

2448 III

THE

ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

19

№ 13

PERFECT
RESILIENCE

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JOINTING MATERIAL
RESISTS OILS & SPIRITS

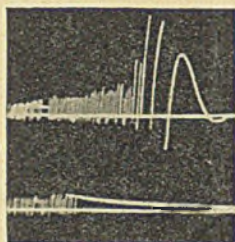
CORK MANUFACTURING CO., LTD.,
Telephone: SILverthorn 2666 (7 lines).

SOUTH CHINGFORD, LONDON, E.4
(Associated with Flexo Plywood Industries Ltd.)

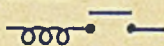
11 APRIL, 1947
SIXPENCE

Mind the Surge!

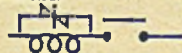
The oscillograph shows how Metrosil reduces the surge, when the contactor opens an inductive circuit.



UNPROTECTED
3,100 v. SURGE



PROTECTED WITH
METROSIL
450 v.



“**METROSIL**”
is the ideal
DISCHARGE RESISTOR



**METROPOLITAN
Vickers**

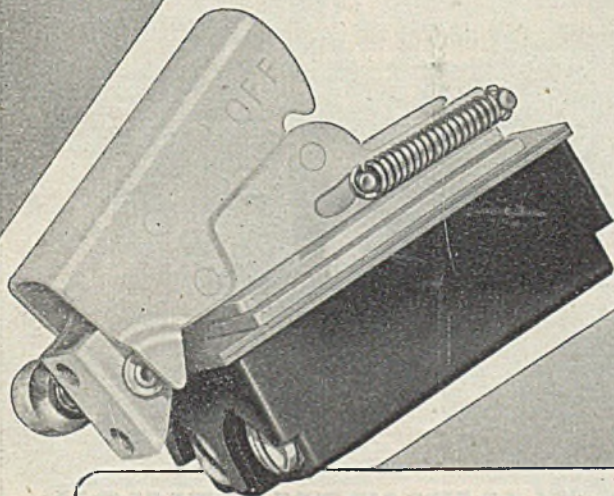
ELECTRICAL CO. LTD.
TRAFFORD PARK ... MANCHESTER 17.

Switch to

METROVICK
lighting

when daylight fades

The **AB** Type **T.C.2** **SWITCH**



The A.B. Type "T.C.2" switch is a 10 amp., double pole, on-off switch, fitted with a spring loaded trigger which "makes" when depressed and automatically returns to the "off" position when pressure is released. A latch-bar is fitted to hold the switch in the "on" position when required.

The need for soldered connections is avoided by the use of heavy terminal screws, and the mechanism is totally enclosed in a moulded case.

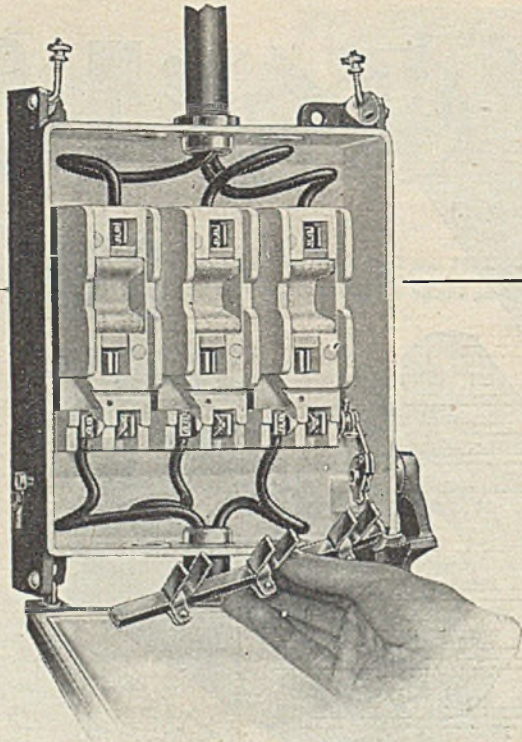
Designed chiefly for use as a control switch for portable electric tools, the switch is of substantial design, conservatively rated, and will give unfailing service under the most arduous conditions.

A. B. METAL PRODUCTS LTD.

GREAT SOUTH WEST ROAD · FELTHAM · MIDDLESEX

TELEPHONES: HOUNSLOW 6256 FELTHAM 2865

NEW ERA 119



THE *NEW* 'MEMREX-SENIOR' with the Patent Removable Switch bar

Just loosen the pivotal screw and you can then remove the switch bar. This is one of the advanced features of the new 'Memrex-Senior' switch-fuses designed to simplify wiring and cut down erection costs.

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Excellent Workmanship and finish characterise this new MEM gear and the prices provide yet another example of MEM large scale, low cost, production methods.

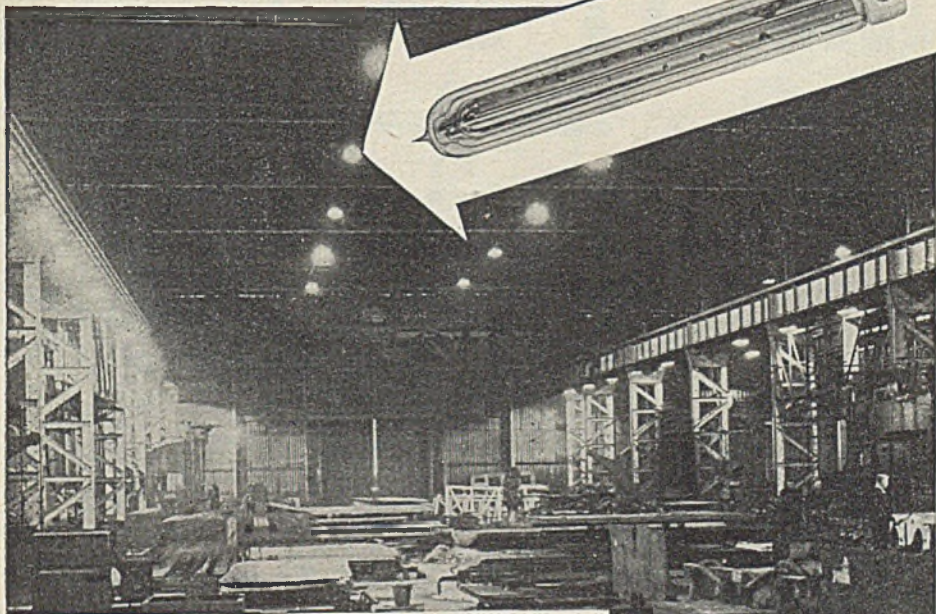
Send for your copy of List No. 280 giving full details of the new 'Memrex-Senior' range rated from 15-100 amps.

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

MIDLAND ELECTRIC MANUFACTURING CO. LTD
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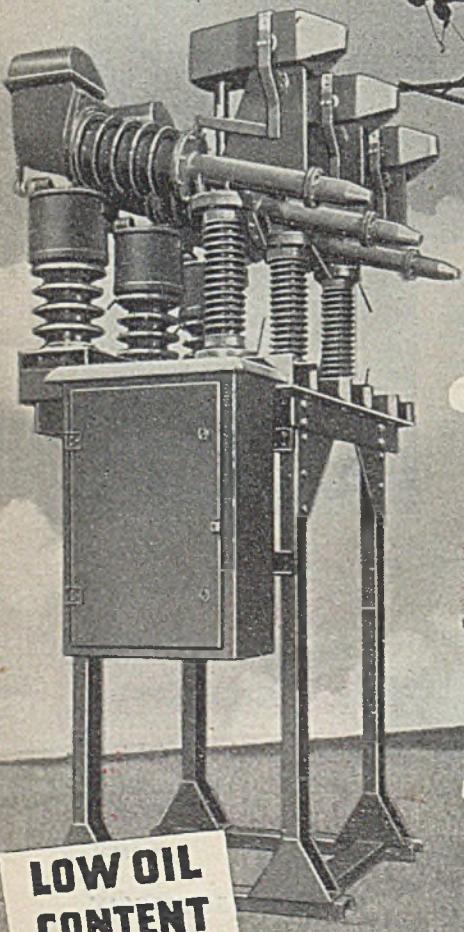
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(LD233D)

THE COOKE & FERGUSON OUTDOOR OIL CIRCUIT BREAKER

TYPE O.E.6.

UP TO
1500 M.V.A. 44kV
1500 M.V.A. 33kV
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*Short-circuit
tested and
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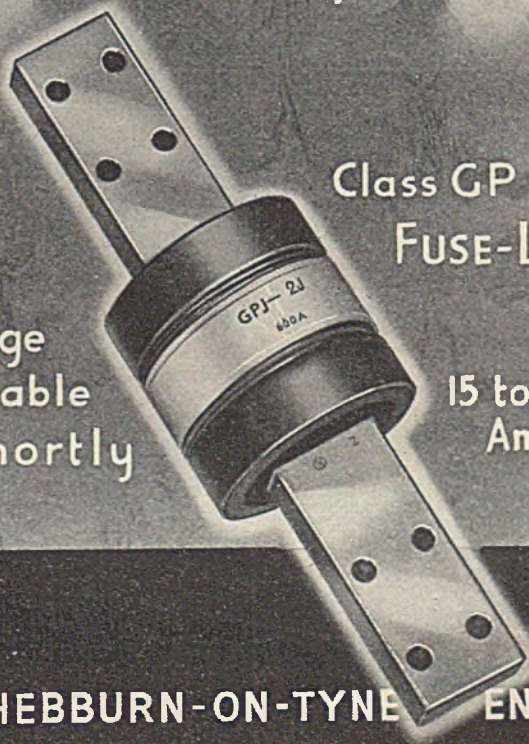
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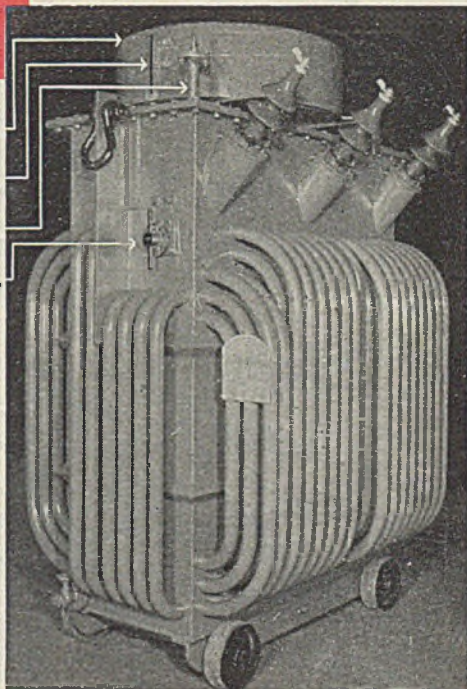
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**NO MOISTURE
NO SLUDGING
OF OIL
NO SERVICE
COSTS**



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Designed to give

TRUBLE-FREE SERVICE under
DAMP and HUMID CONDITIONS.

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OIL-BREAK • AIR-BREAK • AIR-BLAST



Each unit has a self-contained circuit-breaker, carriage and tank lift.

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UP TO 11 kv., 150 MVA.,

incorporating

VERTICAL-PLUGGING
OIL CIRCUIT-BREAKERS

FULLY TESTED FOR
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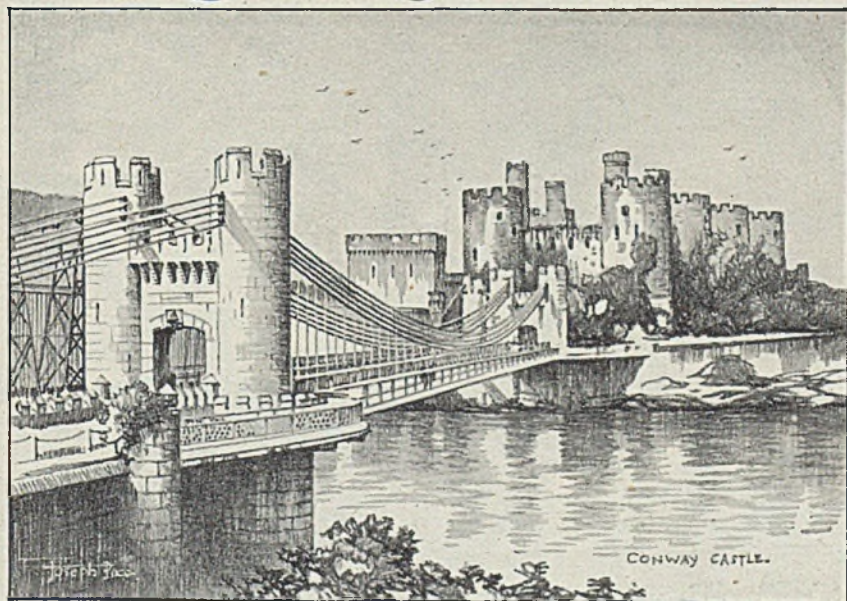
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for
RELIABILITY
'Wylex must be good'

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and Co. Ltd.
Wylex Works, Wythenshawe
MANCHESTER

Landmarks of Britain

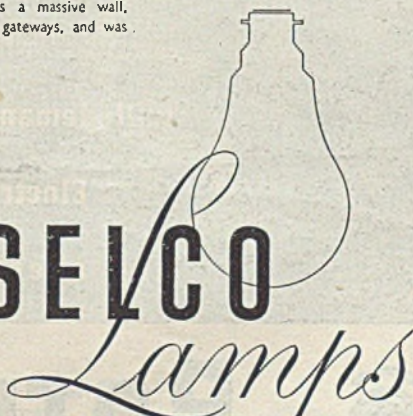


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This fine mediæval castle has a massive wall, twenty-one towers and three gateways, and was a stronghold of Edward I.

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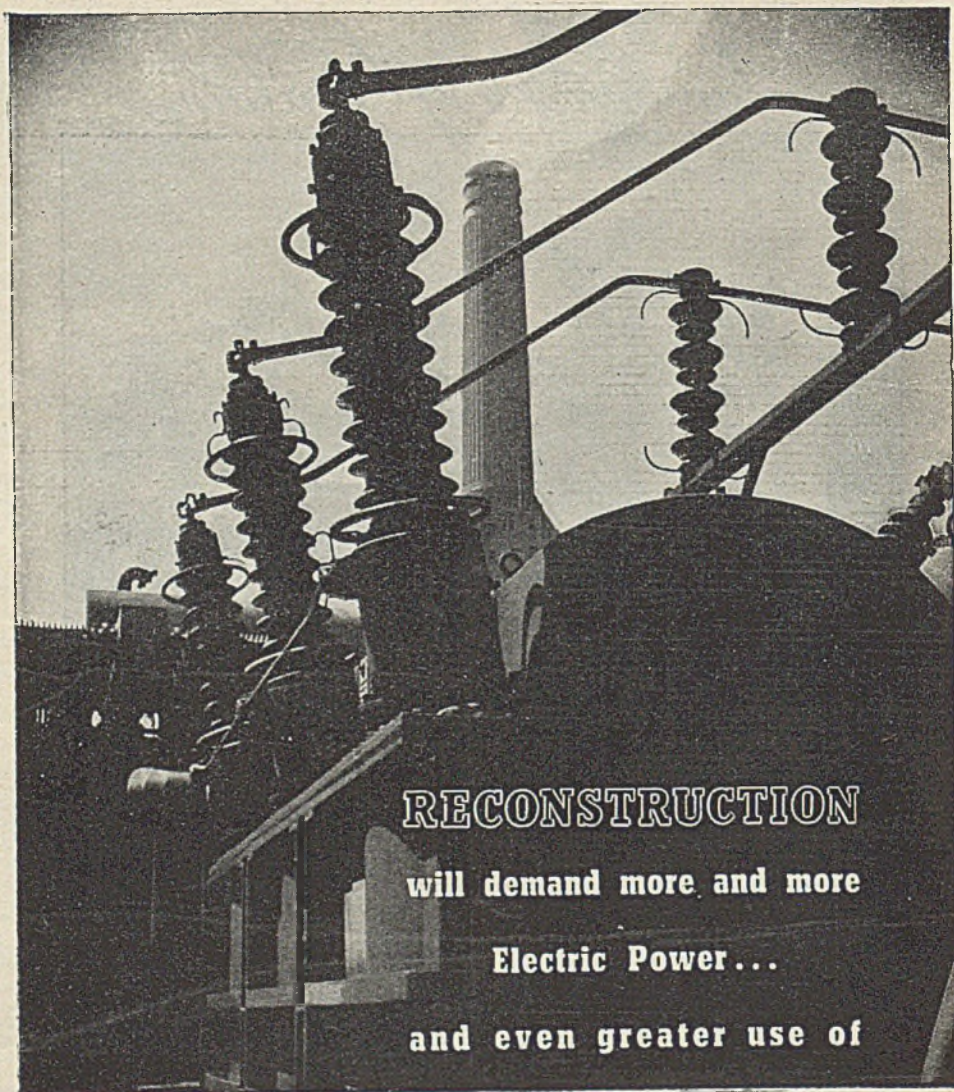
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will demand more and more

Electric Power...

and even greater use of



ROTHMILL

CABLE INSULATING PAPER

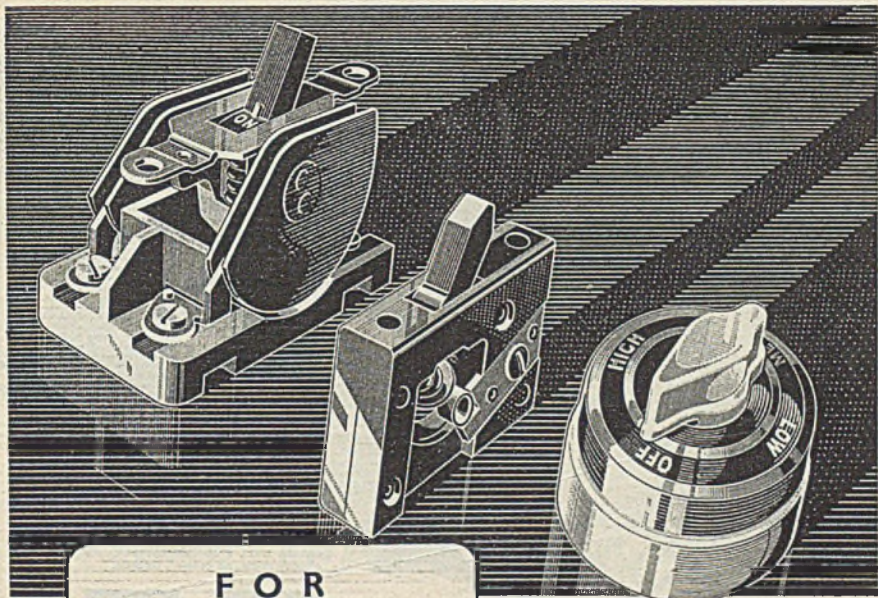
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FOR
DOMESTIC
APPLIANCE
CONTROL

Arrow offers the largest range of Precision Built Switches for every

specific need in the industrial and domestic field.

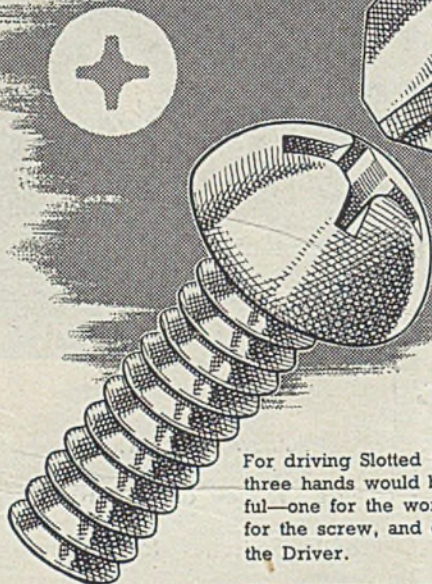
Tumbler switches from 1 to 60 amp. rating, and rotary switches in all circuit combinations from 5 to 35 amps. 250 volts.

Arrow Switches are quick make and break. They have been carefully designed and manufactured to give long trouble-free service.

ARROW

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THIRD HAND INFORMATION ABOUT A FIRST RATE SCREW

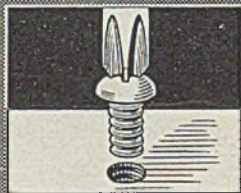


For driving Slotted Screws three hands would be useful—one for the work, one for the screw, and one for the Driver.

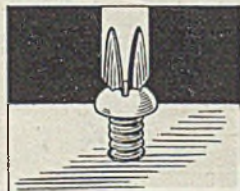
THE LINREAD PHILLIP'S SCREW BRINGS YOU THAT THIRD HAND. Put the Screw on the Driver and it stays there to the end of the driving. No slipping, no wobbling, no burrs.

The more screws you use, the more this screw that "uses its head" will benefit your work. It cuts down costs, saves time, saves screws and saves work.

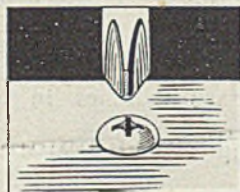
A booklet on the Phillip's Screw giving more details is available. Write to Linread Limited, Department [P 12] Sterling Works, Cox Street, Birmingham, 3, for a copy. We are always pleased to advise on fastening problems.



With Linread Phillip's Screws, Driver and Bit make a straight line unit. No wobbly starts, no crossed threads.



Linread Phillip's Screws stay on the Driver all the way home. No slips, no spoilt work.



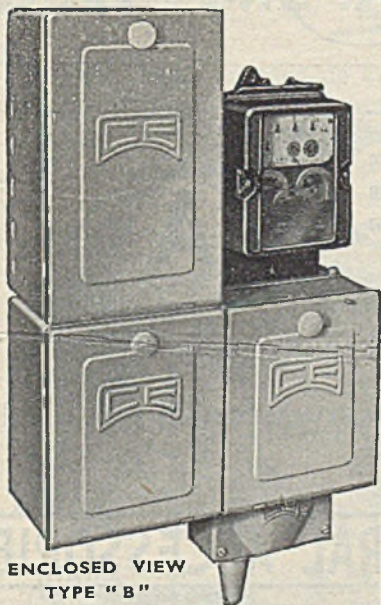
Linread Phillip's Screws give the better finish. No burrs or scratches spoil the completed work.

Linread Phillips Screws

CEMDU
 CARLISLE ELECTRICAL MAINS
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*The up-to-date,
 Compact and
 Flexible supply
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TYPE "B" THREE
 COMPONENTS
 250 V.A.C. 60 AMPS



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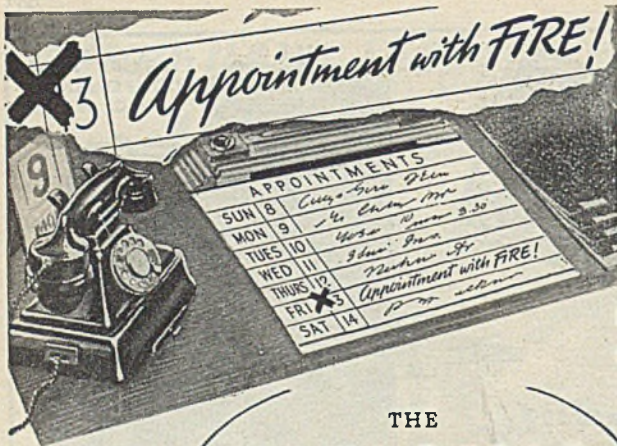
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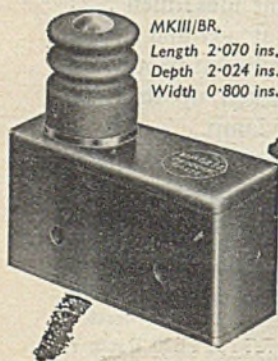
Illustration shows a standard 65 watt model; other types and sizes available.

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SOLDERING IRON FOR INDUSTRIAL USE

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

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

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BURGESS
MICRO -
SWITCHES

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days
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5-16 May 1947

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the buyer, after a lapse of seven years, to establish direct contact with his suppliers and to discuss his marketing problems in person with the actual manufacturer.

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LONDON

(Olympia & Earls Court)

Trade Buyers 9.30 a.m.-7.30 p.m.

Buyers' Badge 2/6



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(Castle Bromwich)

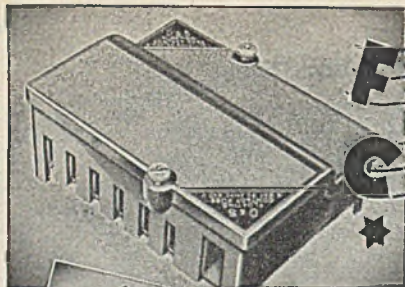
Trade Buyers 10 a.m.-6 p.m.

Buyers' Badge 2/6

THE PUBLIC — Hours of admission to the Public at Olympia and Earls Court are limited for the convenience of Home and Overseas Buyers:—Monday to

Fri. 4.30 p.m.—7.30 p.m. Sat. 9.30 a.m.—7.30 p.m. Birmingham Section open to the Public 10 a.m.—6 p.m. daily. Admission 2/6.

ELECTRICAL EQUIPMENT and ACCESSORIES will be shown in Birmingham



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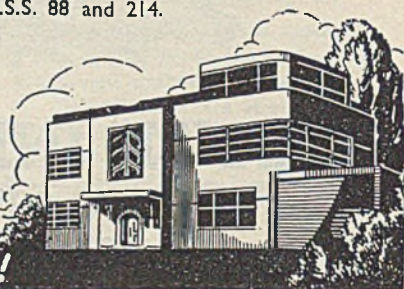
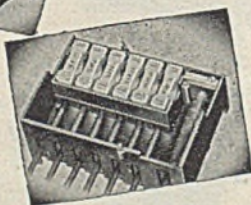
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- Power Lighting and Heating "under one roof."
- Saving in wiring cost and space.
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- Each fuse in its own compartment.
- Conforms to B.S.S. 88 and 214.



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

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EIF46

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Copper Strip of soft, hard and medium qualities, are finished in either straight lengths, wound on drums, in coils and pads, or to any other specification required.

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*If it's threaded
- we make it!*

DATIM

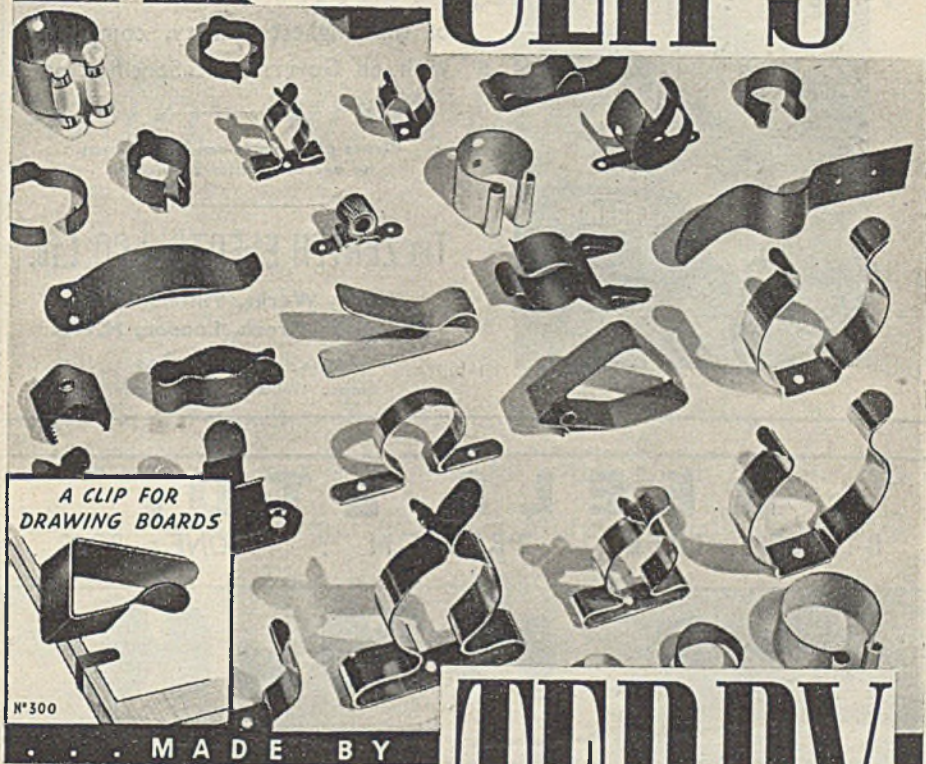
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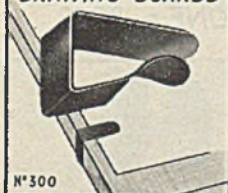


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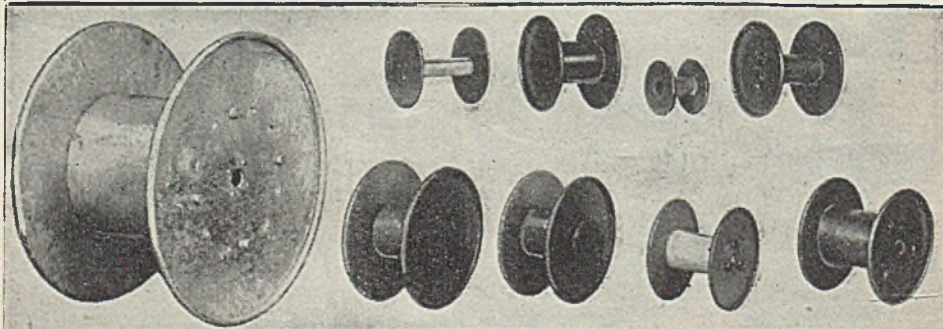
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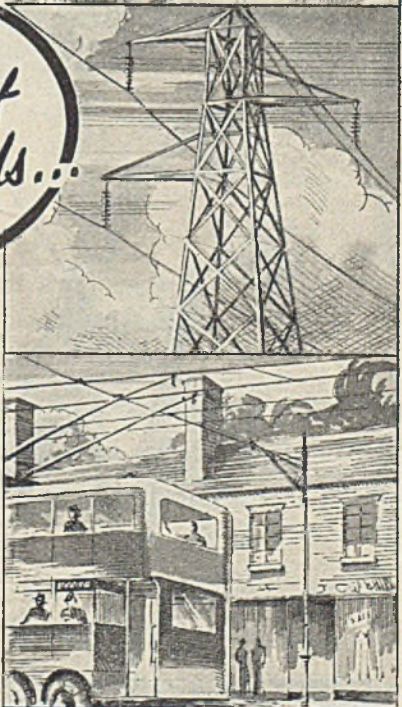
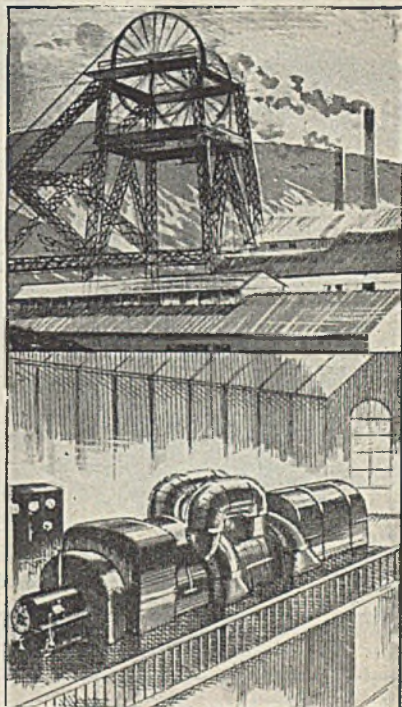
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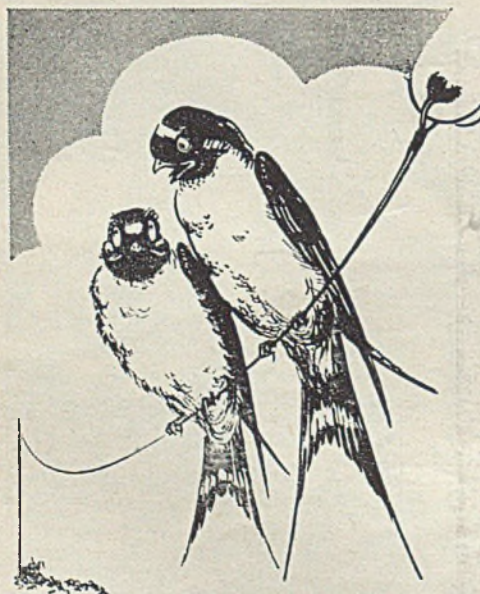
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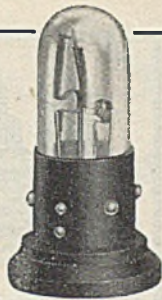
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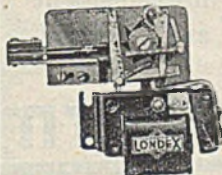
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Illustration shows TWO
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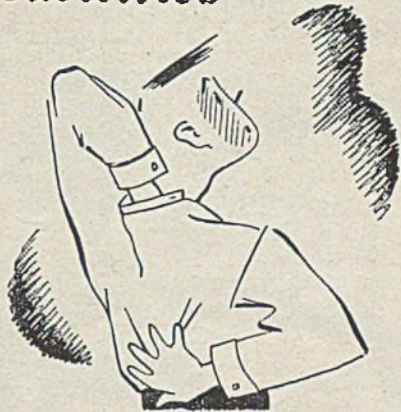
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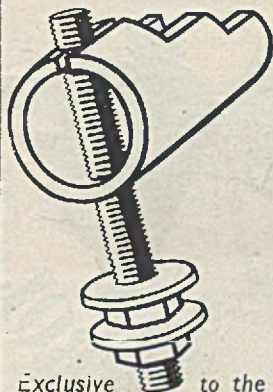
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For accurate
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COOKER CONTROL - DS PLUG STYLE

COOKER DS CONTROL

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.

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All day long we make
Threads of all sorts,
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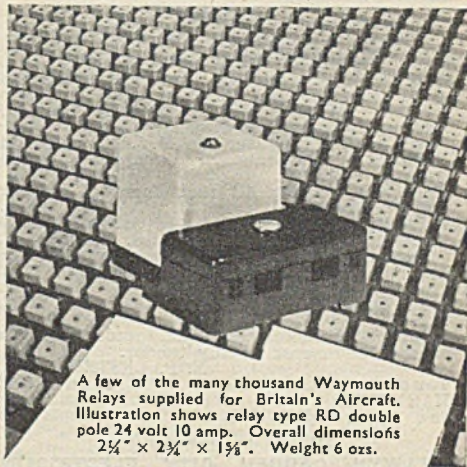
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The result is

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Large Stocks, Prompt Delivery

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



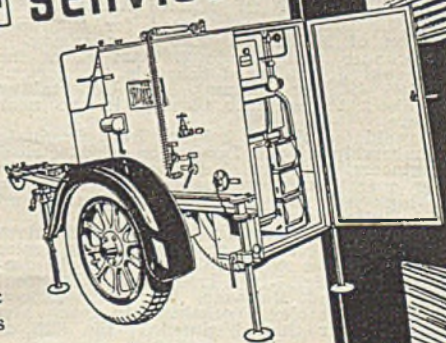
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The largest Power Companies, the best known Electrical Manufacturers and users of electricity large and small throughout the world employ the Stream-Line Filter to raise the Stream-Line value of the oil in transformers and switch gear to over 60 K.V. in a single passage. Fully portable, weatherproof and automatic plants from 5 gallons to 500 gallons per hour.



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COUNTY BOROUGH OF HASTINGS. ELECTRICITY DEPARTMENT.

TENDERS are invited from Manufacturers for the supply, delivery and complete erection at Broomgrove Power Station, Hastings, of the following:—

One 11 kV, 3-phase, 500 M.V.A. rupturing capacity Switchboard comprising five units.

Specification No. 137 and Form of Tender may be obtained from J. SAVAGE, ESQ., BOROUGH ELECTRICAL ENGINEER AND MANAGER, YORK BUILDINGS, HASTINGS.

Tenders enclosed in plain envelopes sealed and endorsed "Electricity Tender No. 137" must be addressed and delivered to me not later than first post on Monday, 5th May, 1947.

The Corporation do not undertake to accept the lowest or any tender.

N. P. LESTER,

Town Hall, Hastings. Town Clerk.
2nd April, 1947.

SITUATIONS VACANT

WELWYN GARDEN CITY ELECTRICITY SUPPLY CO. LTD.

APPLICANTS are invited for the position of Mains Assistant at a salary in accordance with Class "F," Grade 8, of the N.J.B. Schedule of Salaries.

Applicants must possess sound technical qualifications and have had experience of underground electricity supply systems up to 11 kV including transformers, switchgear and protective equipment. Preference will be given to candidates having passed the A.M.I.E.E. qualifying examination.

Applications, stating age, married or single, and full particulars of experience, and enclosing copies of testimonials, to be sent to the undersigned not later than April 25th, 1947.

A. T. BULLEN, M.I.E.E.,
Engineer and Manager,
40, Howardsgate,
Welwyn Garden City,
Herts.

SHIPLEY URBAN DISTRICT COUNCIL— ELECTRICITY UNDERTAKING.

APPOINTMENT OF MAINS ASSISTANT.

APPLICATIONS are invited for the position of Mains Assistant at a salary in accordance with Grade 7, Class E, of the National Joint Board Schedule (at present £449/459/469 per annum). The Undertaking is likely to rise into Class F in the near future.

Candidates should hold at least Graduate Membership of the Institution of Electrical Engineers, and have had good experience in the operation, maintenance and extension of high and low pressure transmission and distribution systems.

Applications stating age, qualifications and experience, and accompanied by copies of two recent testimonials, should be forwarded to Mr. Nigel L. Duncan, Electrical Engineer and Manager, Electricity Offices, Dockfield, Shipley, Yorkshire, to reach him by not later than Wednesday, the 30th of April, 1947.

H. S. HASLAM,

Clerk of the Council.
Town Hall, Shipley, Yorks.
March, 1947.

CONTRACTS Draughtsman required, experienced in layout and design of L.T. distribution equipment and switchfuse gear. Apply stating age, salary, experience, to Manager, Cantie Switches, Northgate Works, Chester.

SITUATIONS VACANT

BEDFORD CORPORATION ELECTRICITY UNDERTAKING.

APPOINTMENT OF MAINS ASSISTANT.

APPLICATIONS are invited for the position of Mains Assistant. Candidates, whose age must not exceed 40 years, must be a Graduate or Corporate Member of the Institution of Electrical Engineers or other acceptable equivalent qualification, with practical experience in the laying, erection and maintenance of 33 kV, 11 kV and lower voltage underground and overhead cables and the associated sub-station equipment.

The commencing salary will be in accordance with Grade 7, Class "G," of the National Joint Board Schedule (at present £494 per annum). The appointment will be subject to the provisions of the Local Government and other Officers' Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications containing full details of age, qualifications and experience, accompanied by copies of three testimonials, to be forwarded to the undersigned not later than 28th April, 1947. Canvassing, either directly or indirectly, will disqualify the candidates.

A flat will be available to the successful candidate at a reasonable rent, if required.

P. G. CAMPLING,

Chief Engineer and General Manager.
Electricity Offices,
Prebend Street, BEDFORD.
March 26th, 1947.

THE Home Office invites applications from men under 42 with experience of Very High Frequency Wireless for the post of Senior Wireless Engineer in its Communications Directorate. Salary £650-£750, plus consolidation addition of £90.

Candidates should possess professional qualifications in Electrical Engineering or equivalent experience. Application forms and fuller details of the Service may be obtained from the Establishment Officer (Room 307), Home Office, Whitehall, S.W.1. Completed application forms must be returned to the Home Office not later than 31st May, 1947.

THE Home Office invites applications from men between 21 and 51 with experience of Very High Frequency Wireless for the following permanent and pensionable posts in its Regional Wireless Service:—Regional Wireless Engineer, salary £620-£710; Chief Wireless Technician, salary not less than £420 at age 30—£570; Senior Wireless Technician, salary £375-£475; Wireless Technician, salary £280 (at 25)—£370.

Candidates should apply for application forms and fuller details of the Service to the Establishment Officer, Room 307, Home Office, Whitehall, S.W.1, or to the Chief Officer, Civil Service Commission, at the following addresses:—

(India) 10, Underhill Lane, Delhi.
(Egypt) 8, Sharia Tolumat, Garden City, Cairo.
(Germany) c/o 2nd Echelon, G.H.Q., B.A.O.R.

Completed application forms must be returned to the Home Office not later than 31st May, 1947, for candidates in the United Kingdom, and by 31st July, 1947, for candidates overseas.

INSIDE SALES ENGINEER required, age 30-35. Experienced estimating and technical sales correspondence in transformers and mercury arc rectifiers; rectifiers preferred. Salary according to experience. —Nevelin Electric Co., Ltd., Purley Way, Croydon.

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

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TECHNICAL COLLEGE.

Principal: W. E. Fisher, O.B.E., D.Sc.
APPPLICATIONS are invited for the following posts:—

- (1) Lecturer in Mechanical Engineering.
- (2) Lecturer in Electrical Engineering.

Applicants should hold a University Degree in Engineering or equivalent qualification. Subject to adequate qualification and experience of applicants, either post may be designated a post of Responsibility carrying an allowance of £30 per annum over and above the Burnham Technical Scale for Assistants.

Burnham Technical Scale Salary for men progresses from £300 per annum to £525 per annum by annual increments of £15; additions for approved study and training; additions for degree; previous experience credited in fixing commencing salary.

Particulars, etc., from

F. LONSDALE MILLS,

Clerk to the Governors,

Education Offices,

North Street, WOLVERHAMPTON.

20th March, 1947.

SITUATION FILLED

BEDFORD CORPORATION ELECTRICITY
UNDERTAKING.

THE position of Consumers' and Installation Engineer has now been filled. The applicants are informed and thanked.

The successful candidate was Mr. A. Stewart, of the East Anglian Electricity Supply Company.

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2—TOTALLY Enclosed B.T.H. Commutator Motors, 230/460 volts 1-phase 50 cycles, continuously rated 2 H.P., 1450 r.p.m. 12—230 volts 1-phase 50 cycles Capacitor Start Motors with Condenser 1/6th H.P., 1450 r.p.m.—Oldfield Engineering Company Limited, 96, East Ordsall Lane, Salford 5.

110 H.P. 3-phase slipping motor, 400-450 volts, 25-50 cycles, coupled direct to Moss enclosed Helical reduction gear. 75 h.p. G.E.C. motor, similar voltage. 7.5 Lawrence Scott generating set, 400 volts to 12 volts, 400 amperes output. Two Vacuum or Impregnating vessels, 8 ft. i.d. by 3 ft. 2 in. deep, fitted with internal steam coils. Other plant available from stock. Enquiries solicited.—H. D. Douglas and Co., 2, Caxton Street, S.W.1. Abbey 6344.

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Receiving and Transmitting Units. Ex Government stocks of WIRELESS RECEIVERS and components, all new. To be disposed of at a fraction of original cost. ROTARY CONVERTORS including voltage control regulator and meter fuses and spares. Enclosed in ironclad cabinets. Input 24 volts D.C. Output 230 volts 75 watts. OSCILLATOR UNITS for short wave reception. RECEIVING AND TRANSMITTING UNITS all complete with 10 to 15 valves. 24 and 12 volt MOTORS model de luxe slow motion dials, etc., etc. Many other lines for the wireless trade. Callers only.—Alec Davis, 8, Percy Street, W.1.

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3 in. by 3 in. by 1/2 in., 6s. doz.; 3 in. by 3 in. by 3/4 in., 6s. 9d. doz.; 3/4 in. by 3/4 in. by 3/4 in., 6s. 9d. doz.; 3/4 in. by 3/4 in. by 3/4 in., 7s. 6d. doz.; 6 in. by 3 in. by 1/2 in., 8s. 9d. doz.; 6 in. by 3 in. by 3/4 in., 9s. 6d. doz.; 6 1/2 in. by 3 1/2 in. by 1/2 in., 9s. 6d. doz.; 6 1/2 in. by 3 1/2 in. by 3/4 in., 10s. 9d. doz. Post paid. Cash with order.—S.T.C. Manufacturing Co., 33, Grange Road, Ramsgate.

RUBBER STAMPS can assist in many ways. Are yours satisfactory and in good condition? W. L. Boughton, maker of all kinds, 53, Kenley Road, Merton, London, S.W.19.

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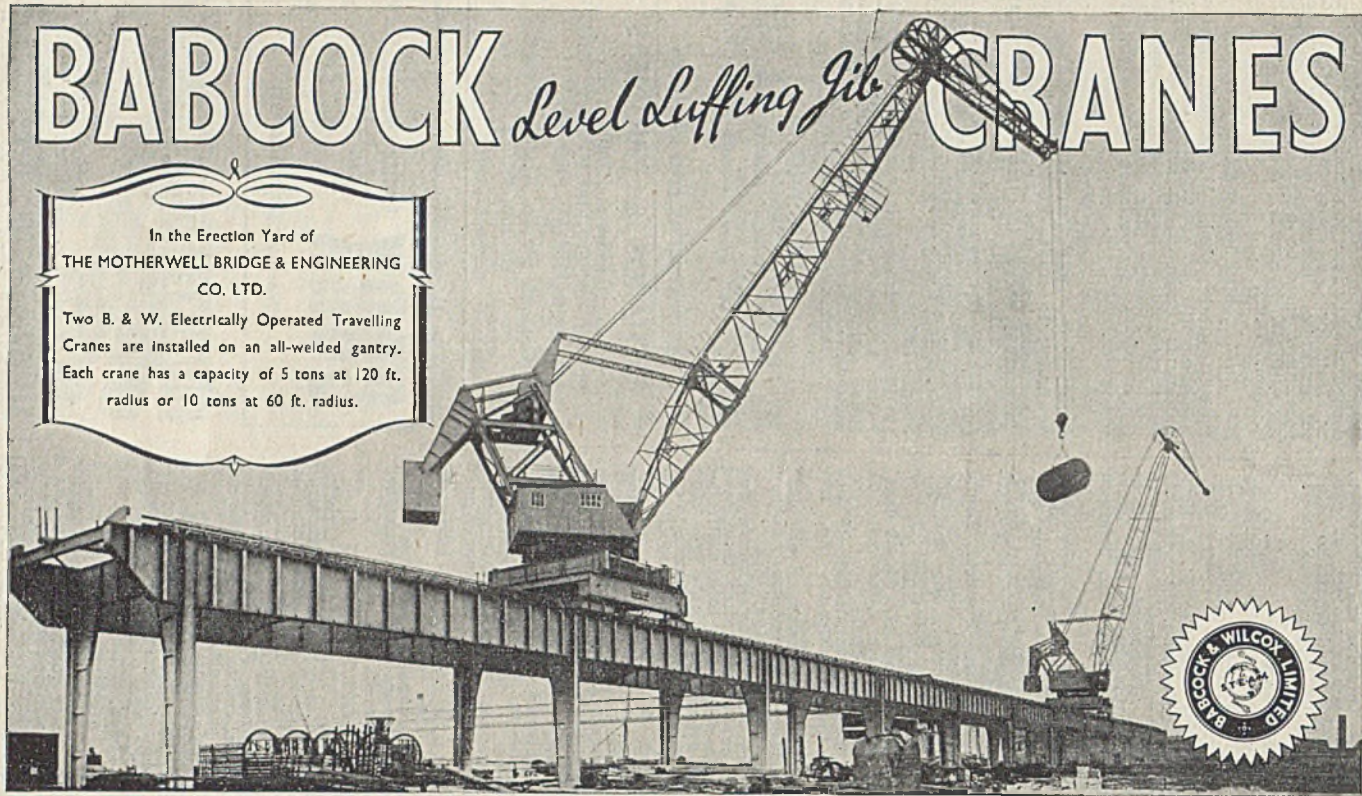
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Fuel for Industry

IN THE ELECTRICIAN of March 14 last, criticism was made of the Government's coal target of 200 000 000 tons for the coming year, and some results of its inadequacy were indicated. The criticism has since been upheld by the T.U.C. and the Federation of British Industries but according to the debate on fuel in Parliament and in a statement by the President of the Board of Trade at the second of the economic Press conferences, the Government is adamant, in that the target figure represents, not what is desirable but "what at the date" of the White Paper "was considered the best we could fairly expect to get."

Production of coal in Great Britain in week-ending March 30 exceeded 4 000 000 tons, the highest recorded since the week ended June 5, 1943 but inclusive of much rough which the electricity supply industry knows to its embarrassment, will not burn. Against this background, Mr. SHINWELL, Minister of Fuel, said in Parliament before the Easter recess that though it is fairly certain that after October we shall be producing coal—all things being equal and everything proceeding smoothly—at a rate rather above 4 000 000 tons per week, "we do not know whether the five-day week beginning on May 1, will have an adverse effect on production." Output at the last recorded figure when spread over the year represents 208 000 000 tons, which is at least 12 000 000 tons short of the volume which the electrical industry regards as

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a possible minimum, while still maintaining existing economies. The Government, if hopeful of maintaining the 208 000 000 tons output is, however, already aware that the figure is too low, for in reference to the matter Mr. SHINWELL said, in the House before Easter, "if we get the men, if the present rate of recruitment continues, and if we get the right spirit in the industry, and if the mining machinery comes along as we hope it will come along . . . it may well be that we can get some further production which will enable us to cover a part of the deficit." The Government's fuel policy is thus still in process of formation. Industry meanwhile is—even with the promised increases of last week—on short rations; the prospects of full employment are receding, the dangers of a further power crisis next winter are growing larger, and the time in which decisions can be taken getting shorter and more precious. To add still another "if" to Mr. SHINWELL's collection—If there was more reference to will-power and less talk about man-power, the miners might be encouraged to work at least as hard as before the war.

Officialdom Takes a Hint

IN THE ELECTRICIAN last week it was suggested that some indication should be made of what is meant by "top priority" when applied to the manufacture of electrical plant, since when evidence is forthcoming that the prefix is to ensure that of the six priority users of steel supplies, generating plant manufacturers are to be given first claim, followed by mining machinery, gas making plant, equipment for coal/oil conversion, railway rolling stock and tracks and finally, atomic energy. Furthermore, the President of the Board of Trade has made it known that in the discussions with the heavy plant makers the possibility of using to a greater extent the resources of sub-contractors is being explored. Certain "half-finished" generating equipment from the British zone in Germany, mostly, it is gathered, lacking boilers, may be brought over here as a short-term expedient. It is reported, too, that as a further means of speeding up manufacture, it has been agreed that new equipment will conform to a few existing designs. This latter decision emphasises

further the implications of the shortage of generating plant, in that the long-range schemes for district heating and power generation, and for the radical advances in thermal efficiency which might result from an improved heat cycle—in short, for resuming the technical progress which was being made until 1939—must be deferred in order that the manufacture of conventional designs may take precedence over developments for the more distant future.

1851 Exhibition Centenary

THE Government's decision that an international exhibition in London in 1951 is impracticable in the present circumstances has been accepted by the electrical industry with mixed feelings. It is, in the first place, agreed by most that the industry is neither ready for the power load which such an exhibition would offer, neither is it yet in a position to stage plant and equipment in sufficient quantity and variety to show the amazing progress made in electrical engineering in the past 100 years. In the second place, the industry feels that such an exhibition would have offered an exceptional opportunity for showing to the world at large, developments which, born in this country, have been adopted by all other nations without, in some cases, sufficient credit being given to British enterprise. A classic example of such treatment is the electric lamp with which the name of EDISON to the exclusion of Sir JOSEPH SWAN, is so carelessly used outside this country when referring to its invention. Another instance is the a.c. h.t. transmission system developed by Dr. SEBASTIAN DE FERRANTI, with which many, if not all modern high tension networks have something in common, while the underground conductors developed by him were the earliest examples of the modern power cable.

Sales Resistance Overseas?

IT has been suggested by some electrical manufacturing interests that there is overseas, a growing sales resistance as opposed to the eagerness to buy of a few months ago, and though not in any way unexpected the changed conditions are worth noting in relation to the circumstances in which British industry is

operating. Manufacturers of electrical goods and apparatus have, as shown by the Board of Trade returns on export trade, firmly re-established themselves in the overseas markets following their seven years absence during the war, and though they may be suffering some disadvantage in delivery time compared with, say, their American competitors, they are, despite any contraction in the sellers' market, doing more than merely holding the ground won. As an example of this it may be pointed out that one of the markets where sales resistance appears to be building up is India, and the British manufacturer there competes with his American counterpart on terms more favourable to the latter, for reasons concerned not only with delivery times, but also to some extent, politics. In spite of these conditions, however, the British manufacturer is not only not losing ground but is gaining it, in that in February there were shipped to that country electrical goods and apparatus to a value greater by £155 000, when compared with the same month a year ago, apart from heavy electrical plant valued at £214 591, an increase of £9 600 compared with the corresponding month of 1946.

A Healthy Sign

THE reason for the maintenance of trade outlined in the above note, in India and for that matter elsewhere, against shorter time deliveries of American and other competitors, is, apart from the superiority of British goods, due to the fact that British manufacturers though offering long dates have fulfilled their promises. American exporters, on the other hand, have been penalised by the shortcomings of a few of their own kind who, after promising deliveries have disappointed in this respect. Overseas purchasers of heavy electrical machinery and other components are as familiar with prevailing world conditions as anyone and it can, therefore, be argued that if sales resistance is growing it is based mainly, not on delivery dates but on price competition, as was the chief reason for its being before the war. From the standpoint of the British electrical manufacturer this is all to the good for as was shown in the years before 1939, where good value for money is concerned he knows no

equal. Competing in a market where delivery time is the deciding factor, British industry might in some cases be at a disadvantage, but with that factor eliminated, our success or failure to lead in export world trade is dependent on the Ministry of Supply and its ability to deliver the raw materials, where they are wanted, when they are wanted, and in the right quantities. If official promises to aid industry in the attainment of the official export target are honoured, the changing conditions in world markets are a healthy sign, and are of the type with which British electrical exporting firms are already well experienced.

Words of War

THE accretions to the language which follow a major war may be regarded—at least by philologists—as one of its minor compensations. To name only two words, “tank” and “U-boat” are probably immortal relics of 1914-1918, and the recent war brought a formidable list, among which “blitz,” “doodlebug,” and the euphemistic “liberate” are likely—although one hopes the occasion for their use again will not arise—to find their place in future dictionaries. Another of these was “boffin” (to the uninitiated, a “backroom boy” working on radar development) and the boffins, cultivating new fields, grew a sizeable crop of jargon of their own. The Inter-Services Radio Circuit Symbols Committee, winnowing these, has now published a glossary of the 800 war-time technical terms, almost all incomprehensible to the worker outside radar, which are likely to be of future use. Reading the list, one feels that there is a certain picturesqueness about “hash,” “snow” and “grass”—all forms of interference on c.r.t. displays—which justifies the official sanction they are now given, but there will be many to regret the decision of the I.R.C.S.C. to “deprecate” the term “Kipp relay,” for one of the most ubiquitous of radar circuits, in favour of the transatlantic “flip-flop circuit.” Those who worked with ground radar in the Battle of Britain will be sorry, too, that the very useful device whose somewhat dubious nickname was coupled with that of its inventor, Mr. L. H. BEDFORD, has not passed into etymological history.

PROFIT AS A SERVICE

by SIR ERNEST BENN

AT a recent Individualist Luncheon in London, Prof. David Douglas said we must revert to first principles and demonstrate their applicability to present events.

Consider what happens if the conversation is of, say, housing. We talk of sites, rents, permanent, temporary, local authorities, private builders, cost, wages, plans, licences, fittings, electricity, gas and priority; some of them false, others side issues, but none of them concerned with principles. It is a thousand chances to one that competition will not be mentioned, and yet the absence of the spirit of competition is the root cause from which these problems arise. Similarly, the economy and safeguards of profit have been forgotten and we are apparently prepared to go on borrowing to cover the losses until, like the American Loan, the Rake's Progress comes to its natural end. First principles, applied to most of our economic troubles, demand that in all things there must be preserved the health-giving spirit of competition, and that in all our dealings the necessity of profit must be recognised.

INSURANCE PREMIUM AGAINST LOSS

The importance of profit to the man who depends upon it for a living is, in fact, a wholly insignificant detail by comparison with its importance to the whole community. Profit may be regarded as an insurance premium against loss, for in return for the chance of gain the seeker after profit must accept the personal responsibility for loss and act as agent for the whole community to secure economy and eliminate waste.

Seeking for the economical way of accomplishing the many processes associated with the production of the simplest article is far more important to the general well-being than is commonly supposed. All of us by nature are inclined to rate our own value a little above its true worth. All of us very naturally and very properly are inclined to maintain a consistent pressure for a little more for ourselves. That common human trait is all to the good in a system governed by the profit and loss account, because in such a system the pressure which we exercise to secure more for ourselves will be checked, restrained, and brought within reason by the limitations of the market itself. Under a profit system every worker is directly governed by the consumer. If,

however, the profit system, with its necessity for avoiding loss, is abandoned, then the restraint upon each one of us is removed; there is hardly any limit to the value we can place upon our own efforts.

RATIONING AND CONTROLS

Special difficulties associated with our "new martyrdom" make the subject of profit the more worthy of discussion. Rations and controlled prices leave no scope for profit to operate in its natural way as an economiser; but as rations tend to go down and controlled prices go up, it is apparent that these are not practical steps towards the plenty of our desire. Against this we have the evidence from America, France, and still more from Belgium, to show how, starting with the black market, uncontrolled commodities have increased in quantity and cheapened in price. First principles should cause us to regard rations and controls as unpleasant necessities and free markets with profits as the goal at which to aim.

The pathetic failure of appeals to increase production is simply due to the absence of the natural forces on which all production depends. The profit and loss system maintains a constant pressure on producers to produce. It makes the producer the slave of the consumer. Our present rulers are striving to establish a system under which we shall all work when and as it suits us, as we shall ourselves direct in a self-governing democracy, and yet at the same time enjoy a full consumer life, having each of us prescriptive rights to a full share of the general wealth. If that proposition were practical it would offer a life with no attractions to "man who is man." We cannot have it both ways, and it is good to be clear and definite and discard fallacious thoughts of a life that is unobtainable, and even if obtainable would not be worth living. The hard truth is that, as producers, we must be slaves to our consumer selves, or, as consumers, we must be slaves to our producer selves. There must be slavery, obligation, necessity—call it what you will—in any honourable and workable scheme of life. We must stand in the marketplace to be hired as producers, or must line up in the queue to be rationed as consumers. In the first arrangement there will always be more and more (not of course all that everybody wants) for general consumption, while in the second scheme there will be a steadily decreasing supply of everything.

Modern Switchgear—VIII

By R. N. Buttrey, M.Sc.Tech., A.M.I.E.E.*

Current Transformers.—In a survey of the most recent developments in switchgear practice, a mention of current transformers which normally constitute an appreciable portion of switchgear assemblies should be made. C.T.'s for metering and protection purposes associated with high power transmission and distribution switchgear must, in addition to satisfying

thereby placed on the maximum normal ampere turns which can be accommodated for a given current rating, thus determining the attainable accuracy of the C.T. For given accuracy and normal current rating, the mechanical construction and, therefore, the cost becomes a function of the overcurrent factor (O.C.F.). B.S. 81/1936 points out that overcurrent factors above 400 tend to become impracticable, the validity of such a rider being dependent, of course, upon rated burden, accuracy, etc.

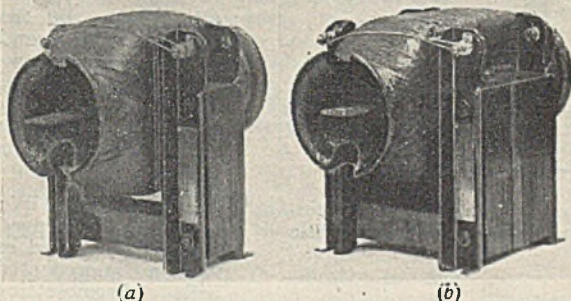


Fig. 1—11 kV wound primary, tape insulated current transformer. (a) single secondary; (b) double secondary

requisite accuracy requirements, be capable of withstanding, thermally and dynamically, the maximum short-circuit conditions corresponding to the rating of the switchgear.

Dynamic Stresses.—For bar-type current transformers, mechanical forces set up due to short-circuit currents are fairly easily withstood by providing adequate support at the connections, so that the proportion of support provided by the transformer itself against right-angle loops (end connections) or interphase effects is within the designed mechanical strength of the assembly.

In the case of wound primary current transformers, short-circuit forces comprise: (a) Radial bursting forces on the wound primary coils; (b) interphase attraction and repulsion between the coils.

The radial bursting force which tends to shape the primary coil to enclose the maximum area, i.e., to form a circle, manifests itself, in the old "trombone" pattern C.T., in the breakage of the insulators, as is well known. Since this bursting force is proportional to the second power of the short-circuit ampere turns, a limitation is

material, it being desirable that no

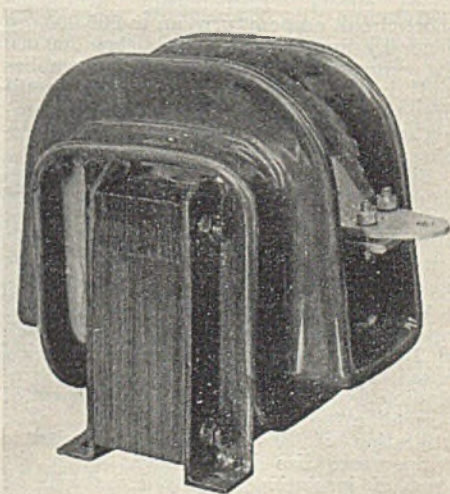


Fig. 2—11 kV wound primary, porcelain-insulated current transformer

additional stresses whatever are applied to the supporting insulation.

Fig. 1 illustrates a tape insulated wound primary 11 kV short-circuit proof C.T.,

* Parts I, II, III, IV, V, VI and VII of this series appeared in THE ELECTRICIAN of July 25, August 16, September 27, October 25, December 6, December 20, 1946 and February 7, last respectively.

whilst Fig. 2 shows the application of all-porcelain insulation in a short-circuit proof C.T.

The interphase attraction and repulsion between primary coils can only be dealt with, in general, by adequate robustness of the completely assembled C.T. since, in this case, the forces must be resisted eventually by the C.T. frame mountings.

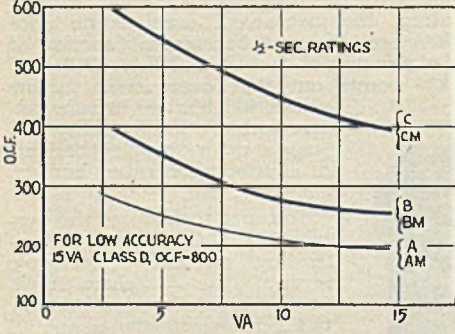


Fig. 3—Typical output characteristics for 11kV wound primary short-circuit proof current transformers

Because of this, particularly in switchgear assemblies with relatively small phase centres, the radial bursting strength of the primary is not fully utilised, limitations on overcurrent factors being dictated by interphase effects. Economically attainable short-circuit ampere turns up to 500 000 are generally limited to a value below 200 000 for compact three-phase C.T. assemblies and in this respect, the short-circuit proving of a C.T. must be qualified according to arrangement, e.g., single or three-phase assembly, mounting centres, etc.

Fig. 3 shows typical O.C.F./V.A. Burden figures attainable on commercial C.T.'s of the types described, the figures being applicable to ½ sec. rating based on a S.C. current density of 150 000 A per sq. in., as specified in B.S. 81/1936.

Thermal Stresses.—Suitable thermal ratings of copper conductors are indicated in B.S. 81/1936, the values given being based upon a total temperature rise (including temperature rise due to passage of normal rated current) of 200° C. The utilisation of this maximum permissible temperature rise is dependent upon the type of insulation employed, as will be mentioned later.

For 2 sec. ratings, O.C.F. values 70-80 per cent. of the values shown in Fig. 3 are attainable within reasonable economic and dimensional limits. Current transformers for voltages above 11 kV become more of a problem of size and insulation, the larger spacings reducing interphase effects to

negligible values. It is feasible and usual to make wound primaries completely circular in form so that the mechanical stresses are simple tensile in the primary conductor. Overcurrent factors are here limited mainly by thermal and space considerations rather than electromagnetic.

It is relevant to point out that current transformers forming integral parts of switchgear assemblies are naturally subjected to the same overload conditions as the remainder of the gear, and should be rated accordingly.

Insulation.—The types of insulation employed for C.T. primary coils are listed as follows—

- | | |
|------------------------------------|--|
| Porcelain | All voltages; in the form of bushings and cast shapes. |
| Synthetic-resin-bonded paper | All voltages; in the form of bushings, tubes, wrapped and resin impregnated assemblies. |
| Synthetic-resin-bonded fabric | Voltages up to 11kV; cotton banded assemblies, dipped or vacuum impregnated with thermosetting resins and varnishes. |
| Wax and compound impregnated coils | Voltages up to 11kV; paper or fabric wrapped assemblies, vacuum impregnated with bituminous compounds, natural or synthetic waxes, etc. |
| Oil impregnated paper | Voltages above 11kV; paper banded assemblies, vacuum impregnated with insulating oil (usually of the highly viscous type). |
| “Plastic” insulation | Present applications up to 11 kV employ extrusion - injection moulding of Polythene or other thermoplastic insulation around the primary coil. |

In considering a suitable form of insulation for dry-type current transformers, mechanical and electrical strength at ambient and maximum operating temperatures, short-time thermal ratings and resistivity to various climatic conditions must be considered. The use of an impregnant of low melting point usually places a design limitation on the maximum short-time ratings attainable for given burden and accuracy.

The transformer shown in Fig. 1 has a cloth-banded primary coil which is vacuum dried and impregnated in a thermosetting resin. Thus the coil is fully proofed against moisture by means of a chemically inert impregnant which retains satisfactory mechanical and electrical properties for momentary temperature rises up to 200° C., a maximum value associated with B.S. 81/1936 recommended short-time ratings.

In developing a suitable technique for the impregnation and stoving of h.t. insulation, considerable investigation of methods and materials is necessary to each type of coil. Many initial difficulties, e.g., solvent retention, loss of impregnant due to drainage during stoving, etc., must be overcome in order to obtain a high-percentage uniform impregnation. A check in consistency of process is afforded by routine X-ray testing (Fig. 4), and on design by power-factor testing and testing to destruction. Fig. 5, a typical p.f./voltage characteristic for an 11 kV tape insulated and impregnated wound primary C.T., demonstrates suitable stressing of insulation as evidenced by the position of the ionisation region.

A typical average B.D. gradient for an impregnated cloth banded insulation as described is about 200 V/mil. Suitable co-ordination of insulation for a three-phase 11 kV system requires an insulator S.O. value approaching 50 kV (50 cycles) or slightly higher in the case of equipment for direct connection to overhead transmission lines. The attainment of such values com-

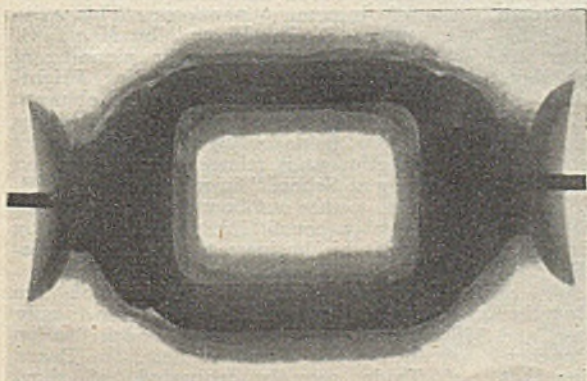


Fig. 4—X-ray check, showing uniform impregnation of transformer insulation

mensurate with compact design in wound primary C.T.'s requires careful investigation of electric field formation at terminals and mounting clamps. Similar care must be observed to avoid corona discharges at normal working voltages, particularly in

the case of porcelain insulation with its attendant high S.I.C. A fairly common practice, although not always necessary, is the insertion of earth-connected metal foils within the taping whilst, for porcelain

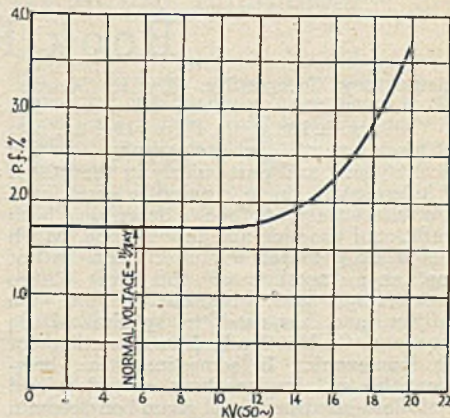


Fig. 5—Power factor/voltage characteristic for 11kV tape insulated wound primary. Tests made at 20°C.

insulators, metallising must be arranged to minimise "edge" stresses.

E.H.T. C.T.'s.—Whereas, for voltages up to 11 kV, wound primary insulation consisting of cloth bandages relies entirely upon the impregnant for insulation strength, the bandages serving merely as mechanical support, the use of paper bandaging for higher voltages relies on the paper material for both insulation and mechanical support, the impregnant serving (a) as a seal against moisture, (b) to equalise electrical stressing, and (c) to prevent ionisation between paper layers. Hence, it is not necessary to impregnate the paper fibres, and grease-proof paper (usually sulphite rag paper) is normally employed.

Coils are bandaged in the dry state (in certain designs, e.g., cross-coil, primary insulation is applied to both primary coil and the magnetic iron) then placed in the tank or insulator as a final assembly. All drying out and impregnation (oil) is carried out under vacuum conditions with the C.T. fully assembled and after completing the process, the oil filler remains in the transformer tank which is sealed off ready for shipment and service.

Correct control of processing as described, guaranteeing complete elimination of air and moisture enables working electrical stresses to be employed of values approxi-

mately twice those generally permissible with the cloth bandaged resin impregnated coils as normally used for 11 kV operation.

Book Reviews

Elementary Telegraphy.—By E. MISSEN. A.M.I.E.E. (London: Newnes.) Pp. 340, with 108 figs. Price, 12s. 6d. net.

Developments in telegraphy during recent years, and particularly in the design of teleprinters, have created a need for a new elementary textbook, describing both traditional practice and innovations, which this work goes far to fulfil. The author has, as a member of the Post Office engineering staff, himself taught the subject, and has used the syllabus of the City and Guilds Grade I examination for his framework. In some instances, however, this syllabus has been exceeded, and a fuller treatment is given on certain points of technique. After a short introduction to codes, the book opens with an exhaustive explanation of the start-stop system and descriptions of the various models of teleprinter used to-day. Subsequently, the author deals with magnetic and thermionic relays and the principles of line transmission, and it may, perhaps, be thought that this general treatment should have preceded the description of specific apparatus. A short chapter on voice-frequency telegraphy follows. In a particularly useful section, the author discusses the various items of equipment to be found in the modern instrument room and the causes and treatment of signal distortion. The uses of test equipment are described, and the book ends with short notes on power supplies. The treatment throughout is straightforward and practical, and the book is admirably illustrated. It is likely to be of value to students and instructors for some time to come.

Current Collecting Brushes in Electrical Machines. By M. E. HAYES. (London: Isaac Pitman and Sons.) Pp. 191. Price 21s. net.

In this book has been gathered together in a handy form much practical and theoretical information upon brushes. Whilst it does not contain anything that is not familiar to experienced machine designers, it will nevertheless be useful for reference, especially for the younger and less experienced designers. The book is written in clear and concise language and cannot fail to be of service to those who have to do with the maintenance of electrical machinery. The chapters on wear and the diagnosis of brush troubles should be of particular interest. Although there

is a large number of illustrations many fail in their purpose through being too small, while the graphs included would have been easier to read if they had been provided with ordinates and abscissæ. It is unfortunate that nothing has been written upon the prevention of wear of brushes in aircraft machines. This is a very serious problem and much work has been done in investigating the matter. Even though it may not be possible to publish much of the data, information upon the lines of attack and the probability, or otherwise, of a solution being found would have added to the value of this publication.—R. H. R.

Lighting Service

THE E.L.M.A. Lighting Service Bureau's journal, "Lighting Service," suspended during the war, has made a welcome reappearance, with its characteristic brightness undimmed. Its progressive ideas and technical information will, as before, do much to improve lighting conditions in the home and industry. The articles in the current edition include "Powdered Light," in which Mr. A. D. S. Atkinson outlines the principles behind the use of fluorescent powders; "Ideas to Remember—I, The Home," by Mr. T. O. Freeth, who deals with the planning of domestic lighting; "Surrounding Brightness—I, Industry," by Mr. W. Robinson, who opens a series of articles on brightness in various fields of lighting and answers the question as it relates to industry; and "Seeing at School," in which Mr. N. I. B. Harrison points out how the lighting man can greatly benefit the community by making it his business to see that education is not hampered by bad lighting.

Resulting from a decision of the architects responsible to use only fluorescent lighting at the London Section of the British Industries Fair, the Board of Trade recently requested, at short notice, about 8 000 daylight 80 W tubes, complete with fixtures and the necessary control gear. Despite the acute shortage, the order has been met, most of the British tube manufacturers participating. At the conclusion of the Fair, the tubes, less the appropriate discount for hours run, will be diverted into the trade channels for which they were originally intended.

Infra-Red Ray Development

Details of Hitherto Secret British Equipment

NOT one of the war's spectacular technical achievements, when measured against radar and the atomic bomb, but, in a more modest way, a striking result of intensive research, was the successful exploitation of infra-red rays as a secret

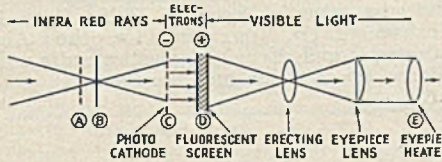


Fig. 1

signalling medium and as an aid to manoeuvring vehicles in complete darkness.

The Services' interest in infra-red, in this country, dates from the 1914 war and development, since that time, has been largely an Admiralty responsibility.

Pre-1939 uses of infra-red were mainly of the burglar alarm variety, in which the interruption of a beam of i.r. radiation between a filtered tungsten lamp and an i.r. sensitive receiver was made to operate a warning relay. Research, both in this country and Germany, was directed towards the construction of receivers which would give a visual impression of an object emitting or irradiated by infra-red light. The British solution—perfected, in 1941, two years before the German—consists, fundamentally, of a small vacuum container with two flat parallel sides, spaced about 0.5 cm. apart, lying at right angles to the optical axis. One side supports a caesium-silver infra-red-sensitive photo-cathode, while the other is given a conventional fluorescent coating and is arranged to be electrically conducting. A d.c. potential of from 3.4 kV is maintained between the photo-cathode and anode.

In Fig. 1, the employment of such a receiver in an elementary telescope is illustrated. Radiation from an infra-red source, after any visible component has been filtered out by a screen, *a*, passes through a lens, *b*, and forms an image on the photo-cathode, *c*. Irradiated areas of the cathode release electrons at a rate proportional to the degree of excitation, and

these, accelerated by the standing potential, pass across the short intervening space in approximately linear paths to the fluorescent screen anode, *d*, where they produce visible scintillations. The monochromatic picture, after inversion, is viewed through an eyepiece, *e*, which may, in some applications, be electrically heated to prevent misting.

Fundamentally, the German equipments, which were demonstrated at Earls Court last year, are similar, but the Germans normally employed an electron-optical lens system, involving accelerating and focusing electrodes, with correspondingly higher voltages, between the photo-cathode and the fluorescent screen. This gave a somewhat sharper picture, but at the expense of increased weight and loss of mobility.

With a current consumption of the order of 10^{-3} A, the British receiver does not present heavy demands on the power source and, although initially vibrator packs were used, a more ingenious method had been devised by 1941. This employed the 100-years old Zamboni pile, in which a number of paper discs, coated on one

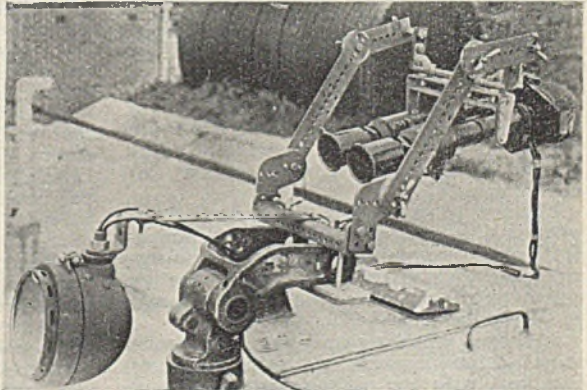


Fig. 2

side with manganese dioxide and on the other with tin foil, form an effective low current, high voltage source. Zamboni piles no bigger than a fountain pen and generating 4 kV were finally evolved.

War-time uses of infra-red receivers may be divided into two major groups: those in which a transmitter, invisible to the enemy, was used as a signalling or identi-

fication lamp, and those in which projectors bathed the field of view with infra-red light, thus permitting detailed observation.

The second group was used extensively by the British Forces, for night driving, the vehicle, as in Fig. 2, carrying screened headlights and infra-red binoculars, and the Germans built experimental A.A. searchlights. A third, but less important group, consisted of detectors for discovering possible enemy uses of infra-red. In Germany, some progress was made in the development of receivers sufficiently sensitive to detect aircraft and tanks by means of the radiations from their exhausts.

The outstanding achievement of the British designers lies in the extreme compactness of the instruments. The smallest British receiver, a single-eyepiece model designed for beacon identification, weighs 1½ lb., against 16 lbs. for the nearest German equivalent, employs 3 kV, against 11 kV and is completely self-contained.

The infra-red receivers were developed and later manufactured by E.M.I., Ltd., and among the other firms co-operating were Messrs. Lines Bros. (production of cells), John Dickinson (Zamboni piles and the later types of receiver), Pullin Optical Instrument Co. (receivers for the Air Ministry) and Erinoid (plastics infra-red filters, for beacons and headlamps).

South African Railways and Harbours

IN his report for the year ended March 31, 1946, the General Manager of Railways and Harbours, in the Union of South Africa, states that a large programme of electrification work was in hand, and this, coupled with major improvement works in progress or under contemplation on existing lines, would permit of further progress in the acceleration of train services. Successful tests had been carried out with fluorescent lighting in suburban coaches operating in electrified areas, and new suburban stock in future would be equipped accordingly. Arrangements were also in hand to provide fluorescent lighting in the dining and lounge cars of the Blue Train.

There were 581½ route miles and 1 165½ single-track miles (including sidings) of electrified lines in the Union, and 322 route miles and 519½ single-track miles of electrified lines under construction or authorised.

Further progress was made during the year in the improvement of the Administration's telecommunications and radio services, as well as providing more effective train control methods, the estimated cost of which was £1 088 978.

A special repeating amplifier to improve speech communication on telephone routes equipped with the old type iron wire had been evolved, and during the year additional units of this device were constructed and were installed on the Hutchinson-Calvinia section. A further innovation during 1945-46 had been the devising by the department of the Chief Electrical Engineer of new designs of universal duplex telegraph terminal sets and universal duplex telegraph repeater sets. One of the former type, designed to provide facilities for operation over voice frequency telegraph channels, had been put

into commission in the Johannesburg telegraph office with excellent results. A repeater set, designed to operate in conjunction with the universal duplex telegraph terminal apparatus, was under construction in the administration's test laboratory at Langlaagte.

Supply in Jamaica

MR. Gammans asked the Secretary of State for the Colonies recently if he was aware that the Jamaica Public Service Co. was converting supply in many parts of the island from 60 cycles to 40 cycles; and what action he proposed to take in view of the fact that this meant that radio sets, electric motors, or any other equipment imported from Great Britain, the U.S.A. or Canada could not be used without costly re-wiring? Mr. Creech Jones said that, according to his information, by far the greater part of the electrical systems in Jamaica provided by the company named at present operated on 40 cycles. In view of the present difficulty in obtaining supplies, particularly of rotational equipment, representations had been made as to the desirability of converting the entire electrical frequency of Jamaica, wherever necessary, from 40 cycles to a standard frequency of 50 or 60 cycles and he had been asked to obtain for the Government of Jamaica an impartial report by consulting engineers in the U.K. on this question. A report of this nature had now been received by him and was being forwarded to the Government of Jamaica, who would, he had no doubt, see that full opportunity was given to all interested to consider the question further.

Wire Recording

A Review of Recent Developments and Applications

A LECTURE on "Developments in Magnetic Recording" was given by Mr. P. T. Hobson to the British Sound Recording Association on March 27, in London, with Dr. L. E. C. Hughes, president, in the chair. Mr. Hobson pointed out that while a model of the original Poulsen recorder may be found in the Science Museum, there was little major advance until the Marconi-Stille machine, using tape, was introduced for broadcasting purposes, and later, the Philips-Miller system. Before the war the Germans up-graded magnetic recording in the Magnetophon system by using a magnetic powder in a plastic film—particulars of which were released recently through the Stationery Office—and the use of a carrier-frequency polarising current while recording; a.c. for wiping-out had previously been well known.

WIRE CHARACTERISTICS

The difficulty which had, since the beginning of the century, blocked designers was the view taken by science of the magnetisation process itself. Research by the Armour Corporation in the U.S.A. and further work in this country revealed a clearer view of the requirements of the material of the wire, and on applying the results of this research to practical machines, wire recording had been raised to a status of the highest class, as Mr. Hobson showed by demonstration.

From a practical point of view, the short answer for speech purposes was to reproduce the Armour Model 50, extensively used by the Services, both in the air and on the ground; a few models of these were available for strictly non-entertainment purposes and development was in hand for other models, possibly available in about a year.

The clue to the realisation of practical machines was in the wire. A stainless-steel wire of 4 mils dia. had been selected, the standard speed for high-quality reproduction being 24 ins. per sec. The standard playing-time was 66 mins., which could be doubled for a lower grade of speech if required. Longitudinal magnetisation was used, running in a carefully designed head. If the wire should break, a knot could be tied, the ends trimmed, and the joint would pass safely over a ridge in the head. The strength of the wire was about 3-4 lb. weight.

The process of magnetisation induced a multitude of disc-like magnets, face to face along the length of the wire, of a thickness

depending on the wave-length. The demagnetisation effect was paramount and determined the losses for a given speed and maximum frequency of the recording currents, because of the self-erasing effect of the high demagnetisation in short magnets. Here related to the constant diameter of the wire.

A demagnetisation curve of a sample of material, used by the speaker to indicate the relation between H and the resulting B , showed the relation between the applied field H and $4\pi I$, where I was the intensity of magnetisation. The curve showed the applied field which was necessary to reduce the coercivity to zero, and this value determined the effectiveness of the material as a permanent magnet.

Coercivity covered two ideas: the inductive coercivity, which was the field required to reduce the remanent induction to zero, and the intensity coercivity, which was the field required to reduce the intensity of magnetisation to zero. This distinction was not of importance, however, when permanent magnets rarely had total coercivities greater than 100 oersteds, since below that figure there was practically no difference between the two. It was the magnetic induction in the wire that generated a reproducing voltage, and even if the self-demagnetisation (longitudinal) was complete, there still remained some intensity of magnetisation, which was only entirely removed if the total demagnetising field was increased to the intensity coercivity of the material.

PHYSICAL CONSIDERATIONS

If a line was drawn from the origin to the demagnetisation point on the $B-H$ curve, it was found that the tangent of this line to the vertical, D , was directly related to the ratio of the wave-length to the diameter, and hence to frequency. It was then found, for the purposes of sound reproduction, that:—

Loss in decibels = $20 \log R/(R + D)$,
where R was the ratio of inductive coercivity to remanent induction, which depended, experimentally, on the material, and had the limit of unity.

The wire for the original machine for the Pacific war had a remanence of 6 000/7 000 gauss, and required a speed of 5 ft./sec. for speech, using an available stainless steel wire, with a coercivity of 60/90 oersteds. Theory now demanded the highest inductive coercivities at the expense of remanence, and these were found in a completely annealed austenitic steel which.

because of the necessary heat treatment, was substantially non-magnetic, the remanence being 600 gauss, and coercivity 300 oersteds. Production of such wire was in hand, with a continuous monitoring and automatic control of the hysteresis loop on a cathode-ray tube, as an annealing current was passed through the wire.

The use of a high-amplitude polarising carrier was usually thought to be valuable in getting over the bend in the initial magnetising curve when recording, but

Mr. Hobson outlined a more fundamental approach along the lines of the Weiss domain theory of magnetisation. The speaker then distinguished between noise contributions, and since one of the principal of these was proportional to the remanence, very low noise-levels, corresponding to a signal/noise ratio of 60 decibels, could be obtained. The plastic-tape system of the Magnetophon was criticised, and references were made to magnetic recording developments both in the U.S.A. and in Switzerland.

Television Development

SPEAKING at the annual dinner of the Television Society in London, on April 1, Sir Robert Renwick, president, claimed that this country still led the world in the commercial development of television. Surely, he said, at a time like this, when British prestige was suffering daily blow upon blow, here was something revolutionary with which to demonstrate clearly to the world that with our skill and ingenuity we could and would still lead. Why did not the Government face up to reality? If they could not afford to give television more support they should agree to sponsored programmes for, say, five years, to enable television to forge ahead with facilities and programmes worthy of the project.

In a statement relative to the future of the television service, the Radio Industry Council has pointed out that though it is common knowledge that the first provincial station is planned for the Birmingham area, with Manchester and Glasgow to follow, the establishment of the Birmingham station has been delayed longer than the industry had hoped, and it now seems unlikely the station will be open until some time in 1948. Notwithstanding these circumstances, however, arrangements have been made to run a two-way link between London and Birmingham so that programmes may be sent in either direction by cable or radio link. This link will serve equally for the present 405 line service, and for 1 000 line definition or colour definition when these are commercially possible. These arrangements do not mean that the Birmingham service is to open on these high standards, however, but that the same link will serve when these standards are possible. It is not the intention to supersede the present system for many years, and even when improved transmission standards are possible, existing sets will not be rendered obsolete, in that programmes will continue to be available on the present standards in addition.

The persistent difficulties of supply encountered by the industry, shortages first of one material, then of another, have prevented production lines from getting into operation as quickly as was expected, so that output has been slower than was anticipated twelve months ago. The picture quality of the new sets, however, shows a marked improvement over the pre-war receivers; a fact to which Mr. Burke, the Assistant Postmaster General, referred in Parliament on January 23 last, when he said that reports of a recent American visit indicated that British television was definitely better than American and that our pictures were better than before the war.

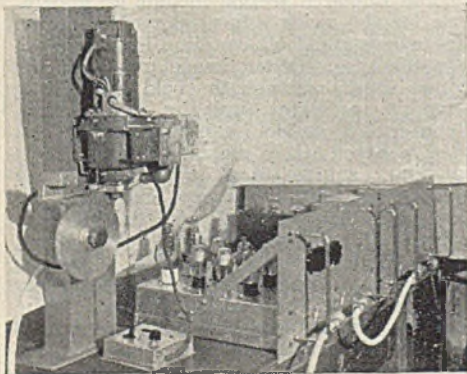
Members of the National Electrical Contractors' Trading Association, Ltd., are reminded that the partial census of production for 1946 is not affected by the Government statement regarding the postponement of the full census of production, and that they have the obligation to complete and return the census forms received earlier this year in respect of their electrical contracting activities. Under the revised procedure whereby members may obtain N.H.D. symbols for cookers, in approved cases from a Regional Materials Officer, the latter will secure such symbols from the local supply authority and pass them on to the members. Therefore, when applying for N.H.D. symbols members should state the supply authority for the area in which the cooker is required, and the exact type of N.H.D. cooker to be supplied. Members of the Electrical Contractors' Association are informed that in the case of Government contracts for work costing less than £100, if the tenderer fears that there may be labour increases between the date of acceptance and the date of starting work on site, which he is not prepared to carry in his price, it is open to him to ask for the operation of a wage variation clause.

Physical Society Exhibition

New Apparatus for Research and Engineering

CONTINUING our review of the Physical Society's exhibition, which opened at the Imperial College, South Kensington, on Wednesday morning, and will close to-morrow, we review briefly a further selection of the exhibits from the stands of the 100-odd manufacturers who are participating.

In addition to a range of the more conventional forms of test gear, including a new pattern clip-on ammeter and an electrostatic high-voltage indicator reading up to 11 kV, Ferranti, Ltd., are showing a number of unusual items, such as xenon-filled and miniature h.v. rectifiers and rolled paper capacitors in which the lead insulation takes the form of a specially designed copper-glass seal. Among the instruments are the "Tesvac," an oscillator with adjustable tungsten gaps designed for use as a gas or leak indicator, and a thunderstorm recorder—essentially a calibrated radio receiver using an ordinary outdoor aerial—which has been developed primarily to warn the operating personnel of power stations of approaching thunderstorms. An interesting application of electronic techniques to the clothing industry is seen in a cloth guiding device and control equipment, in which a photo-cell control signal is derived from the lateral position of a cloth selvedge and



Ferranti cloth-guiding device

used to adjust the angular position of a guiding wheel, so that cloth leaving the wheel is always correctly positioned for entry into a processing machine. The control signal is suitably amplified and operates a split-field motor generator which in turn varies the angular position of the wheel.

Nalder Bros. and Thompson, Ltd., are displaying some new measuring instruments. One of these, a miniature gal-



Four-meter a.c. test set by Nalder Bros.

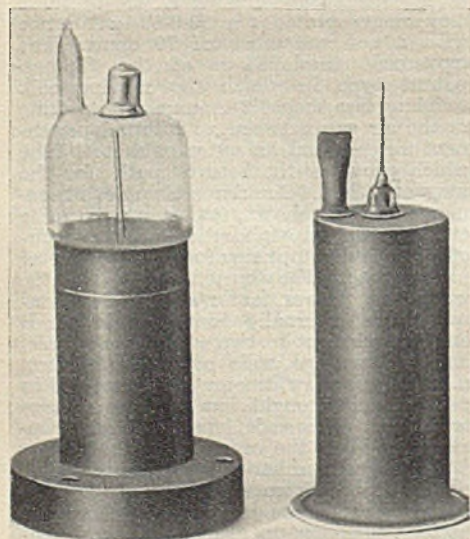
vanometer, possesses a measuring element only 0.6 in. in diameter and of total weight approximately 10 grammes. Arranged with a centre-zero scale for use as a portable galvanometer, one of these movements provides a 50-0-50 μ A range with a coil resistance of 70 ohms. The movement employed is of the Lipman patent type in which the moving coil, weighing less than 0.2 grammes, is working in the air gap between an internal permanent magnet and an outer mild steel tube which provides the return path for the magnetic flux. Circular scale m.c. instruments are also shown, and among portable test sets is a three-phase balanced load circuit analyser comprising four 4 in. diameter instruments. The current coils of the wattmeter, power factor meter and ammeter are internally connected in series and brought out to two current terminals, and the voltage coils of the wattmeter, p.f. meter and voltmeter are connected in parallel and brought out to three voltage terminals. The scale length of each instrument is of the order of 9 in.

Among a number of new items being shown by Electro Methods, Ltd., are magnetic amplifiers, of a type which can be applied to follow-up mechanisms and self-balancing devices, vibrators, timing relays, and a temperature-controlling unit embodying an adjustable contact thermometer and a relay device. Non-linear resistances and surge limiters are also being shown, and the use of silicone varnishes to impregnate flexible resistances so that they may be worked at above-

normal temperatures is demonstrated. There are also several types of relays, some embodying high sensitivity with anti-gravity devices.

Ernest Turner Electrical Instruments, Ltd., have on their stand several new models of orthodox measuring instruments, and in addition are showing a differential meter, which consists of a movement with two insulated windings. The coils of these are matched and one direct reading can give the result of adding, subtracting or balancing the currents in the two coils. Another development, designed for the simultaneous checking of circuit conditions at two separate points, is a twin-moving coil meter. In this device, the two movements are mounted in one case so that their pointers, which are of different colours, cover the same path over the one dial. The movements are designed, of course, to have the same damping and speed characteristics. An equipment for measuring the restoring torque of instrument hair-springs by a periodic time method, correctly to within ± 0.5 per cent., and a high intensity discharge lamp for speed photography purposes are also to be seen.

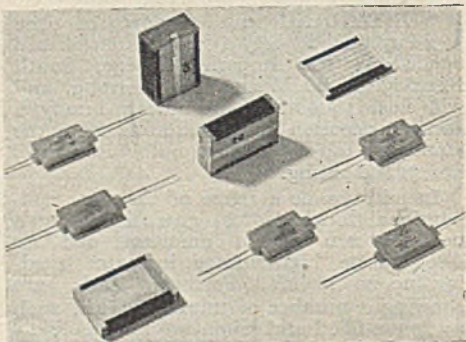
Various temperature measuring devices are being displayed by the Foster Instrument Co., Ltd., and include an optical



Two examples of Geiger-Müller counter tubes, shown by the G.E.C.

pyrometer of the balanced bridge "disappearing filament" type, and a portable balanced-bridge air thermometer, the latter working over the range 0–100°F, and with

a scale readable by estimating to within 0.1°. Another sensitive instrument in the same category is the cascade range electrical resistance thermometer recorder, an



Selection of Johnson, Matthey silvered-mica condenser plates, and finished condensers

instrument which has a range of 0–75°C. in six steps, and providing a record readable to 0.05°C. A range of 12 selected thermo-couples, designed for such applications as the measurement of sparking-plug electrode temperatures, jet engine exhaust temperatures and generator stator temperatures is shown, and there is also a high magnification introscope for cylinder bore examination.

Some results of the year's development work at the General Electric Co., Ltd., research laboratory which are to be seen in the Research section include an apparatus for the quick adjustment of operating frequency and load coupling in magnetron manufacture. Other developments in the very short wavelength field include a tunable oscillator unit in which rubbing metal contacts are eliminated. A new automatic machine is shown making squirrel-cage type grids for thermionic valves. A cap and band are loaded on the mandrel and the machine then spot-welds a wire to the band, stretches the wire, spot-welds it to the cap, cuts it off and indexes and repeats the cycle until the grid is completed. The machine makes grids of this type within a wide range of dimensions. Geiger-Müller counter tubes for beta and gamma ray measurement are being demonstrated, and include all-metal types with end-windows of very thin duralumin and copper. Other instruments designed for the testing of valves during manufacture are shown, and there are also several exhibits in the field of lighting.

Resistance wires, constant resistance materials, and thermo-couples are among a number of materials and components for

electrical apparatus shown on the stand of Johnson, Matthey and Co., Ltd. Other examples of precision work include silvered mica condenser plates and condensers and other forms of metallised ceramic, strip for instrument springs and suspensions, electrical contacts and vitrified enamel scales on glass. There are also items of gamma-radiographic equipment and some specialised electro-chemical and micro-chemical apparatus.

The Plessey Co., Ltd., are displaying a number of test instruments, among which are a frequency synthesiser, a crystal-controlled frequency standard with an accuracy of three parts in 10^7 and working over a range of 500 cycles to 10 Mc/s. direct, and up to 300 Mc/s. by harmonic extension. A beat-frequency oscillator, with a frequency range up to 30 kc/s., an I.F. alignment oscilloscope incorporating a variable speed frequency-modulated oscillator, and an electrolytic condenser bridge are also shown. An interesting apparatus is an automatic bridge designed for the repetition comparison of mixed impedances and employed for the production testing of circuit assemblies. The equipment is capable of checking the component values of 47 circuits, each test taking $\frac{1}{2}$ sec.

The Metropolitan-Vickers Electrical Co., Ltd., are exhibiting both in the Research and Trade sections. In the first category, demonstrations are given of the method of shadow-casting now applied to electron-microscopy, the measurement of the thickness of thin films by the multiple-beam interferometer method, and the recording of high-speed particles by Geiger-Müller counters. There is also a recording electrometer for gauging the intensity of the ion-current beam in mass-spectrometer analyses and a model of the poles, yokes and coils of a betatron magnet system. In the Trade section, the company is showing a 50 kV electron microscope, high-vacuum evaporation plant and oil condensation pumps. One unusual development is a lamination detector, originally made for the detection of laminations (rolled-out pipes) in steel sheet. It is used for testing bearings for the satisfactory adhesion of white-metal linings and for testing small brazed joints, bi-metal strips, etc. The method employed consists of applying one current contact and one potential contact to each surface of the material. The current contacts pass current through the thickness of the material, while the others are used for measuring the potential difference between the two sides. Any discontinuity in the electrical conditions, such as is associated with a defect lying across the path of the current, is indicated on a reflecting galvanometer.

A range of sizes and types of constant voltage transformers is shown by Foster Transformers and Switchgear, Ltd., including a 2 kVA set with waveform correction and compensation for low power factor loads. These sets give an output voltage constant to ± 0.5 per cent. with a $\pm 12\frac{1}{2}$ per cent. change in mains voltage. An interesting additional feature is the correction for changing mains frequency, catered for by a separate unit which may be added to any size set. This ensures a constant output voltage on a fixed load when the mains frequency varies by $\pm 2\frac{1}{2}$ cycles.

In addition to a versatile new multi-range meter, British Physical Laboratories have on view several pieces of bench apparatus, such as an insulation resistance meter, reading up to 50 000 megohms, an



A new a.c.-d.c. multi-range tester, made by British Physical Laboratories

electrolytic condenser bridge, an insulation breakdown tester capable of a maximum output voltage of 5 kV a.c. or d.c., and an elaborate universal impedance bridge. This latter instrument measures resistance from 0.1 ohm to 1 megohm, capacity from 10 pF to 1 000 μ F and inductance from 10 μ H to 1 000 H. An internal oscillator provides a bridge frequency of 1 000 cycles.

Further reviews of the new electrical apparatus seen at the exhibition will appear in our next issue.

• 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.

SIR CLAUDE D. GIBB, chairman and managing director of C. A. Parsons and



SIR CLAUDE D. GIBB

Co., Ltd., and deputy chairman of A. Reyrolle and Co., Ltd., is to have conferred upon him by Durham University the honorary degree of Doctor of Science. MR. T. D. H. HOGG, charge engineer at the Blackburn Meadows generating station of the Sheffield Corporation, has been appointed to the position of assistant power station superintendent at the Neepsend generating station. Mr. Hogg graduated B.Sc. in electrical engineering at Edinburgh University, and received his practical training with the British Thomson-Houston Co., Ltd., at Rugby. He joined the Sheffield electricity department in 1938 as a junior assistant engineer, being employed at the Blackburn Meadows generating station, where he became charge engineer. Mr. Hogg is an associate member of the I.E.E.

SIR STANLEY ANGWIN, chairman of Cable and Wireless, Ltd., has been appointed chairman of the Radio Research Board in succession to Lieut-Col. Sir George Lee.

MR. A. C. LINDSEY, station engineer at the Dalmarnock power station of the Glasgow Corporation, has retired on superannuation, and Mr. Robert Scott, now assistant, has been promoted to fill the vacancy.

ENGINEER VICE-ADMIRAL SIR HAROLD BROWN has been appointed chairman of the Fuel Research Board of the Department of Scientific and Industrial Research in succession to Sir Harold Hartley.

Mr. F. H. D. PAGE, chief signal and telegraph engineer at the G.W.R. works at Reading, is retiring on reaching the age limit, and is being succeeded by Mr. Arthur W. Woodbridge, an associate member of the I.E.E.

MR. H. V. POTTER, managing director

of Bakelite, Ltd., has been elected to the Grand Council of the Federation of British Industries. Mr. Potter is one of the pioneers of the British plastics industry and has been associated with the development of phenolic materials for more than 30 years. He is president of the Institute of Plastics.

MR. D. LIGHTLE, of A. Reyrolle and Co., Ltd., as chairman, and Mr. D. Richmond, of the L.N.E.R., as vice-chairman, have been nominated by the Committee of the I.E.E. North-Eastern Students' Section for election for the 1947-48 session.

MISS EMILY HORNSEY received a presentation on her retirement from the employ of W. T. Henley's Telegraph Works Co., Ltd., North Woolwich, after more than 47 years' service. During the war Miss Hornsey was awarded the British Empire Medal in recognition of her faithful and diligent services.

MR. G. W. E. HOOPER, secretary of the English Electric Co., Ltd., has been elected to the Council of the Chartered Institute of Secretaries. He is a Fellow of the institute. Other prominent representatives of the electrical industry on the Council are Mr. H. F. Carpenter (president), clerk and manager of the West Midlands J.E.A., and Mr. C. R. Heathcock (vice-president), vice-chairman of the West Midlands J.E.A.

COLONEL H. J. WELLINGHAM was elected president of the Batti-Wallahs' Society in succession to Mr. P. V. Hunter, at the general meeting of the society recently. Messrs. A. G. Freeborn, Forbes Jackson, A. E. Mohring, J. W. Porter, H. J. Stone and Alan Williams were elected members of the Committee; Mr. M. Whitgift was re-elected hon. secretary and treasurer; and Mr. J. Temple Hazell was elected to the new office of assistant hon. secretary.

MR. A. J. PHILPOT, director of the British Scientific Instrument Research Association, has been appointed director of the Scientific Instrument Manufacturers' Association of Great Britain, Ltd., as from April 1. He will continue in the office of director of the B.S.I.R.A. and will carry out the duties of both at 26, Russell Square, London, W.C.1. The close connection between the S.I.M.A. and the B.S.I.R.A. will thus further be strengthened.

ened, and the former will share certain facilities offered by the Research Association, such as supplying technical information. Mr. Philpot graduated B.Sc. with first-class honours in physics at London University and was Jelf medallist at King's College in 1911, Layton Research Scholar at King's College for three years, and a research exhibitor at Emmanuel College, Cambridge, in 1913. In the 1914-18 war he served as a captain with the Royal Engineers, in charge of a sound-ranging section. From 1919 to 1920 he was a lecturer in physics, King's College, University of London, until his appointment as chief physicist of the B.S.I.R.A., becoming director of research and secretary of that body in 1937. In the late war Mr. Philpot was chairman of the Plastic Optics Committee, chairman of the Inter-Service Optical Instrument Committee, and a member of many technical committees. In 1942 he visited the U.S.A. on behalf of the Admiralty to report on instrument developments for military use in the States and in 1945 he was promoted from O.B.E. to C.B.E.

MR. A. STEWART, of the East Anglian Electricity Supply Co., has been appointed to the position of consumers' and installation engineer with the Bedford electricity undertaking.

MR. E. C. SHACKLETON has been appointed chief constructional engineer to Newport Corporation and will take charge of the erection of the £15 000 000 power station to be built at the mouth of the River Usk.

MR. L. B. HOGARTH, who has been borough electrical engineer at Whitehaven for 34 years, has retired. He was presented with a solid silver cigarette case at a large gathering of past and present members of the electricity department staff, the gift being handed over by Mr. F. Pellatt, the oldest employee. Mr. Hogarth's successor is Mr. F. G. Roynon, who has been mains superintendent at Whitehaven for six years. Aged 38 years, Mr. Roynon was chief assistant to the Buckrose and South-East Yorkshire Light and Power Co. before going to Whitehaven.

MR. HEDLEY LARGE, borough electrical engineer of Stoke Newington, will be retiring on April 27, after 40 years' service. The Borough Council have expressed their appreciation of the long and faithful service rendered by him. Mr. Large received his technical education under the late Prof. Sylvanus Thompson at Finsbury Technical College, and obtained experience with two or three electricity supply undertakings and the Central London Railway before going to Stoke Newington in 1907. He was promoted to the position of borough electrical engineer in 1928. On Saturday, March 29, the staff of the elec-

tricity undertaking gave a dinner in his honour in the Town Hall canteen, at which Mr. S. F. Bone, chief clerk in the undertaking and chairman of the Staff Social Committee, presented to Mr. Large an electric clock as a token of appreciation from the staff. Mr. J. P. Tanner, consumers' engineer and meter superintendent with the St. Pancras electricity department, as announced in our issue of March 14, is to succeed Mr. Large.

MR. J. L. BAIRD, television pioneer, of Bexhill, left £7 370 (n.p. £7 102).

MR. L. F. CHRISTIE, electrical engineer, Chelmsford, left £49 283 (n.p. £46 496).

Obituary

MR. THOMAS D. CARTWRIGHT, partner in the firm of John T. Cartwright and Sons, Ltd., electrical distributors, Glasgow.

MR. J. W. BEAUCHAMP, first director of the British Electrical Development Association, on March 28, aged 74 years. Before his association with the E.D.A., for the formation of which he was largely responsible, Mr. Beauchamp had been deputy engineer with the Sheffield electricity undertaking and chief electrical engineer at Tunbridge Wells and then West Ham. In 1927 he relinquished the directorship of the E.D.A. to take up the position of general manager of the South Wales Power Co. Three years later he was appointed by the Central Electricity Board as district manager of the South-West England and South Wales area, and in 1935 became commercial manager for the Board. He retired in 1937. He was a member of the I.E.E. and had served on the Council.

MR. REGINALD W. BILES, operation engineer with the Central Electricity Board for the South-West England and South Wales area, at Bristol, aged 51 years. Mr. Biles was educated at the Uckfield Grammar School and received his technical training at Faraday House, where he obtained the Faraday House Diploma. From May, 1913, to February, 1915, he was a charge engineer at the Dover electricity works, and from November, 1915, to January, 1919, he served with the R.A.F., being in charge of mechanical transport. In September, 1920, he went to A. Reyrolle and Co., Ltd., as a technical assistant, and remained with that company until he joined the Central Board in the autumn of 1930 as assistant engineer in the South-Western area. Later he was made technical engineer and he became operation engineer in January, 1938. Mr. Biles took a keen interest in the proceedings of the I.E.E., of which he was a full member, and he was chairman of the Western Centre.

Electricity Bill in Committee

Controversy on Compensation Clauses

AT the beginning of discussions, in the Standing Committee, of the compensation clauses, Opposition speakers charged the Government with damaging public credit by its attitude towards the securities of the Central Electricity Board and the joint electricity undertakings. Mr. Nigel Birch moved an amendment to ensure that these securities should be treated in the same way as London Transport three per cent. guaranteed stock and North Metropolitan Power Station five per cent. debenture—the two stocks on which the Government had shown a change of mind.

COMPANIES AND PUBLIC BOARDS

Opposing the amendment, Mr. Glenvil Hall, Financial Secretary to the Treasury, claimed that there was no analogy whatever between these public boards and the guarantees given to certain classes of London Transport stock. It was the Government's desire, he said, to see compensation on a fair and just basis, but he could not by any stretch of imagination place these securities in the same category as London Transport three per cent. guaranteed.

After Col. Crosthwaite-Eyre had said that if these securities were not going to be honoured it would indeed be a blow to the public, the Financial Secretary stated that in the case of the C.E.B. and the joint undertakings no guarantee against default had been given, and there was no difference between these securities and those of other electricity undertakings.

There was considerable controversy over Clause 15, which gives the boards the right in certain cases to repudiate agreements made after November 19, 1945, which were not "reasonably necessary." It was argued that the uncertainty caused by this wording was having a paralysing effect upon the industry.

The Parliamentary Secretary to the Ministry of Fuel and Power, Mr. Gaitskell, replied that reductions of tariffs were not covered by the clause. Moreover, disputes arising out of the disclaiming of agreements would go to arbitration.

When the Committee adjourned, members were discussing another amendment to Clause 17, moved by Col. Crosthwaite-Eyre, which had the object of ensuring that compensation should be paid direct to the companies whose assets were being taken over, as in the case of the Coal Industry Nationalisation Act, and not to the shareholders.

This argument was renewed when the Committee met for the last time before the Easter recess, but Mr. Glenvil Hall said he saw no reason why these companies should be allowed to remain in existence and act as a "post office" between the Central Authority paying compensation and the shareholders. There was no object in keeping these bodies alive. The Government had nothing to hide at all, and this was a commonsense method of tidying up the companies when they ceased to function. Referring to companies with overseas commitments, he said it would be easy for some arrangement to be made by the directors to have these interests safeguarded. If the amendment was accepted, there would be no guarantee that compensation would be passed to shareholders.

Mr. Nigel Birch then moved an amendment which would enable a company, if it felt aggrieved, to go to an independent tribunal for a valuation. This proposal was rejected by Mr. Glenvil Hall, who said it would involve lengthy proceedings.

Earlier, Mr. Glenvil Hall had moved an amendment to give effect to the scheme adopted under the Transport Bill, under which stocks in the hands of holders would, at the time of transfer, automatically be regarded as British Electricity Stock at the value that stock was given on vesting day. This would enable individuals so minded to sell or buy notwithstanding the new stock had not been issued.

CLAUSE 17

Another amendment to Clause 17 which provoked a lively discussion was moved by Col. Crosthwaite-Eyre, to secure that whatever day compensation was distributed, the value paid by the Government should be equivalent to the value the stockholder was surrendering.

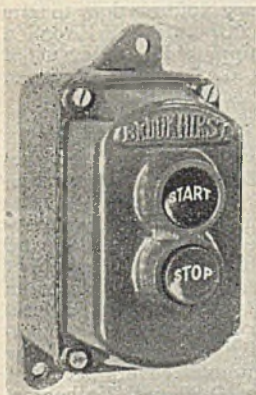
To this, Mr. Glenvil Hall answered that it would be unfair to recipients to try and guess what would be the value of Government securities at the date they would receive compensation. It was generally assumed that the rate of interest on the compensation stock would be 2½ per cent.—it might even be 3 per cent.—nobody knew. It was the same with the actual money value. All the chances were that the new stock would be issued at par.

When the Committee adjourned, after having sat for 12 days, Clause 17, out of a total of 67 clauses and three schedules, was still under discussion. The next meeting will be on Wednesday next.

Equipment and Appliances

Suds-proof F.H.P. Starter

Giving details of a new suds-proof F.H.P. starter which they are now marketing,



Surface-mounting model, suds-proof starter switch

Brookhirst Switchgear, Ltd., say that the unit has been completely redesigned since its first introduction and embodies mouldings and die-castings, ensuring consistency of performance. For normal duty, it is available with various front plates for flush-cavity-mounting, and also in dust-protecting surface-mounting boxes. The starter unit is attached to a cast iron lid and contained within a cast iron box, sealing being by oil and suds-proof gaskets between box and lid, with diaphragms of similar material under each moulded Bakelite push button. The switch itself is a triple-pole, double-break type, with silver contacts, an overcentre toggle and quick-break action. Triple-pole indirectly heated thermal overload trips, acting on the toggle mechanism, provide protection. It is rated at $\frac{1}{2}$ H.P. at 440 V a.c., or 220 V d.c., and weighs seven pounds.

Coloured Plastics Finishes

A brochure issued by Lewis Berger and Sons, Ltd., of Homerton, E.9, describes their new decorative and protective coating for metal and plastic surfaces, "Kemplastite." This coating is based on certain raw materials used in the plastics industry and is tough, resilient and damage-resisting. It is, the makers claim, unaffected by stresses and strains which would cause ordinary finishes to deteriorate. High temperature and protracted stoving processes are unnecessary, a convection temperature of 200°-220°F. for 30 minutes, or infra-red baking for 6-10 minutes, being sufficient, and an added advantage is that polishing is dispensed with, the high-grade finish, from eggshell to high gloss, coming direct from the spray gun. "Kemplastite" is manufactured in a range of 22 colours, including black and white, and may be applied

direct to certain metals, although it is necessary in other cases to use priming coats. For the finishing of castings and similar components, a filler is available to provide the necessary surface for the final processing. Any plastics or metal article, the makers state, may be forwarded to them for an experimental coating.

New Ekco Radiogram

The newest product of E. K. Cole, Ltd., is a radio-gramophone—the company's first post-war venture in this field—which is now ready, in limited quantities, for delivery. The five-valve radio receiver operates on the television sound channel and broadcasting channels at 16-50 m. 200-550 m. and 900-2 000 m. and either press-button (three medium-wave and two long-wave) or manual tuning can be carried out. Other features include an edge-lit glass tuning scale and a four-position tonal balance switch permitting positive selection of the response best suited to broadcast and reception conditions. This switch is effective on both radio and gramophone. A 10 in. p.m. speaker is built in with three-way sound diffusion and the size of the cabinet front-



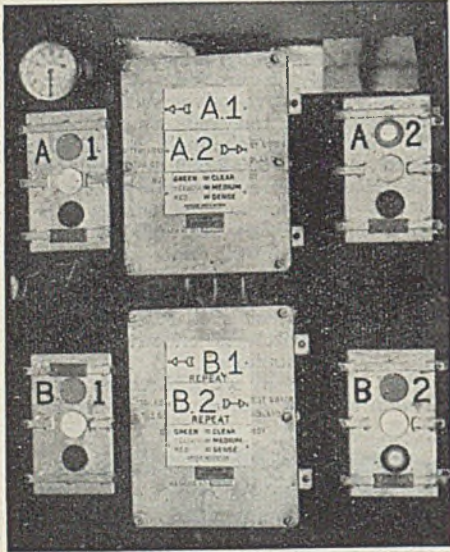
In this view of the Ekco radiogram, press-button and volume controls are seen

age provides a large baffle area. The gramophone unit employs a standard magnetic pick-up on a balanced arm with ball-bearing pivots. The turntable is spring suspended, and automatic brake, speed regulator and needle cups are provided. For normal radio reception using the press-button control, it is unnecessary to raise the lid; but at other times this is

facilitated by the provision of an "inset" hinge, which leaves a four inch shelf at the back of the cabinet, permitting articles on top to be pushed to the rear and also allowing the instrument to be placed flush against a wall. The exterior is finished in a figured walnut veneer.

Photo-Electric Smoke Warning

A photo-cell smoke detecting equipment, designed by the General Electric Co., Ltd., in conjunction with the Admiralty, primarily for marine use with oil-fired



Smoke indicating lamps for four marine boilers, grouped in the main control room

boilers, has recently been fitted to warships, including H.M.S. "Vanguard." Its purpose is to give the boiler attendant immediate warning of a smoky condition in the uptake, and so make possible maximum efficiency of combustion. A projector lamp-house, reflecting mirrors, photo-cell amplifier, indicating lamps and control box are the essential components. Light from a 12 V, 36 W lamp is projected across the uptake and reflected by a mirror through a focussing lens on to the cathode of the photo-cell. In order to obtain the earliest possible indication of any change in combustion, the projector photo-cell, amplifier and mirrors are mounted in the uptake as close as possible to the boiler, and are protected by removable armour plate glasses which prevent their oiling up under working conditions. A control box, usually placed in the main engine control room, contains a constant voltage current transformer and calibrating resistances, while two indicating lamp boxes for each

uptake are placed with one adjacent to the boiler controls and the other in the main engine control room. In the illustration, these boxes can be seen grouped in the main control room of H.M.C.S. "Warrior." Three coloured glasses—green, indicating a clear funnel, yellow, a slight haze, and red, excessive smoke—provide the necessary information to the boiler attendant. Operation is from a 230 V, 50 cycles supply; in the event of there being only a d.c. supply available, a rotary convertor is required.

Versatile Valve Tester

The Type 217 valve tester, manufactured by the H. C. Atkins Laboratories, Cumberland Road, Kew, Surrey, is distinguished by having two wide-scale moving-coil meters, one giving insulation and current readings, and the other direct readings in mutual conductance. Thirteen valve bases of the types in most general use are fitted, but sockets and leads enable any other valve to be tested. The range of the instrument covers a direct reading of G_m from 0-20 mA/V, heater-cathode insulation up to 10 megohms and diode and rectifier emission up to 100 mA. The voltages available on the socket pins are 50-250 V, for anodes and screens, 1.4-110 V, for filament supplies and 25 V for grid bias. The tester is a.c. operated from 50-60 cycles mains, 200-250 V.

Non-Burning Cooker

The Eralite Manufacturing Co., Ltd., of 194, The Broadway, Wimbledon, London,

have extended their range of electric appliances by the inclusion of their "Cuisiniere," a non-burning cooker made in two parts. The lower half, which boils water to cook food in the upper pan, is



"Cuisiniere" in use

composed of a black plastics case into which a spun aluminium anodised pot with a ring element is fitted. The top half of the cooker is an aluminium cooking pan fitted with a black lid and a plastic "easy-hold" handle. A three division egg poacher, fitting into the lower half, is provided. Power consumption is 750 W and the cooker, for 220-220 V or 230-250 V, is supplied with 8 ft. of three-cored flex.

Industrial Information

New Factory Opened

C. H. Blackburn and Co., Ltd., announce that on March 31 production commenced at their new works at Calne, Wiltshire. The new factory replaces their London works destroyed by enemy action in May, 1941, and the address is: Stalex Works, Shelburne Road, Calne, Wilts, to which all goods should be sent as well as correspondence on technical matters. Accounts and matters of policy will continue to be handled by the head office, at 10, Gray's Inn Road, London, W.C.1.

Lamp Tenders

The tender of Thorn Electrical Industries, Ltd., for the supply of electric lamps to the Hertfordshire County Council has been accepted for a further period of twelve months; the company's tender for the supply of Atlas lamps to the Huyton and Roby U.D.C. has been accepted for one year from April 1, and that submitted by Potteries Electrical Warehouse, Ltd., for the supply of Atlas lamps to the City of Stoke-on-Trent has been accepted for the six months to September 30 next.

German Industrial Reports

Among further reports containing scientific and technical intelligence from German industry, now available at the sales offices of the Stationery Office, are the following: B.I.O.S. 530, Photosurfaces. A Report on German Developments of Photocells, Electron Multipliers, Television Pick-up Tubes (6s.); B.I.O.S. 1136, Technical Survey of Electric Cable Industry in Germany (5s. 6d.); B.I.O.S. 1097, German Battery Electric Road Vehicles (5s.); F.I.A.T. 894, Electrostatic High Voltage Generators (1s. 6d.).

Lighting a Shipbuilding Berth

To enable work to continue on the construction of the hull of a vessel in a shipyard during the dark winter hours, Metrovick illuminating engineers have recently designed a system of floodlighting for William Doxford and Sons, Ltd., Sunderland. The first berth being lighted is 88 ft. wide tapering from 90 to 110 ft. in height at the riverside, and is capable of taking a hull up to 550 ft. in length. With this lighting scheme an intensity of 1.2 lumens per sq. ft. is possible at keel level and as the hull develops the intensity increases to 3.7 lumens per sq. ft. on the sides at 20 ft. until a maximum of 6.5 lumens per sq. ft. is obtained at deck level. This illumination is provided by means of totally enclosed floodlight projectors and parabolic angle reflectors hous-

ing high wattage general service lamps. The scheme consists of seven 500 W floodlights mounted in the centre of the berth at heights sloping from 90 ft. to 110 ft.;



A system of floodlighting installed in a shipbuilding berth

14 500 W floodlights mounted on crane columns in two rows of seven, on the sides of the berth, approximately 76 ft. high; and 12 1 000 W parabolic reflectors, mounted in two rows of six, 50 ft. high. The lighting load is 22.5 kW. Messrs. Doxford and Sons, Ltd., are to equip other berths in a similar manner.

Cheerful Rationing

Further instruction on the use and operation of the electric cooker is given in the March and April "Cheerful Rationing" cards issued by the E.A.W., 35, Grosvenor Place, London, the grill or grill-boiler, and the oven, respectively, being discussed. In addition, grill and oven menus are given.

Canteens in Industry

Claiming that the industrial canteen has become an essential employce service in large firms, and in many smaller concerns, the Industrial Welfare Society has published a booklet, entitled "Canteens in Industry" (price 4s. 6d.), giving practical information on planning to assist employers and all concerned with the setting up of a canteen, as well as on many aspects of management for the guidance of those in charge of canteens. Other subjects covered are the kitchen, methods of service, finance, staff, food and diet and legal aspects.

National Register's Journal

Under the title of "Registration," and described as "the official review of the National Register of Electrical Installation

Contractors," a new publication has appeared. In the foreword, Mr. P. V. Hunter, chairman of the Registration Board, states that the venture is in no sense competitive with the established technical periodicals. The intention of the sponsors is to provide, free of charge, to all certificate-holders of the National Register and others intimately concerned with installation work, a journal of their own in which they may find information on matters of special interest.

N.Z. High Commissioner at M.V. Works

Confidence in Britain's ability to weather the economic storm was the keynote of a speech by the High Commissioner for New Zealand, Mr. W. J. Jordan, at the twenty-second annual dinner of the M.V. Overseas Division in Manchester. Subsequently the High Commissioner toured the works of the Metropolitan-Vickers Electrical Co., Ltd., at Trafford Park, where he saw, in addition to generating plant being manufactured for the British grid, electrical equipment being made for his own country. A large amount of hydro-electric plant for New Zealand has been manufactured in these works, including three water-wheel generators of 33 333 kVA capacity, each weighing 330 tons and having an overall diameter of 34 ft., shipped last year for the new power station at Karapiro to which the High Commissioner made special reference in his speech.

Cold Storage Operations

Under this title, a 72-page instructional monograph by A. E. Miller, descriptive of the operations and methods of up-to-date cold storage practice, has been published on behalf of the Institute of Refrigeration. It is the first of a short series of educational monographs dealing with different aspects of refrigeration and should prove a useful guide to all who are interested in the subject. Copies (price, 7s. 6d.) can be obtained from the book department, Modern Refrigeration, Empire House, St. Martin's-le-Grand, London, E.C.1.

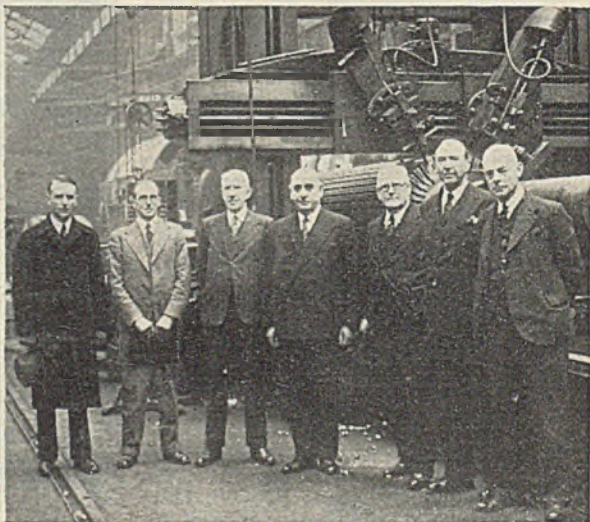
War and Peace-time Developments

Entitled "How it Changed their Lives," an attractive 44-page brochure has been issued by E. K. Cole, Ltd., for limited circulation to trade connections here and

overseas. It tells the story of the pre-war Ekco organisation at Southend, how it went over entirely to the production of essential war equipment and was dispersed to various parts of the country, the reconversion to peace-time activities, new developments and expansion, and the company's contribution to the export drive.

English Electric War Diary

Attractively bound in blue and silver and profusely illustrated, the "War Diary of the English Electric Co., Ltd.," records on 220 pages the achievements at the four main works of the company at Stafford, Preston, Rugby and Bradford



MR. W. J. JORDAN, P.C., High Commissioner for New Zealand in the large electrical machine department of the Metropolitan-Vickers works at Trafford Park. On his right is MR. D. MAC ARTHUR, director and general sales manager of the Metropolitan-Vickers Electrical Co., Ltd., and on his left, MR. J. F. PERRY, director and general manager of the company

and their satellites between March, 1938, and August, 1945, in meeting the various needs of all the fighting services in every theatre of war and of Civil Defence and industry on the home front. In addition to electrical equipment and instruments, the company manufactured tanks, bombers and fighter aircraft, including the "Vampire" jet-propelled interceptor. A further 26 pages are devoted to the war-time activities of D. Napier and Sons, Ltd., who are associated with the English Electric Co., Ltd.

"Front Line Current"

In an illustrated booklet bearing this title, Britannia Batteries, Ltd., Trafalgar House, 9, Great Newport Street, London,

have published an interesting record of their war-time achievements. Their contribution to the war effort was the supply to the three Services of large numbers of all-steel alkaline storage batteries. One interesting problem was the production of batteries capable of a minimum open current voltage of 300 A, with an arc voltage of 23-35 V for under-water cutting and welding in the repair of ships damaged below the water line.

A.M.E.M.E. Convention

The A.M.E.M.E. convention will be held this year at Grange-over-Sands from Wednesday, June 25, to Saturday, June 28. The annual general meeting will take place on Friday, June 27.

Research and the Smaller Firm

A report covering in full the proceedings of the conference on "Research and the Smaller Firm," held at the Albert Hall, Manchester on October 16 last year, has been published by the Manchester Joint Research Council and is now available at 2s. 6d., plus postage.

Circuits for Discharge Lamps

The latest B.T.H. Lighting Bulletin—No. 9, issued by the lighting section of the British Thomson-Houston Co., Ltd., deals with circuits for discharge lamps, and embodies the subject matter of a paper by Messrs. R. Marsted and J. N. Hull of the company's research laboratory, Rugby, read before the Illuminating Engineering Society in London.

Wilco-Wiggins Thermometal

A new 45-page publication on the temperature-sensitive bi-metals, or "Thermometals," produced by the H. A. Wilson Co. in the U.S.A., has been issued by Henry Wiggin and Co., Ltd. Copies may be obtained, without charge, from the company at Wiggin Street, Birmingham, 16.

Radiolympia

The first post-war National Radio Exhibition, to be held at Olympia from September 30 to October 11, is much broader in scope than any previous radio show. It will embrace not only broadcast receiving sets, radiograms, television receivers, sound reproduction equipment, and their valves, components and accessories, but also transmitting and communication equipment, radar, and all the new applications of electronics. Special emphasis will be given to export, now so essential to the re-establishment of the national economy. Space will be allocated by ballot; and to be included in the ballot, application must be made to the secretary, Mr. R. P. Browne, 59, Russell Square, London, W.C.2, on the printed contract form so as to reach him not later

than May 31. All such applications must be accompanied by a deposit of 50 per cent. of the value of the space for which application is made.

Trade Publications Received

A new catalogue from the Morecambe Electrical Equipment Co., Ltd., Westgate Works, Morecambe, giving details and prices of their starters and control gear

The latest technical leaflet on soldering, issued by Fry's Metal Foundries, Ltd., Tandem Works, Merton Abbey, London, S.W.19, entitled "Soft Solders for Service at Elevated Temperatures."

A booklet entitled "Starting from Scratch," describing the beginnings and development of Higg's Motors, Ltd., Witton, Birmingham, and its manufacturing facilities.

"The National Bulletin," issued by the National Gas and Oil Engine Co., Ltd., Ashton-under-Lyne, giving details of a new comprehensive range of high-speed oil engines.

"Enfield Can Do It" Exhibition

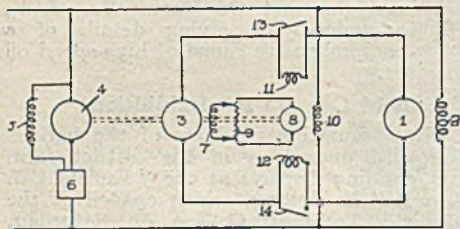
Representative products of the various electrical industries in the district form outstanding displays at the "Enfield Can Do It" Exhibition, which opened at the Enfield Technical College on Saturday, April 5, and will conclude to-morrow evening. Every phase of civic, commercial and industrial life in Enfield is portrayed. The exhibitors include Belling and Co., Ltd., with electric heating and cooking appliances; Belling and Lee, Ltd., radio components; Cosmos Manufacturing Co., Ltd., valves, lamps, etc.; Enfield Cables, Ltd., various types of cables in sections, a three-core compression cable straight-through joint, wire drawing demonstration; Enfield Rolling Mills, Ltd., non-ferrous metal products; Edison Swan Electric Co., Ltd., lamps, with demonstration of filament coiling; valves and special instruments; Ferguson Radio Corporation, Ltd., radio receivers; Murex Welding Processes, Ltd., electric welding equipment and electrodes; the Northmet Power Co., a model of Brimsdown power station, public lighting equipment, house service units, test gear, and so on; Ripaults, Ltd., demonstrations of cable covering by knitting and wire whipping of telephone leads; cables for motor cars, and so on; the Majestic Electric Co., Ltd., battery chargers and measuring instruments; Thorn Electrical Industries, Ltd., Atlas lamps in process of manufacture, electric irons and vacuum cleaners; the Sterling Cable Co., Ltd., cables and flexible leads; Royal Small Arms Factory, dies for the manufacture of electric ceramics in the Government factories at Swinerton and Poole, tools, jigs, and other products.

Electrical Inventions

Hoisting Motor Control

A modified Ward-Leonard system, for the speed control of hoisting motors, is described. The arrangement is such that, on certain given steps of an automatic controller, the speed of the motor to be controlled will be low under heavy loads and high under light loads, whether the motor is driving or restraining.

Referring to the diagram, 1 and 2 are the hoisting motor and its separately excited field winding. The armature is fed at a variable voltage from the generator 3 of a motor-generator set, the motor 4 of which has a shunt winding 5 and a starter 6. The generator 3 is separately excited,



its field 7 being fed from a separate exciter 8. The controller 9 regulates the excitation of the winding 7, step-by-step, from a full positive to a full negative value. Three field windings, 10, 11 and 12, are provided for the exciter 8, the first of which is fed from a constant voltage supply and the remainder series-connected in the armature circuit of the hoisting motor 1.

The winding 11 is wound to oppose the main winding 10 when the motor 1 is taking power from the generator 3, while the winding 12 opposes the main field when the motor 1 is regenerating power—as when lowering the load. Automatically-controlled short-circuiting switches, 13, 14, open independently, when the current to or from the motor reaches a predetermined value, and thus reduce the generator voltage, on heavy loads, in inverse ratio to the load.

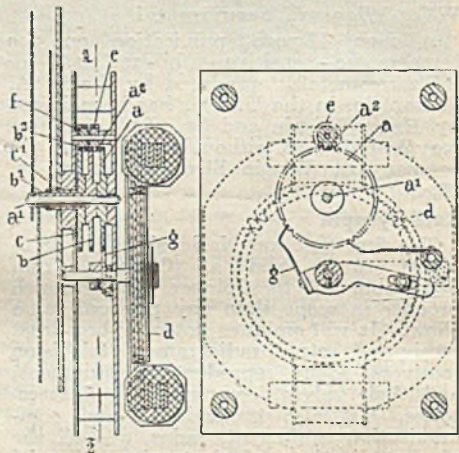
H. D. Wheeler and P. A. H. Mossay, of Gothic Works, Norwich. Application date, May 24, 1944. No. 583 053.

Electric Clock

The patentee describes a construction for synchronous electric clocks which is claimed to reduce the number of parts required, be capable of cheap manufacture and make possible small overall dimensions. A further advantage claimed is that the hands may be moved backwards or forwards without impairing the operation of the clock. It may also be made to emit a ticking sound, if desired.

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

The clock is provided with three toothed wheels a b c arranged side by side upon independent concentric spindles a^1 b^1 c^1 . The wheels are all of similar construction in regard to the number of teeth, but only the seconds wheel a is driven directly by the synchronous motor d . The seconds wheel has one tooth of increased width which meshes at the appropriate time with a coupling pinion e , which, in turn, engages the teeth of the minute wheel b . Every twelfth tooth of the latter is of increased width, and these five teeth b^2 engage a further coupling pinion f which also meshes with the teeth on the hour hand wheel c . The motor revolves at the rate of one revolution per second, and drives the second wheel by an eccentric pawl g . Thus, when the seconds wheel



has made a complete revolution, the minute wheel is moved through one tooth: at the end of each twelve-minute interval, the hour wheel is moved through one tooth. The minute and hour wheels are connected to their respective hands.

T. G. Farish. Application date, October 11, 1944. No. 583 153

Electricity Supply

Brighton.—The Electricity Committee is to proceed with the completion of the town's 33 kV ring main, at a cost of £221 694.

Bexhill.—Anticipating a profit of £5 874 for the year, the Electricity Committee has recommended a 10 per cent. reduction on accounts for the March quarter.

Hackney.—Sanction has been obtained by the Electricity Committee to borrow £14 000 for extensions at the Millfields Road station.

Middlesbrough.—The electricity estimates include £37 700 for mains and sub-station equipment; £7 765 for meters and meter testing equipment; £6 550 for hire-purchase and £1 820 for vehicles for the electricity department.

Islington.—After deciding recently that municipal servicing and repairing of radio sets should not be limited to sets sold by the Council, it has now been agreed that these activities should be so limited.

Fulham.—The collier "Fulham VI," serving the Borough Council power station, is to be converted to oil-burning, at a cost of £12 500. The Electricity Committee has approved an estimate of £200 000 for gas-washing plant.

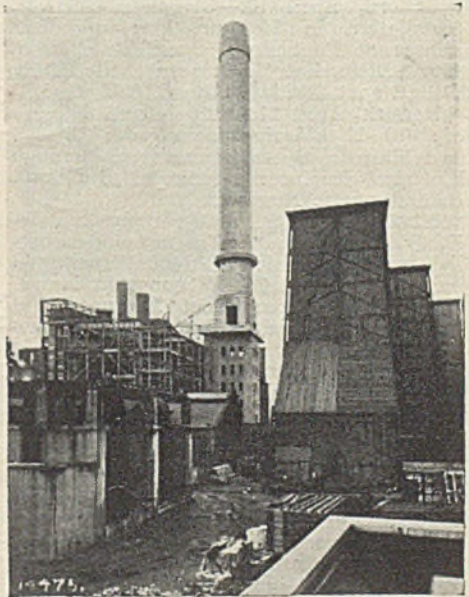
Guildford.—Following rebates to industrial consumers, arising from the fuel crisis, the Electricity Committee has now remitted standing charges of £1 752 in respect of public lighting, and £1 700 for water pumping.

Basingstoke.—Charges for electricity are to be reduced to the pre-war level, by abolishing percentage charges on the standard tariffs, and the ½d. per unit on the flat rates for lighting purposes, levied by the Council in 1944.

Burnley.—A deficiency on the year's working of £16 000 this year, rising probably to £27 000 by 1948, has been forecast by the electricity department. In view of impending legislation it has been decided to utilise part of the £82 000 reserve fund to meet the deficiency, rather than increase charges.

Alton.—The Minister of Fuel and Power has reversed his decision (reported in our issue of December 13 last) upholding the appeal of the Lord Wandsworth Agricultural College at Alton against the proposal to run the Aldershot-Reading overhead line through the college grounds, and has issued a compulsory order for the erection of the line over the original route suggested by the Rural Council and neighbouring local authorities.

London.—Consents have been issued to the establishment of a 25 kV underground main transmission line between Taplow and Maidenhead, in the area of the Metropolitan Electric Supply Co., Ltd., and to four 33 kV underground lines in the area of the Northmet Power Co. The County of London Electric Supply Co.,



A view of constructional work now taking place at the Valley Road power station of Bradford Corporation. The chimney, which is of reinforced concrete, is 350 ft. high and has an internal diameter of 22 ft. Offices are located in the base of the stack

Ltd., has applied to the Commissioners for consent to reinforce the system by two underground oil-duct type 33 kV cables between the Beddington and Purley substations.

Blackpool.—Referring to a decision to grant a 20 per cent. rebate to electricity consumers on the March accounts, a speaker at a recent Council meeting said this was due to the large consumption in the period, which had far exceeded estimates and caused a great increase in profits. The rebate would exceed £28 000, and would form a recompense for the inconvenience caused by the recent power cuts.

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:—

Epsom and Ewell, April 14.—Supply and delivery of h.t. and l.t. cable, p.i., lead-covered, armoured and served. Specification from Borough Electrical Engineer, Church Street, Epsom, Surrey.

Salford, April 16.—Complete electrical installation in 16 bungalows and 172 houses at Pendleton. Specification from City Electrical Engineer, Electricity Department, Frederick Road, Salford, 6.

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.

Manchester, April 21.—Supply and delivery, for one year, of meters and street-lighting lanterns for 300/500 W tungsten lamps and 500/1 000 W tungsten lamps. Specifications from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2.

Heywood, April 21.—Tenders for: (a) Supply and delivery of one 5 000 kVA, three-phase, 50 cycles, oil-immersed naturally cooled transformer for outdoor installation, ratio 11/6.6 kV; (b) supply and laying of 5 000 yds. 0.3 sq. in. 11 kV cable. Specifications from Borough Electrical Engineer, Electricity Department, Egerton Street, Heywood.

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.

Edinburgh, April 25.—Supply of: (a) telephone type control and indication equipment; (b) telephone type remote supervisory control and indication equipment; both for Portobello power station. Specification from Consulting Engineers, Messrs. Kennedy and Donkin, 12, Caxton Street, London, S.W.1.

Rhondda, April 26.—Supply and delivery of cables, wire, joint-boxes, fuse-boxes, cookers, wash-boilers and meters, for year ending March 31, 1948. Specification from Electrical Engineer, Electricity Works, Porth, Rhondda.

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 1s. each.

Newcastle-under-Lyme, April 29.—Supply and delivery of: (a) one 500 kVA rectifier, with transformer; (b) sub-station switchgear, comprising 14 panels for 11 kV and seven for 400 V, with ancillary equipment; (c) four 250 kVA, one 400 kVA and three 500 kVA sub-station transformers. Specifications from Messrs. Mackness and Shipney, Consulting Engineers, Parliament Mansions, Abbey Orchard Street, London, S.W.1.

Cleethorpes, April 30.—Supply and delivery of l.t. cables. Specification from Electrical Engineer and Manager, Grimsby Road, Cleethorpes.

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.

Salford, May 3.—Supply of: (a) 500 MVA, 33 kV, metal-clad switchgear; (b) four 15 000 kVA, 33/6.6 kV transformers; (c) 4 300 yds. 0.3 sq. in., 33 kV, three-core cable; (d) four neutral earthing resistors; (e) 250 MVA, 6.6 kV, metal-clad switchgear. Specifications from City Electrical Engineer, Electricity Department, Frederick Road, Salford, 6.

Sale, May 5.—(a) Supply, delivery and laying of 1 700 yds. 0.2 sq. in., 6.6 kV cable and the laying of 1 200 yds. 0.25 sq. in. l.t. cable in same track; (b) supply and delivery of two 500 kVA, three-phase standard indoor core-type double-wound 0.N. cooled transformers. Specifications from Borough Electrical Engineer, Town Hall, Sale, Manchester.

Plymouth, May 10.—Supply, delivery and erection of one 100-ton, overhead electric travelling crane. Specification from City Electrical Engineer, Arinada Street, Plymouth.

Dartford, May 10.—Provision of additional light points in houses on the Council's estates. Specification from Town Clerk, Town Clerk's Office, Dartford, Kent.

What Manufacturers Are Doing

G.E.C. Electrical Progress and Development

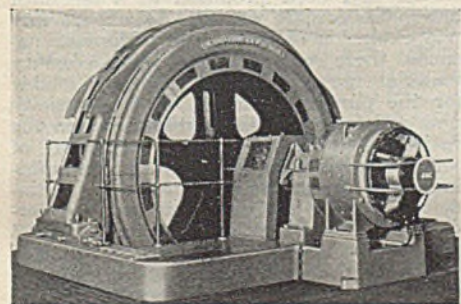
OF the manifold activities of the General Electric Co., Ltd., covering the whole field of electrical engineering, it is possible in the space available to mention only a few of the achievements and developments that took place recently. Reference to others has already been made in our columns.

Investigation of the problems of hydrogen cooling of alternator windings has been actively continued. The design of the seal and casing has received particular attention, as well as such ancillary equipment as apparatus to indicate the purity of the hydrogen, and oil purification equipment.

A salient pole synchronous motor rated at 1 500 H.P. has been supplied to the Government Gold Mining Areas (Modderfontein) Consolidated. Operating at unity power factor it drives a 30 ft. diameter ventilating fan at 120 r.p.m. The original drive was steam. A d.c. winder motor with a peak rating of over 4 000 H.P. has been completed for the Crown Mines, Johannesburg. The drive for the associated Ward-Leonard set is a slipping induction motor rated at 1 800 H.P., 2 200 V, 500 r.p.m.

Electrical propulsion equipment, including auxiliaries and switch and control gear, is in hand for a new single-screw tanker. The salient pole motor is rated at 9 000 s.h.p. at 124 r.p.m., and is supplied by a turbo-alternator giving an output of 6 940 kW at 3 220 r.p.m., 53.8 cycles.

Three vertical shaft direct-coupled water wheel alternators on order for the Errochty

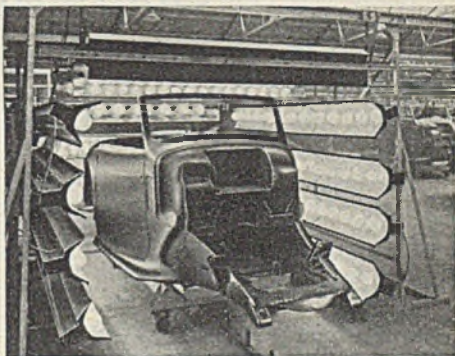


Salient pole synchronous induction motor, rated at 1 500 H.P. for South Africa

power station in the Tummel Garry scheme are each rated at 27 800 kVA, 4 000 V.

Among turbo-alternators in hand for

the equipment of central stations at home and abroad, are a further two 37 500 kVA sets for the Orlando power station, Johannesburg. For Haifa power station a 40 000 kVA unit is being built. Of the



Stoving the paintwork on a car body by means of radiant heat

four 35 300 kVA sets on order for the new Meaford power station, two are in course of erection at the site. A 37 500 kVA unit has been installed at the Seuloates station, Hull, and another of the same capacity is being erected at Woolwich. For Newport Corporation, a further set rated at 37 800 kVA is in course of construction.

The new "J" type switch for on-load tap changing has been designed for use with 132 kV transformers with earthed neutral, 66 kV fully insulated transformers and the larger sizes of 33 kV transformers, the switch being designed for transporting in position on the transformer.

The company is responsible for the entire electrical equipment of the new Shimshon Portland Cement Works to be erected in Palestine. Nine 2 000 kW and thirteen 1 500 kW pumpless mercury arc steel tank rectifiers are being installed on the eastern extension of the London Transport Underground system.

A comprehensive ore bedding and blending plant employing the Robins-Messler system, which will probably be the largest of its kind in the country, is in course of installation at the Corby works of Stewarts and Lloyds, Northamptonshire. The maximum rate of handling is 600 tons per conveyor per hour, two conveyors operating in parallel. About 80 motors will be employed, and the control panels aggregate a total length of 250 ft.

Intricate sequence control is essential, and an illuminated mimic diagram is being provided.

The range of applications of radiant heating has been developed, and a medium intensity oven has been introduced to fill the gap between lamp equipment and high

intensity ovens developed during the war. For the car industry a plant simultaneously stoves primer-surfacer and stopper on a well-known coupé body, taking 20 minutes for the complete operation. Softening of plastic sheet before shaping has proved an important application.

Company News

ELECTROLYTIC ZINC OF AUSTRALASIA, LTD.—Net prft. to June 30, 1946, £381 537 (£324 491). Divs. absorbed £330 000 (£270 000), now plant and devpt. West Coast Mines £11 146 (£12 250), fwd. £215 109 (£277 718).

NORTHAMPTON ELECTRIC LIGHT AND POWER CO., LTD.—Fin. div. on ord. 6% (same), mkg. 10%, less tax (same). Net prfts., 1946, after provn. for inc. tax and inclgd. £65 000 E.P.T. recoverable, were £98 170 (£97 931) subject to audit; fwd. £139 927 (£111 050).

BRUCE PEEBLES AND CO., LTD.—Full rept. 1946 shows trdg. prft., after taxn., £51 920 (£38 747), plus int. and transf. fees £4 175 (£2 898), mkg. £56 095 (£41 645). Deductg. dirs.' fees £1 306 (£1 028), audit fees £315 (£250), deprecn. res. £25 000 (£20 000), leaves net blee. £29 474 (£20 367). Pref. div. 7½% with further 2½% (same), ord. div. 5% and bonus 5% (div. same, bonus 3), research and devpt. res. £15 000 (£10 000 gen. res.), fwd. £18 095 (£16 208). Current assets £518 523 (£440 521), curr. liabilities £342 536 (£315 171).

WESTINGHOUSE BRAKE AND SIGNAL CO., LTD.—Full accts. for yr. ended Sept. 30 last show trdg. prft. and other income, after whg. exes. of £253 513 (£376 938), plus £166 000 (£48 500) reduction in prev. provn. for E.P.T., mkg. £419 513 (£425 438). After deprecn. £59 989 (£54 152), dirs.' fees £3 100 (£3 700), inc. tax £147 000 (£171 700), lvg. prft. £209 424 (£195 886). Div. 10% and bonus 4% (same), staff pensions £20 000 (£15 000), prov. contings. nil (£50 000), gen. res. £100 000 (£50 000); fwd. £99 193 (£96 192). Yr. ago transfer of £104 873 from contings. placed agst. chrgs. relating to a pre-war contract.

MARCONI INTERNATIONAL MARINE COMMUNICATION CO., LTD.—Rentals, profit on sales and sundry receipts £617 303 (£604 612), from sub. and assoc. cos. and int. £149 945 (£132 534), prft. on sale secs. £3 950 (nil, but trans. fees £44), mkg. £771 198 (£737 190). To sals. £103 561 (£101 799), gen. chrgs. £34 958 (£33 838), fees £4 604 (£5 649), exes. ship stations, etc., £424 266 (£355 665), deprecn. £85 300 (£78 314), taxation £30 000

(£71 000), net prft. £88 509 (£90 925). Fin. div. 5% (same), mkg. 7½% again. Fwd. £35 581 (£36 526). Provisional excess profits tax refund amounting to £37 802, spent on capital assets. On August 12, 1946, English Electric Co. acquired control of Marconi's Wireless Telegraph and as a result Board of Marconi International Marine was reconstituted.

MATHER AND PLATT, LTD.—Prft. 1946 £304 740 (£303 989). Deduct deprecn. £60 088 (£45 135), inc. tax, less E.P.T. recvble., £80 000 (£124 838), repairs, etc., £14 724 (£16 700), dir's. fee £500 (nil), off shs. in sub. cos. £4 000 (£10 000). Net prft. £145 428 (£107 316). Brot. in £91 474 (£90 686). To res. £50 000 (£25 000), benefit fund £5 000 (£2 000), pref. div. £11 000, ord. fin. 7% (6%), mkg. 11% (10%) £82 501; fwd. £88 401. Stock £1 217 910 (£1 141 237), debtors £633 096 (£465 858), cash £125 970 (£296 760), tax certs. £214 350 (£250 000). Creditors £486 896 (£495 475), acceptance credits £120 000 (£60 000).

YORKSHIRE ELECTRIC POWER Co.—Referring to the Electricity Bill, in his statement to shareholders circulated with the accounts, the Chairman (Sir Robert G. Ellis) said that although a better and wider service had been promised as a result of nationalisation, it was idle to expect any real extension of present development because there was neither the necessary material nor the skilled labour available for the purpose. Indeed, with electricity now and for some time likely to be on the ration, restriction and not extension of service was inevitable. New station buildings and transmission material were indefinitely held up because industry generally was under-supplied both in material and skilled labour. Moreover, the raw material of electricity was coal, and the supply of coal was still deteriorating both in quantity and quality. Clearly, he said, the Bill was without positive advantages alike to industrial, farming and domestic consumers.

E. K. COLE, LTD.—A review of the company's conversion to peace-time activities was given by Mr. E. K. Cole (chairman and

managing director) at the annual general meeting. In 1944, he said, the company had six war production plants in operation, as compared with only one at Southend before the war. They had now closed down two of these and reorganised their Southend and Glasgow factories for commercial production, while the Malmesbury plant remained as a unit for special Government development and small production contracts. They had reason to believe that they could look forward to an expanding market in car radios. In the manufacture of fluorescent lamps there had been progressive expansion, a range of fittings, control gear and other accessories having been developed. Much remained to be done, however, before the considerable potential market for these new products could be fully exploited. The Ekco-Ensign lighting interests, Mr. Cole explained, now virtually formed one organisation, and it was proposed to change the name to "Ekco-Ensign Electric, Ltd.," and to arrange for this subsidiary to be responsible for the whole of the lighting activities.

LANCASHIRE ELECTRIC LIGHT AND POWER CO., LTD.—Prft. for 1946, after deb. int., etc., but before taxn., £386 494 (£368 978). To taxn. £169 169 (£184 800), deb. redemption £14 596 (£13 901), fixed div. on pref. stks., less tax, £79 982 (£59 489) and addtl. $\frac{1}{2}$ % on 7% ptpg. pref. £2 750 (£2 500), intm. ord. div. £39 875 (£36 250), fin. ord. div. 5% mkg. $7\frac{1}{2}$ % (same); fwd. £15 523 (£15 151). Cons. prft. £386 966 (£361 443) and cons. blice. sheet shows curr. assets £1 779 518 (£1 575 396), agst. current liabs. and provns. £783 960 (£746 868).

ENFIELD ROLLING MILLS, LTD.—Prft. for 1946, before deprecn. and dirs.' fees, £177 847 (£97 497), plus int. £3 546 (£5 042) and divs. on invest. £150 (same), mkg. £181 543 (£102 689). To deprecn. £34 752 (£39 506), int. £2 633 (£2 343), deb. int. £7 524 (£7 713), dirs.' fees £500 (same), A.R.P., etc., £3 162 (£2 935), obsolescence £4 000 (same), inc. tax £60 000 (£22 000), lvg. net prft. £68 972 (£23 692). To div. of 5% (same) £15 400, spec. bonus $2\frac{1}{2}$ % (nil) £7 700, fwd. £175 621 (£129 749). Cons. blice. sheet shows stk. and work £426 363, debtors £522 408, paymts. in advance £9 167, tax res. certs. £300 000, cash £73 957. Creditors, etc., £368 355, prov. for taxn. £399 731, for defd. reprs. £132 776. Blice. sheet total £1 859 628.

SOUTH LONDON ELECTRIC SUPPLY CORP., LTD.—Speaking at the annual general meeting, Sir Robert Renwick (chairman) said that consumers on the system numbered 51 500 at the end of 1946, as compared with 44 000 at the end of 1938. This showed, he said, how they had continued

with development in the interests of consumers at full speed, despite the threat of nationalisation and the shortages of materials. Sales of current had increased by 19 million units to more than 85 million units, and the average price had dropped by 5 per cent. Units sold for lighting, heating and cooking last year were approximately 63.8 millions, compared with under 46 millions sold in 1945 and rather less than 43 millions in 1938. The shortage and high price of house coal, Sir Robert continued, was clearly a contributory factor, but also, he believed, the people of this country were realising more and more the flexibility and economy of electricity for domestic purposes. The restrictions on the use of domestic electricity, for which neither the companies nor the municipalities were in any way to blame, were a bitter blow to those engaged in the industry who had striven for so many years to encourage the use of the commodity they sold. After discussing nationalisation, which, he contended, was at this time irresponsible, Sir Robert concluded by saying that the problems facing the country were ones requiring primarily administrative—not legislative—action by the Government, if we were to surmount our troubles and move steadily towards a better standard of living.

Metal Prices

	Monday, Price	Inc.	April 7 Dec.
Copper—			
Best Selected (nom.)...per ton	£136 10 0	—	—
Electro Wire bars	£137 0 0	—	—
H.C. Wires, basis	£155 0 0	—	—
Sheet	£178 10 0	—	—
Bronze Electrical quality			
1% Tin—			
Wire (Telephone) basis per ton	£177 15 0	—	—
Brass (60/40)—			
Rod basis	1s. 2½d.	—	—
Wire	1s. 0½d.	—	—
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	£91 10 0	—	—
Foreign and Colonial... ..	£90 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity)	£440 10 0	—	—
Wire, basis	per lb. 5s. 6¼d.	—	—
Aluminium Ingots ...per ton			
Spelter	£80 0 0	—	—
Mercury (spot)	£70 0 0	—	—
Mercury (spot)	per bott. £21 0 0	—	—

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

Metropolitan Electric Supply

Nationalisation a Risk

The sixtieth ordinary general meeting of the Metropolitan Electric Supply Co., Ltd. was held on April 1 in London.

Major H. Richardson, M.C., T.D., J.P., M.I.E.E., chairman and managing director, said that the year under review was the first full year's trading since the cessation of hostilities and he thought it would be agreed that the results were satisfactory. The total units supplied to their consumers and to those of their subsidiary companies amounted to 590 millions, to which must be added a further 230 millions supplied to other undertakings, an increase of 66 millions. The London areas, which had suffered most in the war, had contributed nearly 25 million units to the increase. The substantial progress made in the London areas had enabled them to give some alleviation of the unavoidable increase in charges made during the war.

The balance on revenue account had increased by £159 770 compared with 1945, and amounted to £228 682. The directors recom-

mended a final dividend of 6 per cent. on the ordinary stock, making 9 per cent., less tax, for the year. The consolidated accounts revealed a satisfactory position.

With regard to the Government's intentions, in view of the great problems which beset them and the solution of which was so vital to the economic recovery of the country, it was indeed difficult to understand why any Government should at such a time risk experimenting on an industry which was part of the very foundation of the industrial life of the nation, an industry which had amply demonstrated its efficiency and reliability.

He was convinced that the proposed form of national management could only result in the elimination of reasonably healthy competition, initiative and incentive, with the result that, unless subsidised, the majority of consumers would undoubtedly have to pay more for their electricity.

The report was adopted.

Aberdare Cables

Growing World-wide Demand—Sir George Usher's Review

The tenth ordinary general meeting of Aberdare Cables Ltd. was held on April 2 at 19, Woburn Place, London, W.C.

Sir George Usher (chairman of the company), who presided, said:—Ladies and gentlemen,—It gives me great pleasure to report another year of substantial progress which, as you will realise, has been effected under great difficulties.

Balance Sheet and Accounts.—You will notice that, whilst there is a considerable increase in the profits of the company for last year, high taxation takes a large part of such increase.

Dividend.—I am pleased to report that the results for the year justify your directors in recommending the payment of a final dividend of 4 per cent., making a total of 10 per cent. for the year on a capital of £332 000, against 6 per cent. on a capital of £282 000 for the previous year.

General.—Our most serious problem at the moment is in maintaining a steady flow of raw materials to the factories. There is a world-wide shortage of two of our principal raw materials—lead and copper. Both are subject to Government bulk buying control and licence. Other raw materials, such as jute and timber, are difficult to obtain. The prices of these, as of copper and lead, are continually rising: in fact, there is no stability in the prices of any of the raw materials used by your company, a problem which adds greatly to the difficulties of management.

New Equipment Ordered

Amongst other problems, we have had to surmount the difficulties brought about by the necessary re-absorption of demobilised workers from the Forces and the reduction in working hours with its consequent in-

crease in the costs of production. In spite of all these difficulties, I am pleased to be able to inform you that production has remained at a high level throughout the period of this review and during the few months of our new financial year. In fact, we believe it is not possible to obtain greater production from the present installed plant. Certain important new equipment has been ordered and should be in operation within a few months' time, which will materially facilitate production.

The volume of orders continues to flow in at a very high rate, and every endeavour is being made by our works to satisfy our regular customers, both at home and abroad, who have supported us from the early days, as well as many new ones. The demand for cables from electricity supply undertakings, both in this country and all over the world, is phenomenally large and, if the known proposals for the expansion of the electric supply industry are carried out, this demand should continue at a high level for many years to come. Enquiries and orders from overseas territories are most gratifying, covering, as they do, nearly all parts of the world.

You will be interested to know that we have accredited representatives in some forty different territories overseas and, whilst trading conditions are not equally favourable in all these countries, the diversity factor assures us of business on a substantial scale provided our efforts to maintain competitive prices prevail.

The increase in the number of visits which we receive both from overseas buyers and from overseas representatives at our Aberdare Works is an interesting feature of our activities, as it enables them to see the plant and products and at the same time

(continued on p. 956)

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Aberdare Cables Ltd.—continued from p. 954

get to know the management and staff, which is such an important factor in the continuation of friendly relations.

In passing I should like to add that, notwithstanding the serious increase in costs and the necessary consequent rise in the selling price of cables, we continue to make progress, and at the present time our prices are competitive with those of other manufacturers both in Europe and in the United States.

Progress of Subsidiaries

South Wales Switchgear, Ltd.—This subsidiary company of yours continues to develop and make very satisfactory progress. The new factory at Blackwood is in full operation, and an important extension has been authorised, which will help us to cope with its rapidly increasing turnover.

Aberdare Cables of South Africa, Ltd.—This company is now in being and has initiated a vigorous selling policy in the Union of South Africa, which has already

met with great success, and a large volume of orders has been secured. At the present time these are being filled from your Aberdare factory. The senior officials of the new organisation have been appointed and are actively engaged in the work of training the necessary operatives. Work on the factory is proceeding satisfactorily, and the progress made in the manufacture of the necessary plant ordered in this country is gratifying. This plant will be installed as soon as the building is capable of housing it.

My hearty thanks are due to our tireless and resourceful managing director, Mr. F. G. Penny, and his loyal colleagues at both Aberdare Cables, Ltd., and South Wales Switchgear, Ltd. I should like also to pay a special tribute to our workpeople at Aberdare, Treforest and Blackwood for their energy and conscientious work, and I am delighted to be able to tell you that our relations with our workers continue to be happy. They have shown a remarkable aptitude to learn their new occupations, and take pride in becoming proficient.

The report and accounts were adopted.

Coming Events

Friday, April 11 (To-day)

I.E.E., SCOTTISH CENTRE.—Edinburgh. North British Station Hotel. Presidential Visit and Luncheon. 12.30 p.m.

I.E.E., LONDON STUDENTS' SECTION.—Kensington. Spring Dance. 7.50 p.m.

Saturday, April 12

ASSOCIATION OF MINING ELECTRICAL AND MECHANICAL ENGINEERS.—At Cardiff. "Considerations in the Design of Electric Winding Engines," by T. A. Hughes. 5.30 p.m.

I.E.E., SOUTHERN CENTRE.—At the Pavilion, Bournemouth. "Engineering Principles Applied to the Design of Domestic Water-Heating Installations of the Solid Fuel/Electric Type," by R. Grierson and Forbes Jackson. 2.50 p.m.

I.E.E., N. WESTERN STUDENTS' SECTION.—At the Engineers' Club, Manchester. "The Principles of H-V. Measurement," by E. Hartill, and "Piezo-Electric Crystals in Engineering Measurements," by M. W. Jervis. 2.15 p.m.

Monday, April 14

I.E.E., WESTERN CENTRE.—At Cardiff. "Commercial Development of Electricity Supply as a Consumer Service," by C. T. Melling. 6 p.m.

INSTITUTE OF METALS, Scottish Section.—At I.E.S., Glasgow. "Atomic Energy," by Prof. N. Feather, F.R.S. 6.50 p.m.

I.E.E., S. MIDLAND CENTRE.—At the Midland Institute, Birmingham. Faraday Lecture, "The Generation and Wholesale Distribution of Electricity," by J. Hacking. 6 p.m.

Tuesday, April 15

I.E.E., SOUTHERN SECTION.—At Southsea. Visit of President and Annual Dinner and Dance. 7 p.m.

I.E.E., NORTHERN IRELAND CENTRE.—At Queen's University, Belfast. "Recent Progress in the Design of the H-V. Overhead Lines of the British Grid System," by W. J. Nicholls. 6.45 p.m.

I.E.E., RADIO SECTION.—London. Discussion on "Does Standardisation Conflict With Progress?" opened by J. W. Dalgleish. 5.50 p.m.

I.E.E., N. WESTERN MEASUREMENTS GROUP.—At the Engineers' Club, Manchester. "Calibration of Uniform Field Spark-Gaps for H-V. Measurement at Power Frequencies," and "The Design of an Ellipsoid voltmeter for the Precision Measurement of High Alternating Voltages," by Dr. F. M. Bruce. 6 p.m.

BRITISH SOCIETY FOR INTERNATIONAL BIBLIOGRAPHY.—At the I.E.E., London. "The Use of U.D.C. in Periodical Abstracting Services for Scientists and Engineers," by Dr. B. M. Crowther. 3 p.m.

Wednesday, April 16

WOMEN'S ENGINEERING SOCIETY.—At 35, Grosvenor Place, London, S.W.1. Discussion on Equal Pay, opened by Miss D. McClellan. 7 p.m.

I.E.E., INSTALLATIONS SECTION.—At the Connaught Rooms, London, W.O.2. Section Luncheon. 12.50 p.m.

I.E.E., SHEFFIELD SUB-SECTION.—At the Royal Victoria Station Hotel, Sheffield. "The Heat Pump," by J. A. Sumner. 6.15 p.m.

I.E.E., TRANSMISSION SECTION.—London. "Record of Experience on the Irish Electricity Supply System," by A. Burke, R. C. Cuffe and W. O'Neill. 5.50 p.m.

Thursday, April 17

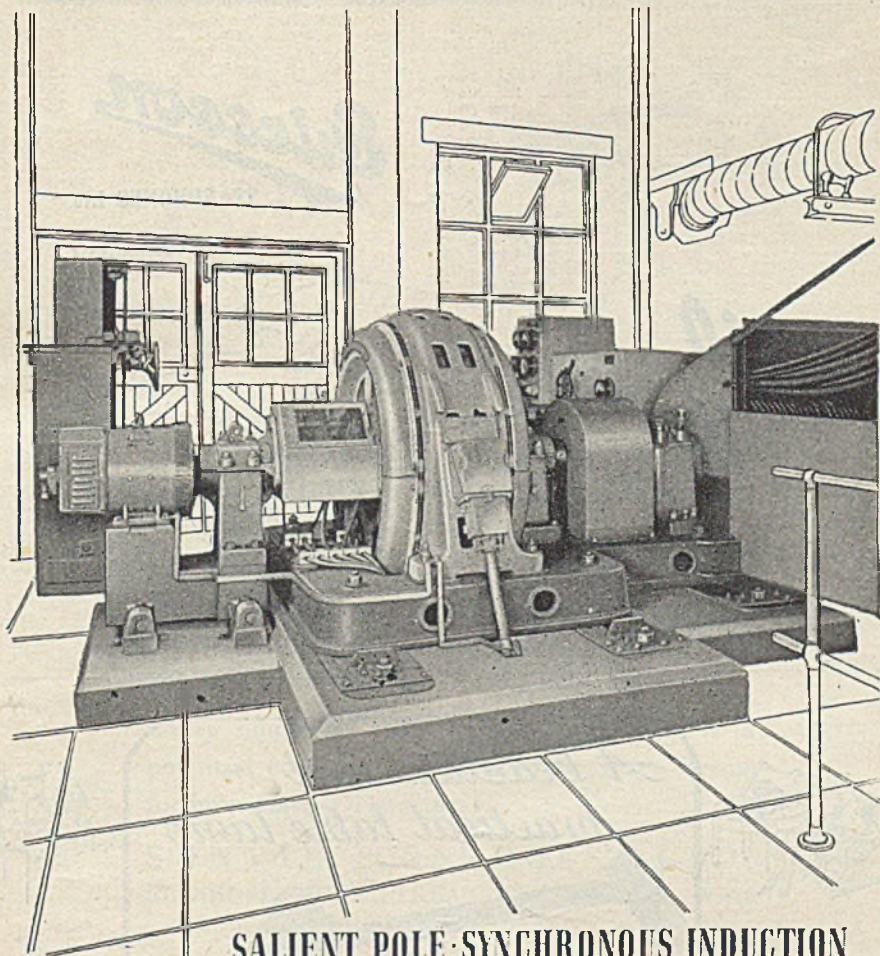
I.E.E., WESTERN INSTALLATIONS GROUP.—At the Guildhall, Swansea. "Engineering Principles Applied to the Design of Domestic Water-Heating Installations of the Solid Fuel/Electric Type," by R. Grierson and Forbes Jackson. 6 p.m.

Friday, April 18

ILLUMINATING ENGINEERING SOCIETY, BIRMINGHAM CENTRE.—At Imperial Hotel. "Portable Photometers," by J. S. Preston. 6 p.m.

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. Visit of Mr. J. H. Reyner. "Compressed Air Equipment for Air-Blast Circuit Breakers," by J. L. Morris. 6.50 p.m.

I.E.E., N. WESTERN STUDENTS' SECTION.—At the Engineers' Club, Manchester. "The Layout and Design of Electric Power Stations," by J. C. Goward. 6.45 p.m.

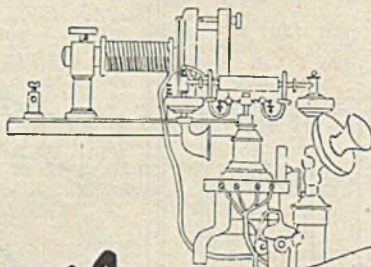


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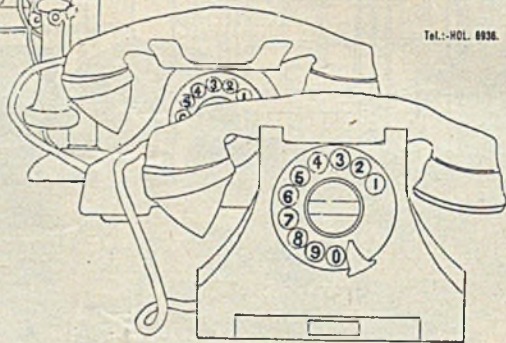


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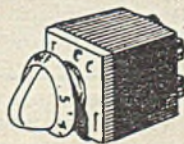
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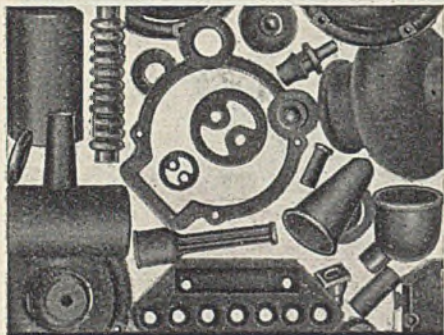
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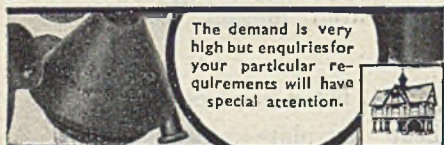




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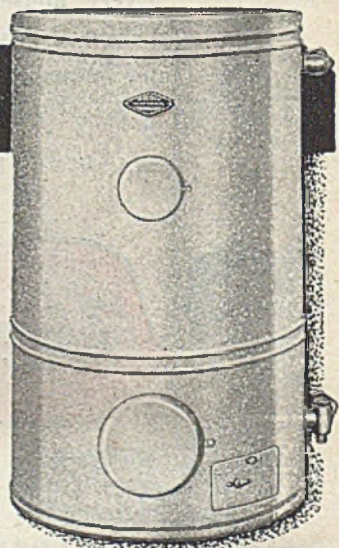
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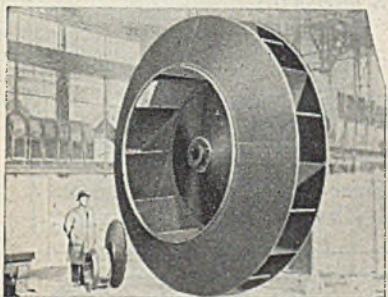
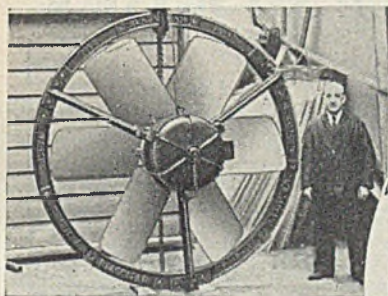


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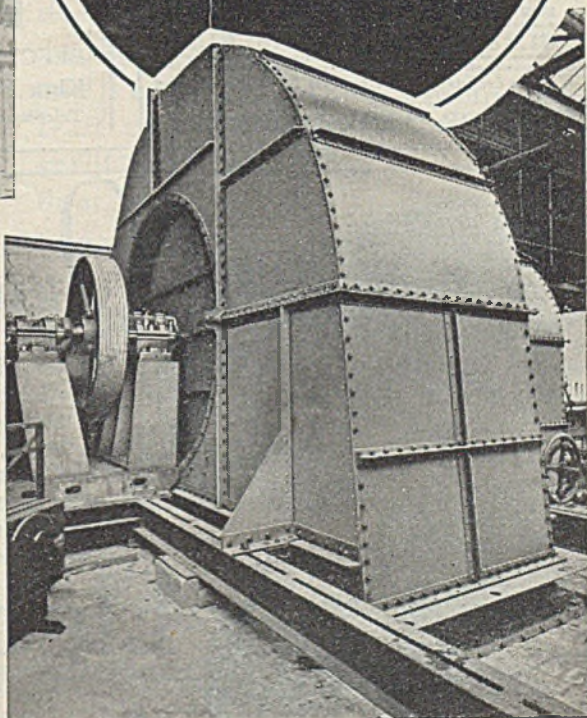
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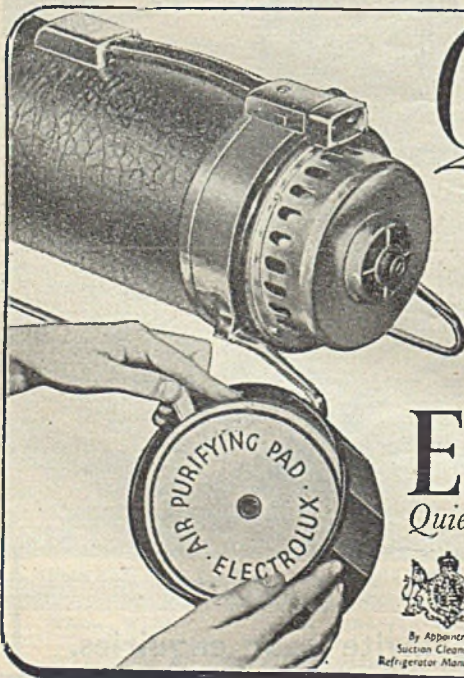
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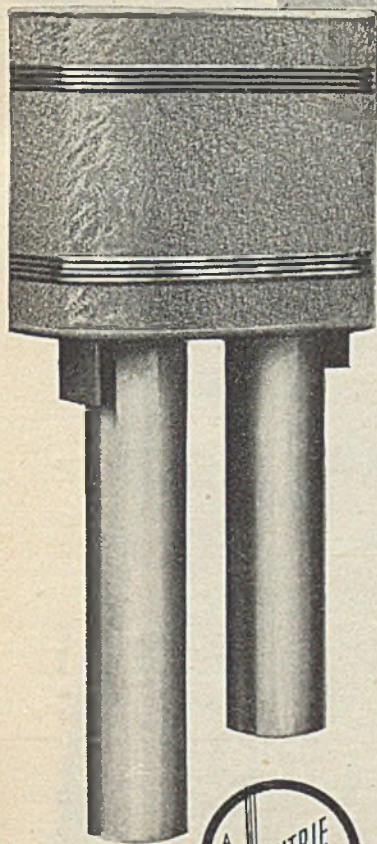
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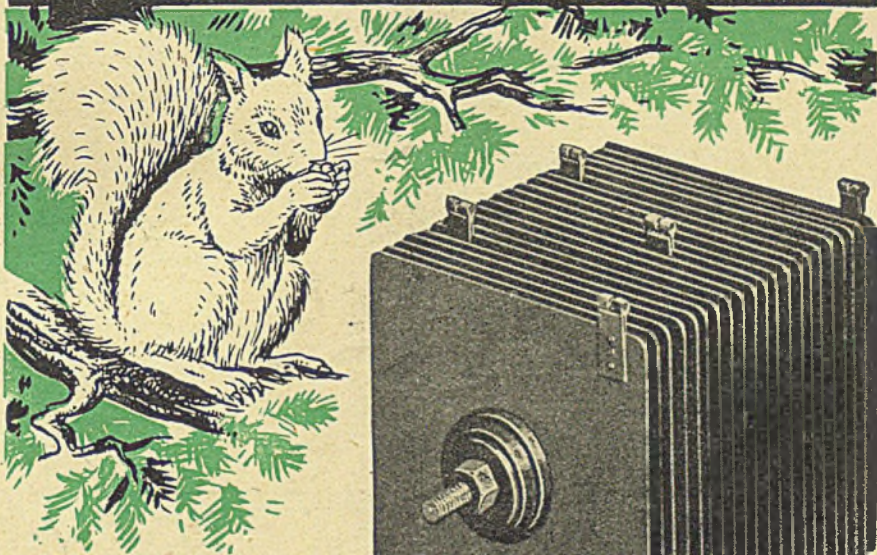
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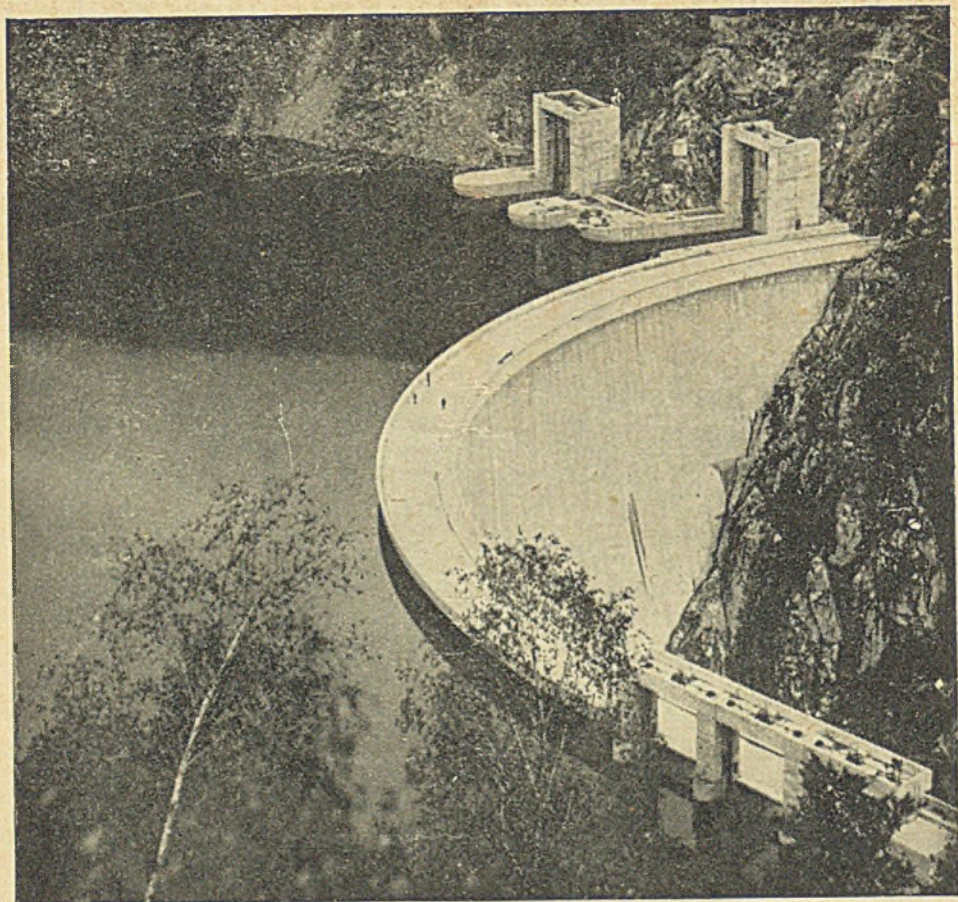


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