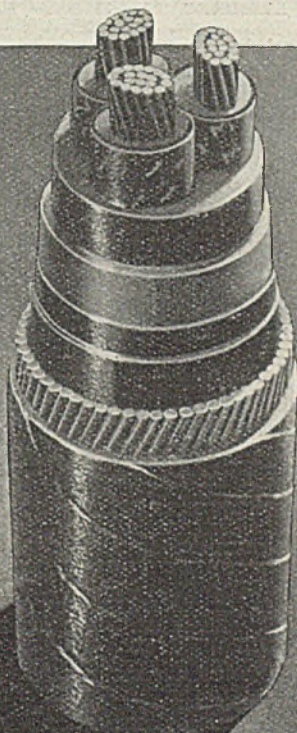
The monthly average production of electrical appliances during the last quarter of 1946, given in thousands, was as follows: Fires 243.6, of which 206 were for the home civilian market; irons 285.5, of which 203.9 were for the home market; vacuum cleaners 75.3, of which 58.4 were for the home market; electric kettles, 71.4, of which 55.4 were for the home market. For the corresponding quarter of 1945 the comparative numbers were: Fires 122 (115); irons 170 (155); vacuum cleaners 20.4 (17.3); kettles, 22 (21).

The production of electrical appliances for housing schemes in January showed increases over the December figures as follows: Cookers, 15.4 to 18.7 thousands; wash-boilers, 18.8 to 22.4 thousands; and meters from 105.3 to 130.7 thousands. Immersion water heaters produced remained the same at 36.5 thousands.

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Company News

RANGOON ELECTRIC TRAMWAY AND SUPPLY CO., LTD.—Net prft. 1945, inclgd. £5 022 (nil) inc.-tax refund, £2 475 (net loss £12 335); brot. in £23 374 (£35 710), fwd. £25 849.

ELECTRICAL FINANCE AND SECURITIES CO., LTD. (assoc. with Brit. Electric Traction).—Fin. div. 6%, and bonus 5% (both same), mkg. 15% (same). Prft. 1946 £49 438 (£50 642), fwd. £123 434 (£110 708).

NORTH METROPOLITAN POWER STATION CO., LTD.—Rev. 1946 £534 888 (£519 007). To exes. and fees £1 736 (£1 458), deb. int. £183 412 (£185 136), loan int. nil £3 674), sinking funds £191 921 (£164 048), tax £157 816 (£164 688), ord. div. 6% (same).

CHESHAM ELECTRIC LIGHT AND POWER CO., LTD.—Trading prft. 1946 was £42 311 (£41 887), plus int. £848 (£475). To int. on deposits £601 (£560), inc.-tax £13 319 (£15 310), depen. £18 412 (£18 187), to res. £2 946 (£468). Div. on ord. 3%, free of tax (same) £7 950, fwd. £1 790 (£1 859).

EGHAM AND STAINES ELECTRICITY, LTD.—Trdg. blee. for 1946 £161 574 (£156 357). Brot. in and int. receiv. £10 843. To int. on consumers' deposits £1 055 (£983), inc.-tax £57 617 (£65 410), div. on pref. £6 187, depen. acct. £56 212 (£54 155), res. £3 466 (£279), contng. acct. £15 000 (£10 000 to res. for war damage contribtns.). Div. on ord. 4%, free of tax (same); fwd. £3 279 (£2 856).

FOLKESTONE ELECTRIC SUPPLY CO., LTD.—Net rev. 1946 £70 176 (£60 085). Surplus sale of Brit. Govt. secs. £2 146 (nil). To depren. £27 000 (£26 000), tax £31 000 (£25 000), changeover expend. £3 500 (same), contngs. £2 500 (nil), ord. and "A" ord. div. 5% (same), fwd. £15 617 (£8 852).

BRENTFORD ELECTRIC SUPPLY CO., LTD.—Trdg. prft. 1946 £30 734 (£26 413), plus int. receivable £1 772 (£1 592). To int. on consumers' deposits £212 (£198), inc.-tax £11 269 (£14 492), depen. £7 281 (£7 172), res. £3 337 (£243), contng. £5 500 (£2 000 to war damage res.), ord. div. 5% (same), tax free, fwd. £975 (£569).

SOUTH LONDON ELECTRIC SUPPLY CORP., LTD.—Blee. from rev. acct. for 1946 £192 758 (£142 733), plus surplus on sale of Govt. secs. £3 844 (nil). To deb. int. £13 500 (same), diffce. between issue and red. price of deb. stk. £685 (same), skg. fund contributions £66 086 (£77 891), tax £50 000 (£26 000), contng. fund £2 817 (nil). No. 2 res. £13 869 (nil), pref. div. £1 800 (same), fin. ord. div. 4%, mkg. 7% (same), fwd. £10 924 (£426).

NORTHMET POWER CO.—Fin. on ord. 6% less tax, mkg. 9% for 1946 (same). Blee. from wrkg. £695 808 (£823 893), plus int. and divs. £112 146 (£97 079), prft. on sale of invests. nil (£7 325), less int. payable £73 183 (£74 186), prov. for red. of mortg. and deb. stks. £47 387 (same), depren. £408 073 (£460 486), war damage contribtn. nil (£50 000), res. for inc.-tax on prfts. for yr. nil (£76 551). Divs. recommended require £234 107 (£211 858), lvg. £125 442 (£80 238) fwd.

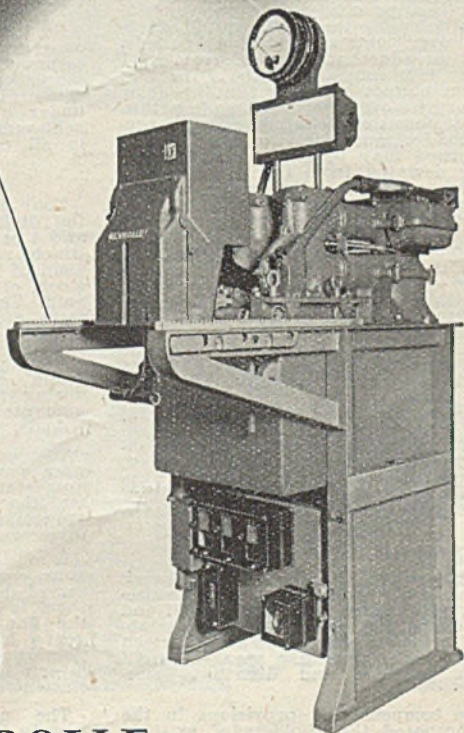
POWELL DUFFRYN TECHNICAL SERVICES, LTD.—The Board of this new Powell Duffryn subsidiary, whose formation was recently announced, has now been completed. Mr. Robert Foot is the chairman and the other directors are Messrs. Edmund Hann (chairman and managing director of Powell Duffryn), H. H. Merrett (chairman of Cory Bros. and of Gueret, Llewellyn and Merrett, and a managing director of Powell Duffryn), J. G. Bennett and W. L. Boon.

POWER SECURITIES CORPORATION, LTD.—An outline of the plans of the corporation and its subsidiary, Balfour Beatty and Co., Ltd., was given to shareholders by Mr. William Shearer, chairman and managing director, at the annual meeting. Despite the threat of nationalisation, Mr. Shearer said, work had been commenced during the past financial year on the site of a new station at Staythorne, Notts., which they were constructing under agreement with the C.E.B. Designed for a minimum capacity of 300 MW, the station was estimated to involve a capital expenditure of £7 000 000. Another scheme involving, for the first stage, £5 000 000 provided for the construction of a new large generating station in South Wales—at Carmarthen Bay—which was also being undertaken in agreement with the Central Board. This station would have an ultimate capacity of 300 MW and would, like Staythorne, be constructed in two sections, the first of which was now being put in hand. The finance for these projects, Mr. Shearer later said, would be raised by public issues of the capital of the companies concerned, if they were permitted to do so. If the Electricity Bill became law, opportunities to carry out financial work would be denied the corporation. Nevertheless, they would seek to expand that side of their business in other fields. "This country," he continued, "is being subjected to a deliberate political attack on capital and this at a time when there is a greater need for capital than ever in our history."



There was a star danced and under that
I was born ...

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The Northmet Power Company

At the annual general meeting of the Northmet Power Company held in London on Tuesday, March 18, Mr. K. A. Scott Moncrieff, M.I.E.E., who presided, said:

You will be disappointed to learn that our chairman is unwell and is therefore unable to preside at this meeting. In Lord Ashfield's absence I have been requested to take the chair this morning. I will ask the secretary to read the speech Lord Ashfield has prepared.

The secretary, Mr. Evelyn Boys, read Lord Ashfield's speech, of which the following are extracts:

At our annual general meeting in 1930 I said that I was firmly convinced that your company could provide a service at least as cheap and efficient as that of any authority. Nothing has happened in the interval to lead me to modify my views.

In 1919 the area of supply covered 326 square miles; it now extends to 671 square miles. The total consumers now number 350 000 as against 22 000 in 1919. The output to meet the demands of our consumers has grown from 53 million units in 1919 to roundly 1 220 million units in 1946, whilst the total capital expenditure to meet these demands has grown from something over one million to more than thirteen million pounds, and if you include the Station Company the total capital expenditure is over nineteen million pounds. Finally, let me add that we now have a staff of well over 4 000 compared with 700 in 1919. These figures cannot but show that we have, by our enterprise over the years made within our area a consistent contribution to productivity, comfort and safety, of which everybody concerned may be justly proud. We have never deviated from the sound policy to which I have referred in past years—the maintenance of the undertaking at the highest possible level of efficiency and the supply of electricity at the lowest possible cost to the consumer. Indeed, efficiency must be reflected in the cost of supply to the consumer. The average price per unit sold in 1919 was 1.463d.; to-day it is 1.108d. In other words, the price has fallen from nearly 1d. to just over 1d. a unit, a decrease of over 24 per cent. When you consider the increase in the cost of plant and equipment and also labour and materials, especially coal, that has taken place over this period you can readily see that a ceaseless and successful search for efficiency is always maintained. This policy has been so implemented without requiring the urge of nationalisation, that a supply of electricity is available in no less than 131 townships and parishes out of a total number of 137 in the company's area of supply.

Compensation Provisions

The Government by the Electricity Bill seek to co-ordinate under publicownership the electricity supply industry in Great Britain, and to that end the Bill provides for the establishment of a Central Authority and fourteen Area Boards who, generally speaking, will respectively generate and distribute electricity.

Under the compensation provisions in the Bill it is proposed that holders of existing securities are to receive an amount of British electricity stock, the principal and interest being guaranteed by the Treasury, of a value equal to the value of the existing hold-

ings on the basis of Stock Exchange quotations. The value of the new stock to be issued will be based on what, in the opinion of the Treasury, is the then market value of Government securities, but a very substantial decrease of the annual income which will be suffered by all classes of the company's stockholders under these proposed terms of compensation and on certain assumptions made by the Chancellor of the Exchequer.

I am confident that after making due and proper allowance for all adverse factors, it must on any impartial view be conceded that the financial position of the undertaking demands more equitable treatment than that afforded by the compensation provisions of the Electricity Bill.

A Fine Achievement

At the request of the Central Electricity Board load shedding was carried out by the company on 53 occasions during 1946. In the great majority of instances the reduction of the load was effected by lowering the voltage, and consequently on these occasions no consumer was disconnected. On the few occasions when disconnection was necessary no consumer was without supply for more than a period of 30 minutes. Whilst the recent fuel crisis does not come within the period under review, I would take this opportunity of saying that the staff concerned have, during these last few weeks, carried out their job magnificently despite many difficulties and the necessity to work under great pressure. It has been a fine achievement and reflects the greatest credit to all concerned.

Dividends

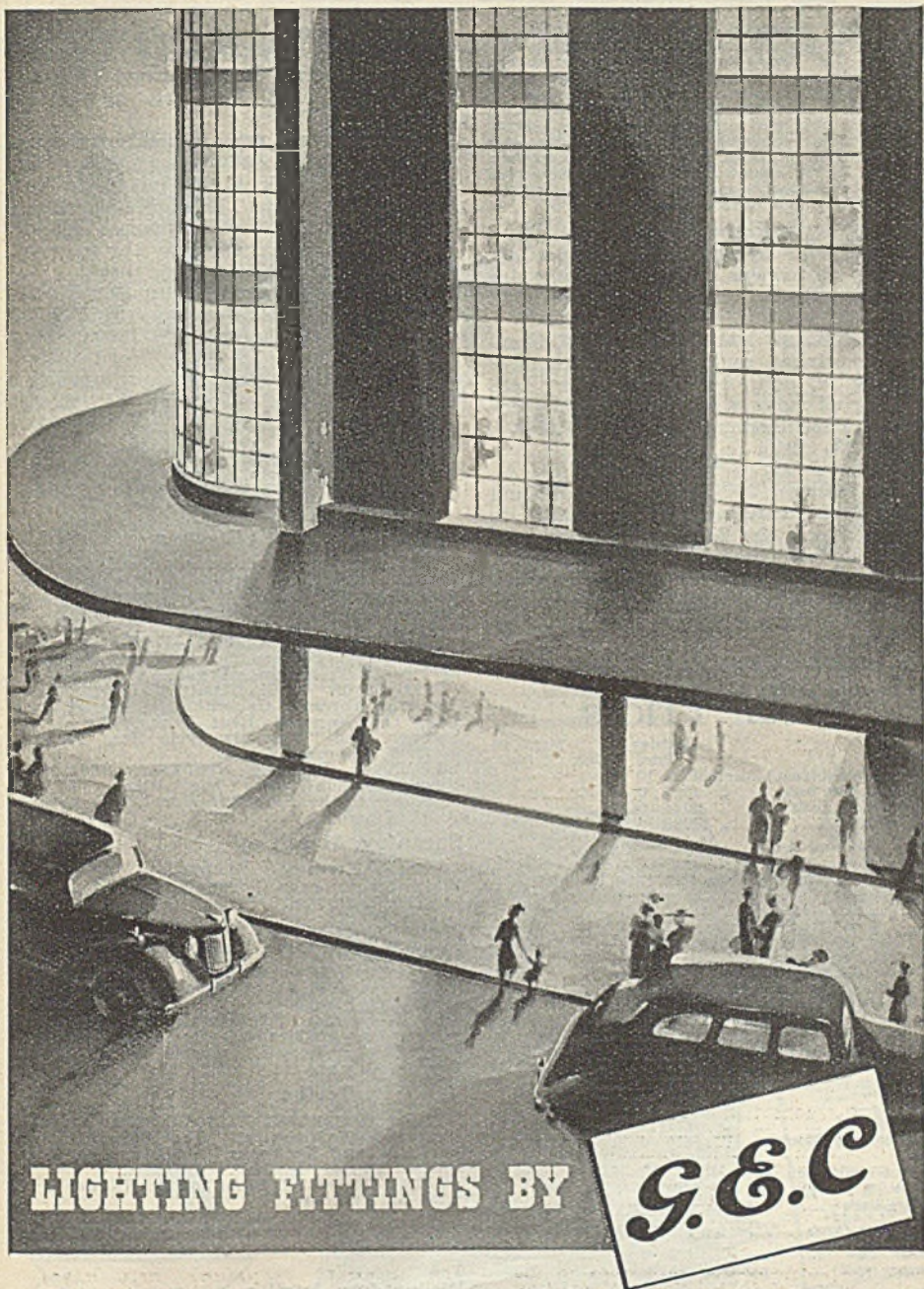
Your directors recommend the payment of the dividends, less tax, on the 6 per cent. and 4 per cent. cumulative preference stocks, which requires nearly £76 000, and a dividend of 9 per cent., less tax, on the ordinary stock, of which 3 per cent. has already been paid. The total amount required to meet these dividends is just over £234 000, leaving a balance of approximately £125 000 to be carried forward.

The capital expenditure has increased during the year by some £290 000, and now amounts to nearly thirteen and a half million pounds.

The company have invested during the year some £252 000; the total sum invested now stands at £3 482 000 odd, and you will see that there has been a considerable appreciation in the market value of these investments.

I am sure you will agree with me that your company has been fortunate in being served by an efficient and loyal staff. To them is due in large measure the credit for the fine record of achievements in the 47 years' history of the company, and I feel you would wish to join my colleagues and myself in a warm expression of our appreciation of their services.

The necessary resolutions were unanimously adopted, and the meeting terminated with a vote of thanks to Mr. K. A. Scott-Moncrieff, the chairman of the meeting, and to Lord Ashfield, the chairman of the company.



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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.

GRANT SWITCHGEAR, LTD., London, N.—January 28, charge to Midland Bank, Ltd. securing all moneys due or to become due to the Bank; general charge. *—March 31, 1945.

EDWARDS AND MARSHALL, LTD., Cheltenham, electrical and motor engineers.—January 29, deb., to Lloyds Bank, Ltd. securing all moneys due or to become due to the Bank; general charge. *£2 000. March 29, 1946.

ELECTRICAL APPARATUS CO., LTD., St. Albans.—January 30, mort., to Midland Bank, Ltd. securing all moneys due or to become due to the Bank; charged on land with factory thereon New Barnes Avenue, and land formerly part of Newhouse Park Farm, both St. Albans, with machinery, etc., also general charge. *Nil. January 14, 1946.

Metal Prices

	Monday, Price	Inc.	March 24 Dec.
Copper—			
Best Selected (nom.)...per ton	£125 10 0	—	—
Electro Wire bars ... "	£127 0 0	—	—
H.C. Wires, basis ... "	£144 0 0	—	—
Sheet ... "	£168 10 0	—	—
Bronze Electrical quality			
1% Tin—			
Wire (Telephone) basis per ton	£165 15 0	—	—
Brass (80/40)—			
Rod basis ... "	1s. 1½d.	—	—
Wire ... "	1s. 5¼d.	—	—
Iron and Steel—			
Pig Iron (E. Coast Hematite No. 1) ...per ton	£8 19 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... "	£34 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.) ... "	£21 15 0	—	—
Lead Pig—			
English ... "	£71 10 0	—	—
Foreign and Colonial... "	£70 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity) ... "	£384 0 0	—	—
Wire, basis ... "	per lb. 4s. 10½d.	—	—
Aluminium Ingots ...per ton	£80 0 0	£27 5 0	—
Spelter ... "	£70 0 0	—	—
Mercury (spot) ... "	per bott. £21 0 0	—	—

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

LINCOLN ELECTRIC HOLDINGS, LTD., Welwyn Garden City.—February 5, £99 000 deb. to Industrial and Commercial Finance Corporation, Ltd., charged on certain shares.

H. R. LOCKLEY, LTD. (formerly WIRELESS AND GRAMOPHONE SERVICE CO., LTD.), Barwell.—February 5, £7 000 mort., to Earl Shilton Permanent Benefit Bldg. Soc.; charged on shop and premises Market Place, Hinckley, occupied by the co. *Nil. December 14, 1945.

PROVINCIAL ELECTRICS AND REFRIGERATORS, LTD., Gosport.—January 29, £10 000 deb.; general charge. *£20 000. May 22, 1946.

JOHN MORRIS ELECTRICAL ENGINEERING CO., LTD, Bilston.—January 25, £2 000 deb.; general charge.

Coming Events

Friday, March 28 (To-day)

I.E.E.—London. Radiocommunication Convention. Papers on propagation, radio components, and "Review of the Convention and Future Trends," Sir Clifford Paterson, F.R.S. 9.45 a.m.

I.E.E., RUGBY SUB-CENTRE.—Rugby. "Power Supply for Generating Station Auxiliary Services," W. Szwander. 6.45 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—London. Annual General Meeting. Papers on "The Norwich Heat Pump," by J. A. Sumner, and "The Air Cycle Heat Pump," by T. F. Thomas. 5 p.m.

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-upon-Tyne. "The Place of the Engineer in the Post-War World," Sir Arthur P. M. Fleming.

Saturday, March 29

I.E.E., LONDON STUDENTS' SECTION.—Visit to Fulham Borough Council Power Station. 2.30 p.m.

Monday, March 31

I.E.E., N. EASTERN CENTRE.—Royal Station Hotel, Newcastle-upon-Tyne. Annual general meeting and visit of President and Secretary. 6.15 p.m.

I.E.E.—London. Informal Meeting. Discussion on "Developments in Fractional-Horse-Power Motors," opened by A. N. D. Kerr. 5.30 p.m.

Tuesday, April 1

I.E.E., CAMBRIDGE RADIO GROUP.—At the Cavendish Laboratory. "The Pulse Testing of Wide-Band Networks," D. C. Espley, E. C. Cherry and M. M. Levy. 6.30 p.m.

I.E.E., TEES-SIDE SUB-CENTRE.—Dinner and visit of President.

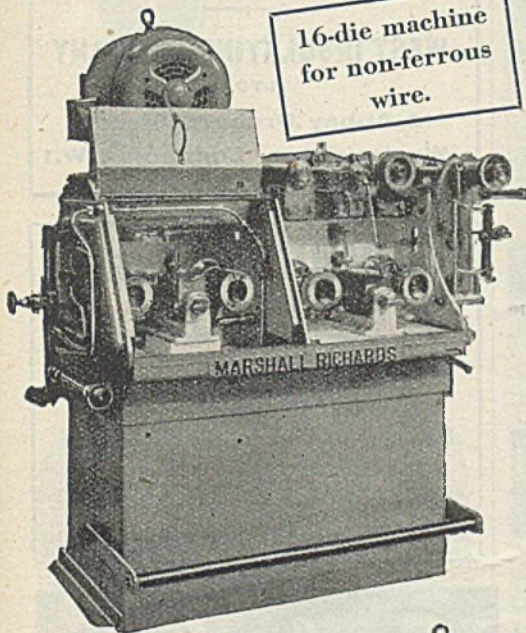
I.E.E., N. MIDLAND INSTALLATIONS GROUP.—At Leeds Electricity Department. "Modern Electric Lift Practice," L. S. Atkinson. 6 p.m.

Wednesday, April 2

I.E.E.—London.—Radiocommunication Convention. Additional meeting, papers on C.W. Navigational Aids. 5.30 p.m.

fine Wire drawing— *easy to some—a bugbear to others?*

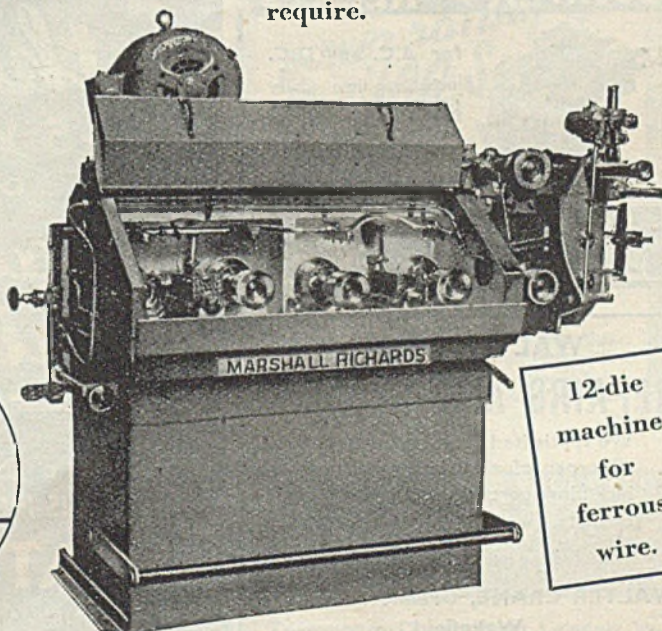
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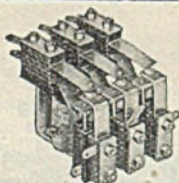
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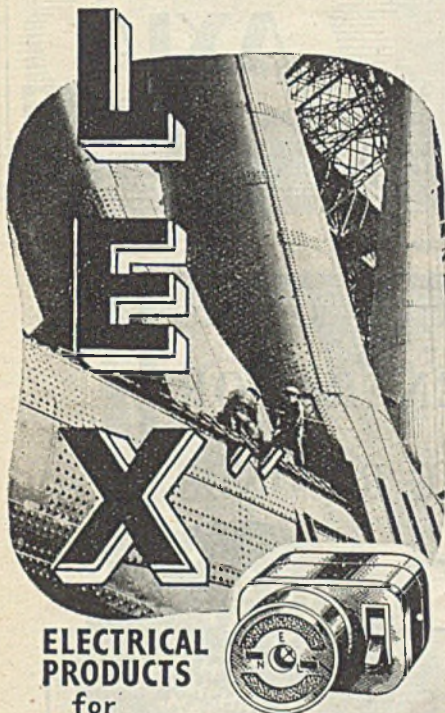
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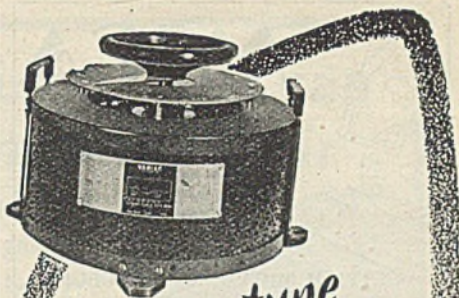
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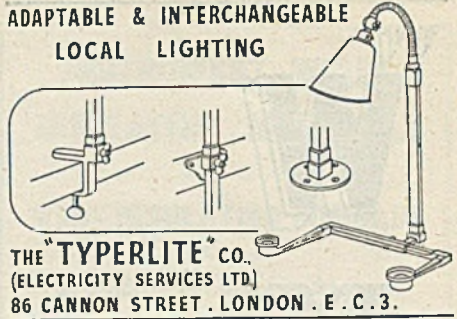


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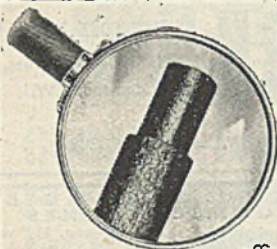
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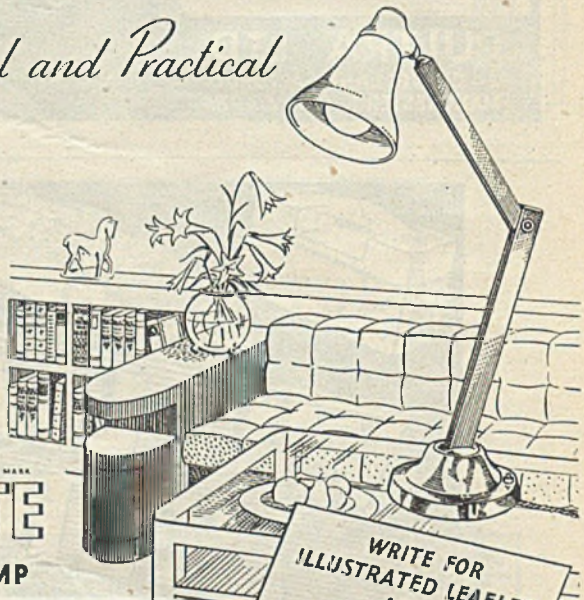
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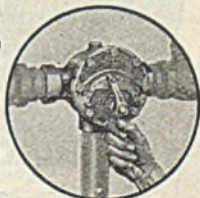
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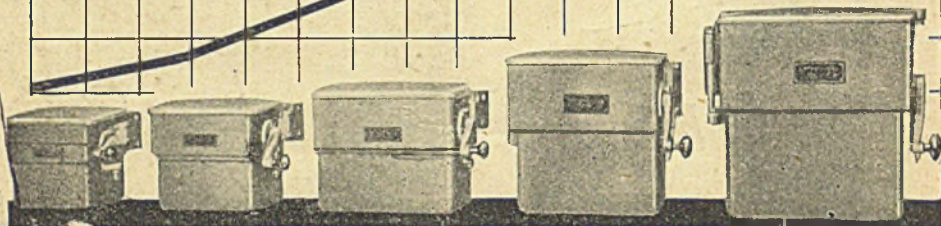
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