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THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

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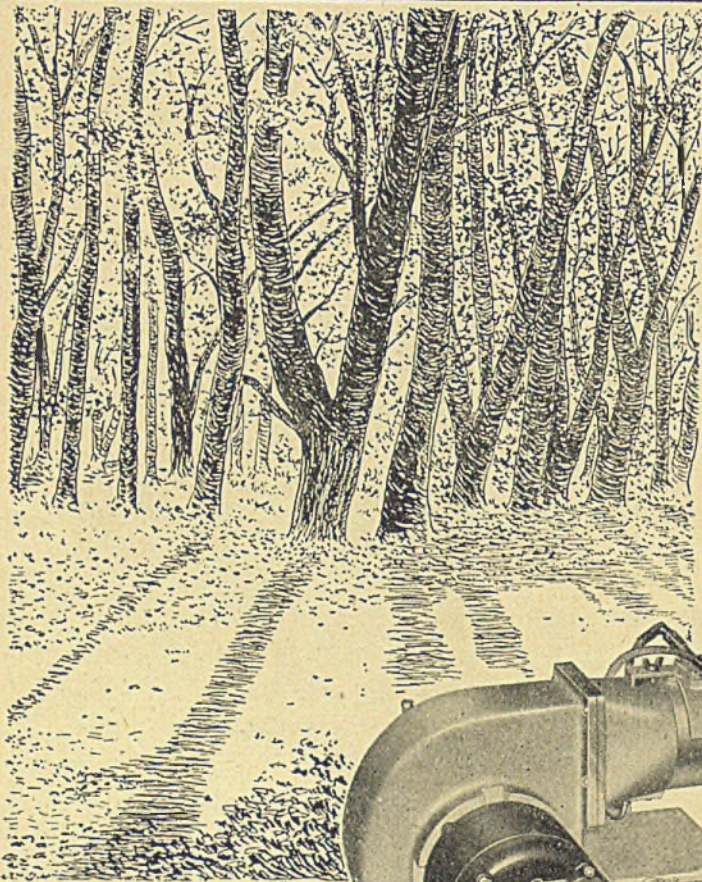
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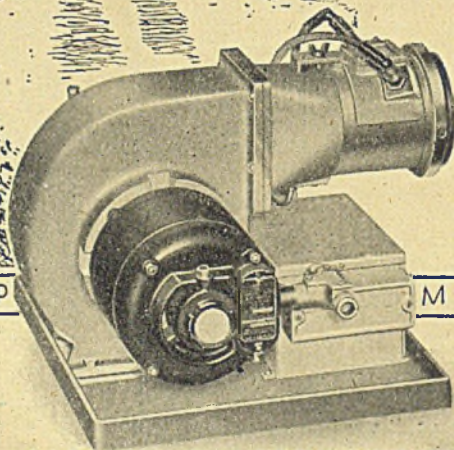
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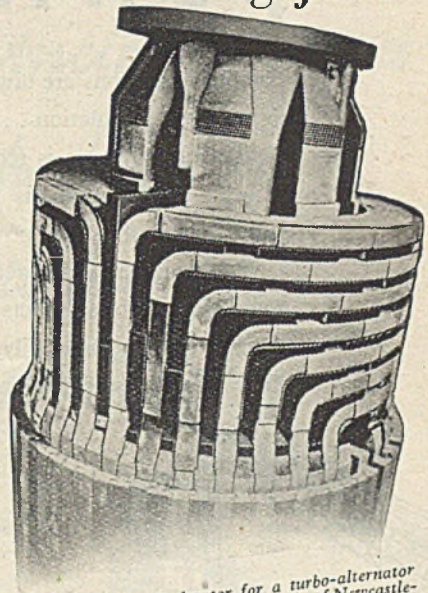
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TREFOIL

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REGD. TRADE MARKS

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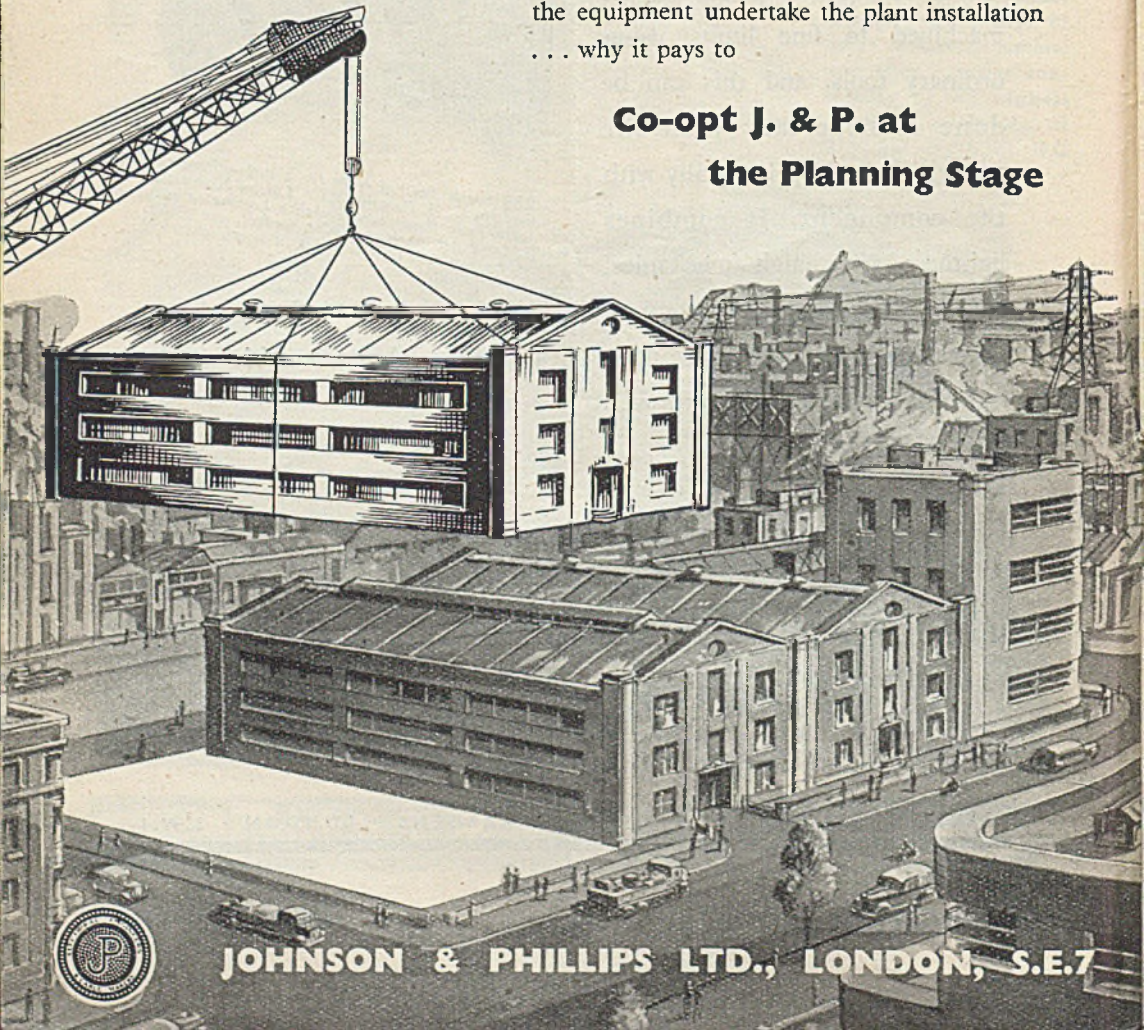
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Factory extensions are always a head-ache, intensified by the necessity to maintain production . . . for timing operations so that interruption in the existing shops is reduced to an absolute minimum.

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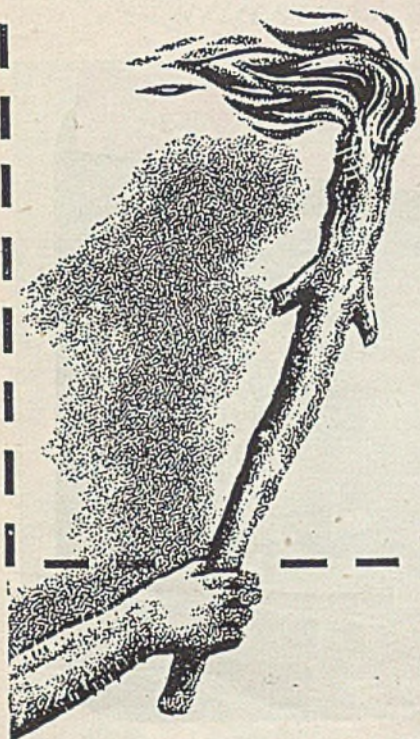
This is but one of the reasons why it pays to let the manufacturer of the equipment undertake the plant installation . . . why it pays to

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the Planning Stage**



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Osram



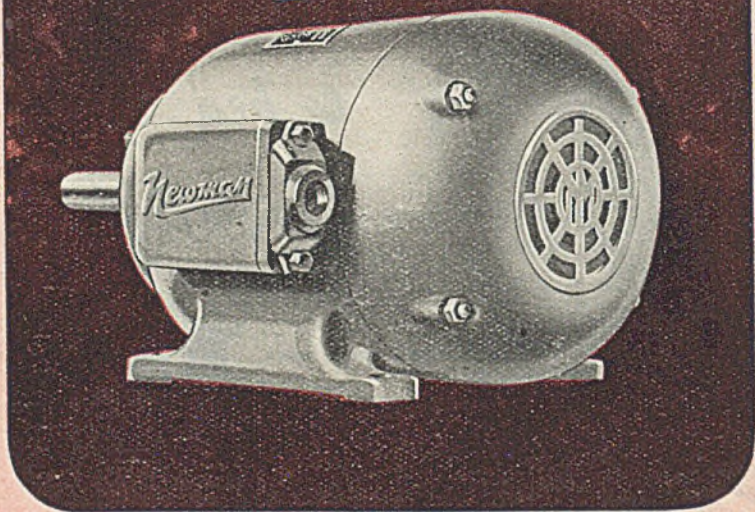
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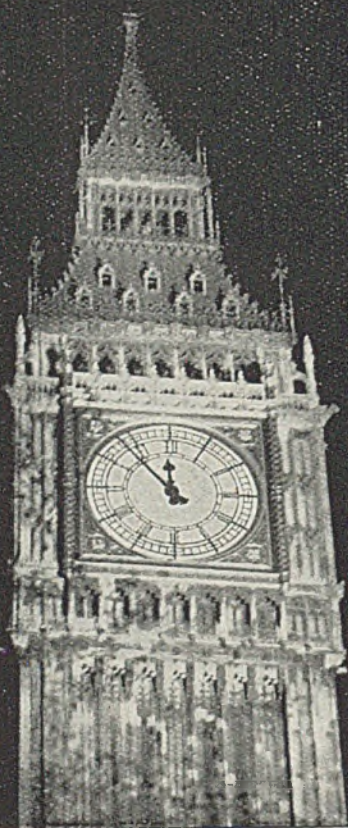
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BTH

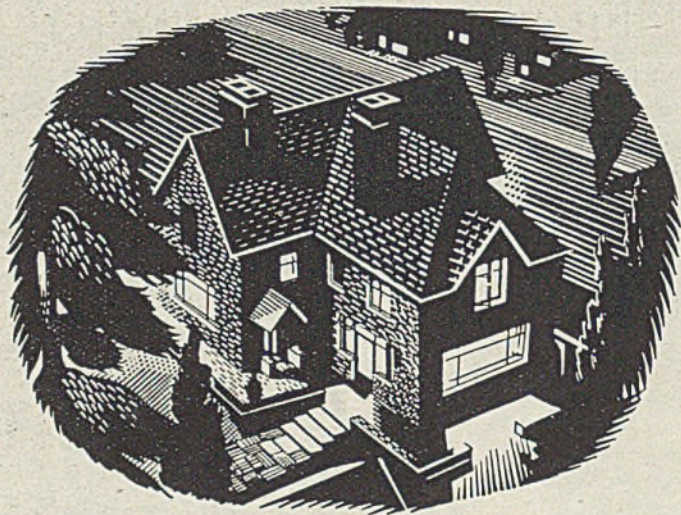
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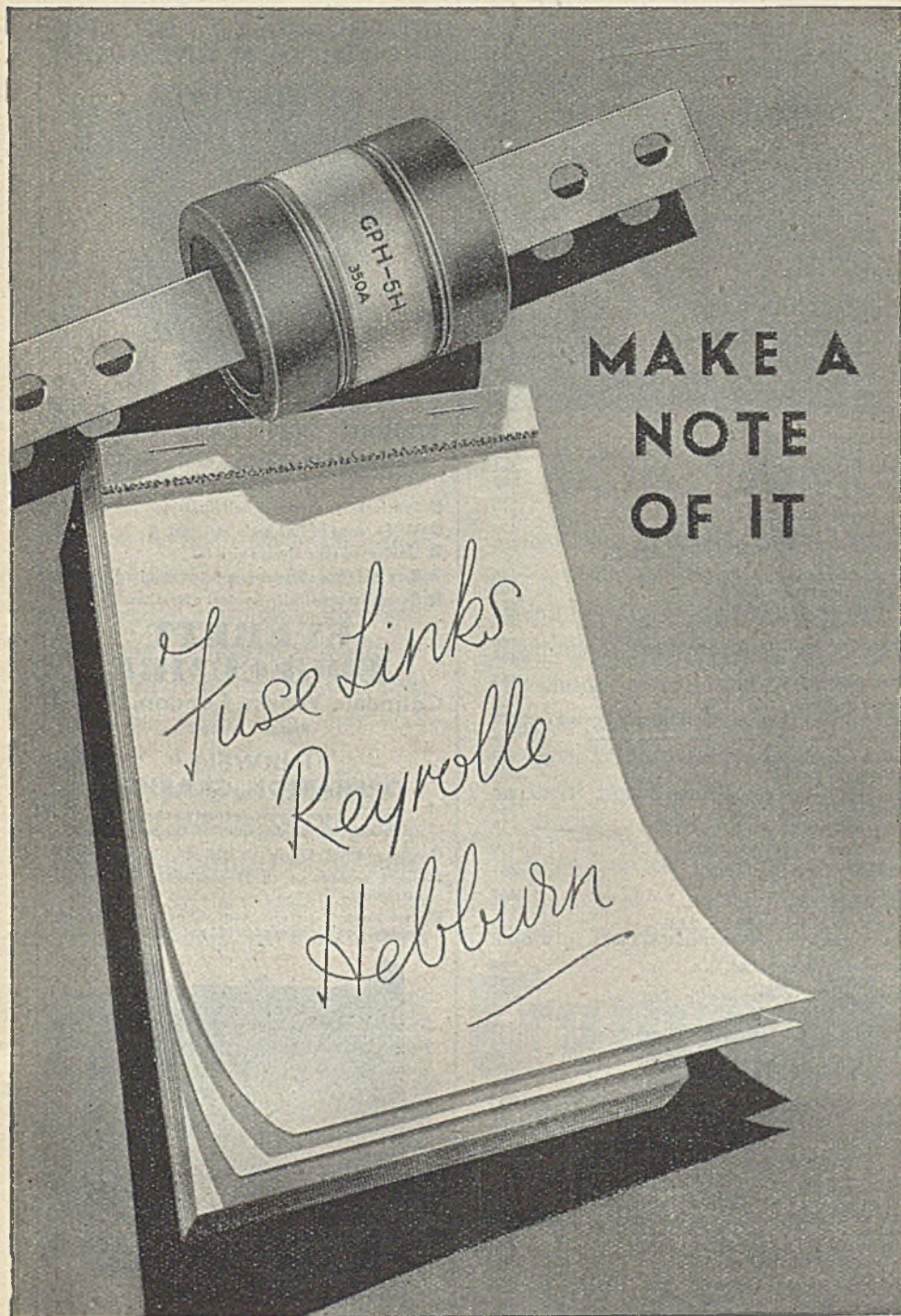
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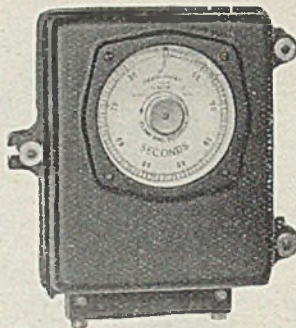


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NOTE
OF IT**

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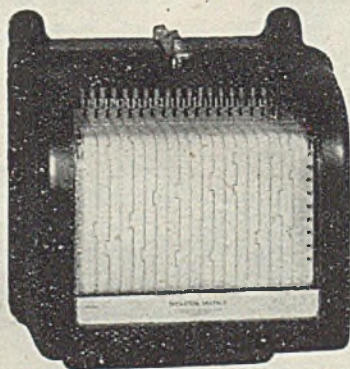
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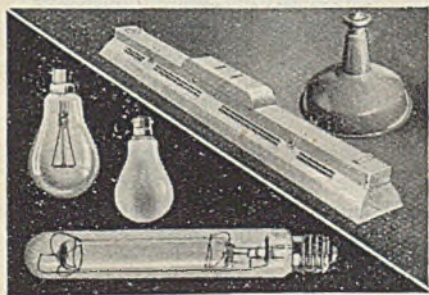


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COOKER CONTROL - DS PLUG STYLE

COOKER DS CONTROL

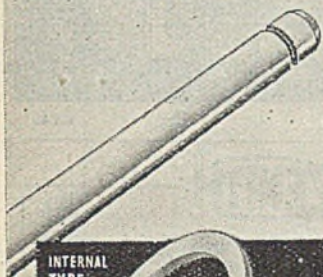
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Announcement of D.S. Plugs Ltd., Manchester, London, Glasgow.

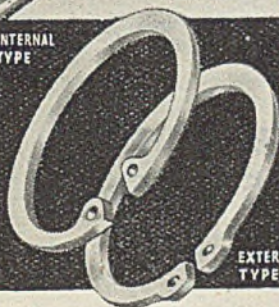
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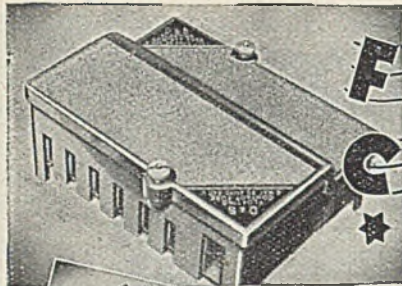
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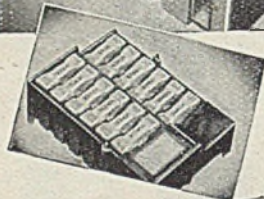
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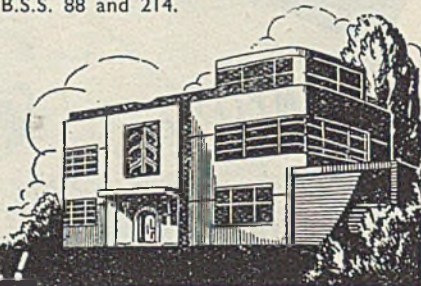
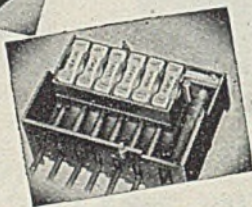
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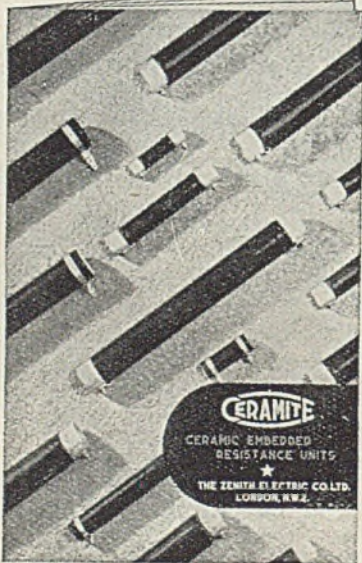
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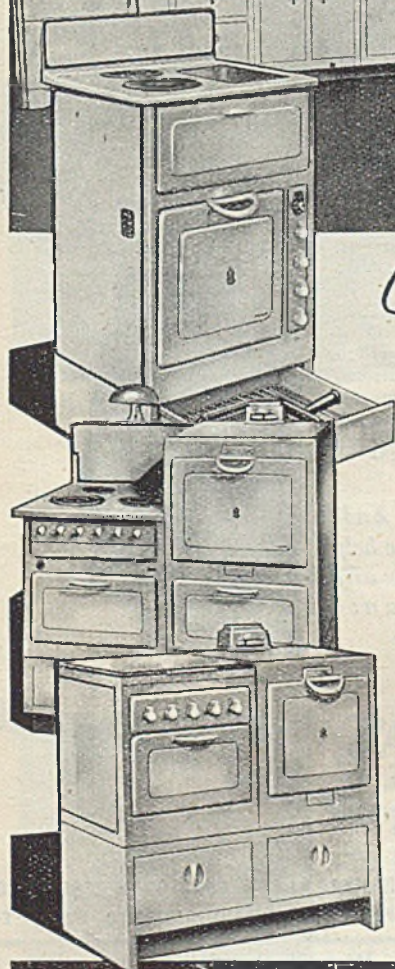
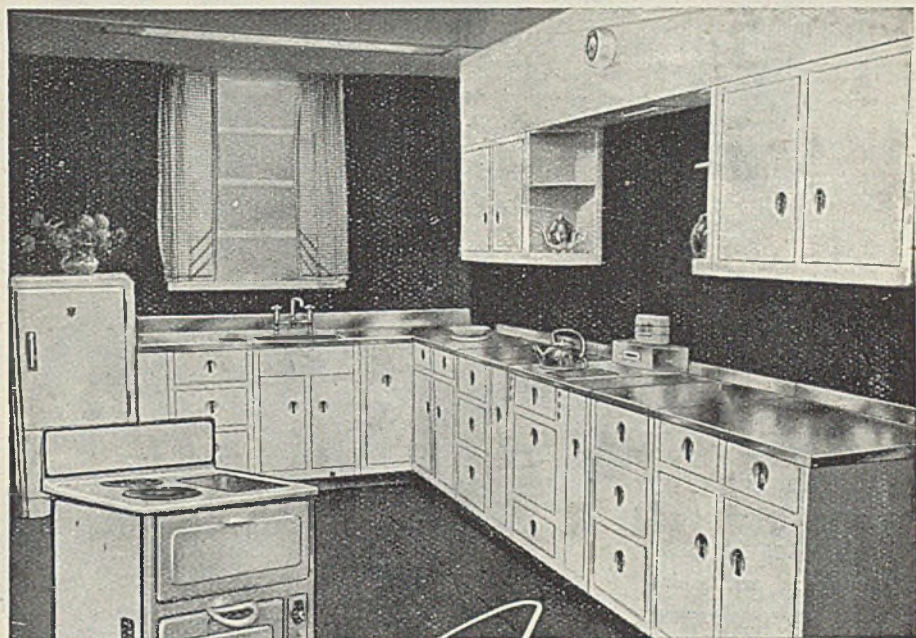
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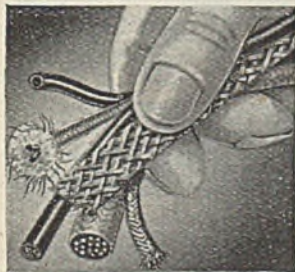


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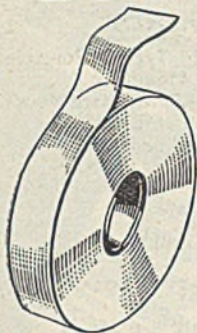
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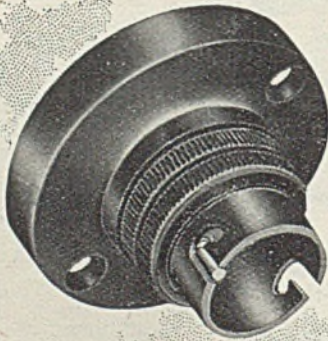
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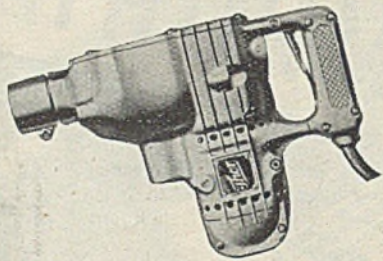
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Where repair or construction jobs require star drilling, demolition, cutting, shaping, chipping, scaling or gouging in stone, wood or metal, you can get it done faster and easier with a Thor Portable Electric Hammer. Compact and light, this tool delivers a *more powerful blow* than any hammer of comparable size and capacity. Completely different in design and construction, the Thor Electric Hammer will stand up for long, dependable service.

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How that service has grown—our pioneer would be amazed. This steady growth is a measure of the inestimable value of our supply service for everything electrical.



That first travellers job is filled by a team of experienced men whose task is not simply to **SELL** but to help you with their skill in getting round awkward problems of supply. A substitution or improvisation often helps to complete an installation held up for lack of material.



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BRITMAC, M.K., WYLEX, TENBY,
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T/56. Replacement mains trans-
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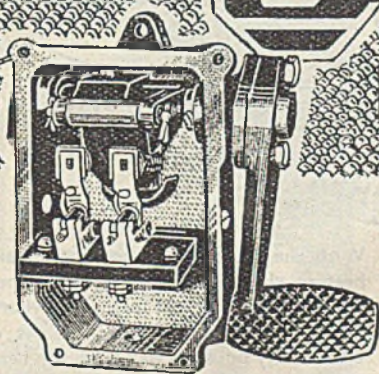
Wellington Street, Burslem, Stoke-on-Trent
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To take full advantage of the high efficiency of Fluorescent and Gasous-discharge lighting it is necessary to correct the power factor of these lamps. DUBILIER NITROGOL CAPACITORS are the most effective, reliable and convenient method of ensuring this correction. The NITROGOL process means small, light and dependable Capacitors easily placed in position in all standard fittings. Complete suppressor units are also available in a wide and comprehensive range.

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Telegrams: Hivoltcon, Phone, London.

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D7



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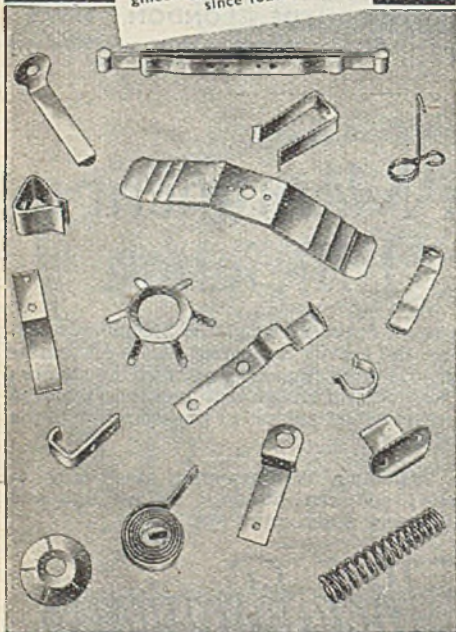
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Specialists in Springs and
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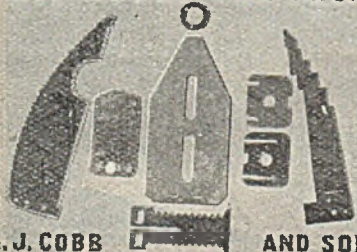


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Carter Fractional Horse Power Electric Motors can be fitted and then forgotten . . . there will be no trouble from them to remind you of their existence. These 100 per cent. British 'fault-killed' motors are manufactured entirely under one roof at the Carter Factory and pass twenty separate electrical tests before they reach you. Available from 1/200 to 1 H.P., these compact little machines can be supplied with spur or worm reduction gear from 2 to 125,000 to 1 . . . and in special types to suit your job. If you have any problems concerning Fractional H.P. Motors, please do not hesitate to consult our technical dept., — their practical experience gained over years is always at your disposal.

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*If it's threaded
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THE NAME THAT SPELLS QUALITY IN THE FIELD OF DOMESTIC APPLIANCES

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STANDARD IRON

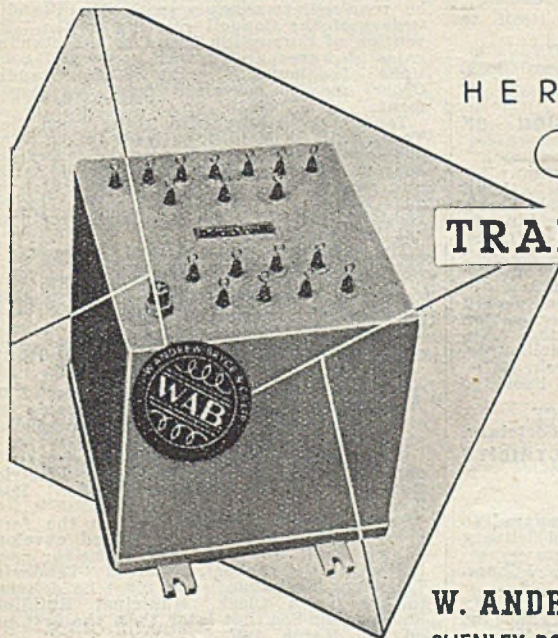
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The Andrew Bryce Hermetically Sealed Transformer was originally designed and developed to meet Service requirements for a Transformer which would operate efficiently under extreme tropical conditions. The Transformer is sealed against humidity, destruction by termites and other pests. It is now in production for general industrial use. Full particulars and specifications will be sent on request.

W. ANDREW BRYCE & CO. LTD.

SHENLEY ROAD, BOREHAM WOOD, HERTS

Telephone: ELStree 1875 & 1117.

T/1

MISCELLANEOUS ADVERTISEMENTS

TENDERS

COUNTY BOROUGH OF SOUTHAMPTON. ELECTRICITY DEPARTMENT.

Paper Insulated Cables, Stores and Materials, Domestic Apparatus and Electricity Meters.
TENDERS are invited for the supply and delivery during the year ending 31st March, 1948, of the following:—

- A. PAPER INSULATED CABLES up to 33 kV
B. STORES AND MATERIALS as follows:—
(i) Brass and/or mild steel set screws, bolts, nuts, washers, wood screws, etc. (ii) Mild steel (flat, rod, angles and sheet). (iii) Solder. (iv) Files. (v) Shovels, forks, pick heads, broom heads, shafts, etc. (vi) Lead soil pipe and sheets (vii) Copper fuse wire. (viii) Brushes. (ix) Sponge cloths, green canvas covers. (x) Service cut-outs. (xi) Cable protection covers. (xii) Stone-ware conduits. (xiii) Transformer oil. (xiv) Chemicals for water softening. (xv) Dungarees (xvi) Bitumen.
C. DOMESTIC APPARATUS including circulators, cookers, kettles, refrigerators, thermal storage tanks and washboilers.
D. ELECTRICITY METERS.

Conditions of Contract, Specification and Form of Tender, for each of the above, may be obtained from Mr. W. G. Turner, Borough Electrical Engineer, Civic Centre, Southampton, by application and on payment for each of one guinea which will be refunded on receipt of a bona-fide tender. Additional copies may be purchased at 10s. 6d. each.

Sealed tenders, in plain envelopes marked, as the case may be, "Cables," "Stores and Materials," "Domestic Apparatus" or "Meters," must be delivered to the undersigned not later than Friday, 21st February, 1947.

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

R. RONALD H. MEGGESON,
Town Clerk.

Civic Centre, SOUTHAMPTON.
31st January, 1947.

STATE ELECTRICITY COMMISSION OF VICTORIA, 22-32, William Street, Melbourne, Australia.

TENDERS are invited for Steel Cored Aluminium Conductor and Steel Earth Conductor for 220 kV Transmission Line in accordance with specification No. 46-47/114.

Full particulars available from Agent-General for Victoria, Victoria House, Melbourne Place, Strand, London, W.C.2.

Tenders, accompanied by preliminary deposit of £50, and endorsed "Specification No. 46-47/114," are returnable at the Commission's Office, 22, William Street, Melbourne, by 11 a.m. on Wednesday, 19th March, 1947.

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

W. J. PRICE,
Secretary.

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT. CONTRACT NO. 723. Transformers.

THE Electricity Committee are prepared to receive tenders for the supply and delivery of the undermentioned transformers:—
Three—1000 kVA 11200/3300 volts, 3-phase, 50 cycles.

Contractors desiring to submit tenders may obtain Specification and Form of Tender at this Office on and after 1st February, 1947, on making a deposit of £2 2s., which sum will be refunded on receipt of a bona fide tender.

To meet the convenience of Contractors,

two copies of the Specification will be furnished; additional copies may be purchased at a cost of £1 1s. per copy.

Any person or firm sending in a tender will be required to comply with the Standing Orders of the Council relating to the "Prevention of Corruption" and to the standard rates of wages and proper hours and conditions of labour. A print of the Standing Orders may be obtained from the Department.

The tender and accompanying documents, filled up as directed, must be enclosed in the official envelope supplied with the Specification which shall not bear any name or mark indicating the sender, to be delivered to the Town Clerk, Town Hall, Sheffield, 1, not later than the first post on Monday, 16th March, 1947. Tenders received after the time stipulated herein will not be considered.

The Committee do not bind themselves to accept the lowest or any tender.

JOHN R. STRUTHERS,
General Manager and Engineer.

Commercial Street,
SHEFFIELD, 1.
23th January, 1947.

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT. SPECIFICATION NO. 727.

ONE—55 MVA 12.5% 33 kV Oil-immersed Copper Shielded Reactor.

THE Electricity Committee are prepared to receive tenders for the supply and delivery and erection of the above-mentioned equipment.

Contractors desiring to submit tenders may obtain Specification and Form of Tender at this office on making a deposit of £2 2s., which sum will be refunded on receipt of a bona fide tender.

To meet the convenience of Contractors, two copies of the Specification will be furnished; additional copies may be purchased at a cost of £1 1s. per copy.

Any person or firm sending in a tender will be required to comply with the Standing Orders of the Council relating to the "Prevention of Corruption" and to the standard rates of wages and proper hours and conditions of labour. A print of the Standing Orders may be obtained from the Department.

Tenders to be forwarded to the Town Clerk, Town Hall, Sheffield, 1, enclosed in the official envelope provided which must be sealed, and bear no name or mark indicating the sender, and received by him not later than first post on Monday, 3rd March, 1947. Tenders received after the time stipulated herein will not be considered.

The Committee do not bind themselves to accept the lowest or any tender.

JOHN R. STRUTHERS,
General Manager and Engineer.

Commercial Street, SHEFFIELD, 1.
January, 1947.

COUNTY BOROUGH OF SOUTHEND-ON-SEA ELECTRICITY DEPARTMENT.

TENDERS are invited from Post Office Approved Contractors for the supply and erection of a Private Automatic Branch Telephone Exchange.

Specification and form of tender may be obtained from the Borough Electrical Engineer, Electric House, London Road, Southend-on-Sea.

Tenders must be submitted on the forms provided enclosed in plain sealed envelopes (which shall not bear any name or mark indicating the sender), endorsed "Tender for Telephone Exchange," and must be delivered to the Town Clerk, Municipal Buildings, Southend-on-Sea, not later than the first post on 10th March, 1947.

ARCHIBALD GLEN,
Municipal Buildings, Town Clerk.
SOUTHEND-ON-SEA.

SITUATIONS VACANT

BOROUGH OF WALTHAMSTOW.
ELECTRICITY UNDERTAKING.

Appointment of Technical Assistant.

APPPLICATIONS are invited for the permanent position of Technical Assistant at a salary in accordance with Class "G," Grade 6, of the National Joint Board Schedule, at present £567 per annum.

Applicants should possess technical qualifications admitting to Corporate Membership of the Institute of Electrical Engineers and must have had a sound technical training with practical experience in the technical planning of E.H.T. and L.T. underground distribution systems, substations and large scale applications of electricity supply.

The appointment will be subject to the Local Government Superannuation Act, 1937, to the Council's Sick Pay Regulations, to the successful candidate passing a medical examination, and to termination by one month's notice on either side.

Canvassing in any form will be deemed a disqualification and applicants must disclose any relationship to any member of the Council or holder of any senior office under the Council.

Forms on which applications must be made can be obtained from the Borough Electrical Engineer and Manager, Electric House, Church Hill, Walthamstow, London, E.17, and when completed should be forwarded, together with copies of three recent testimonials, in envelopes endorsed "TECHNICAL ASSISTANT" to reach the undersigned not later than the 24th February, 1947.

G. A. BLAKELEY,

Town Clerk.

Town Hall,
WALTHAMSTOW,
28th January, 1947.

SOUTHEND-ON-SEA CORPORATION
ELECTRICITY DEPARTMENT.APPOINTMENT OF ASSISTANT MAINS
ENGINEER.

APPPLICATIONS are invited for the above appointment from Engineers under 35 years of age who possess the minimum qualification of Graduateship of the I.E.E. or the Higher National Certificate in Electrical Engineering. The successful applicant will be responsible to the Mains Superintendent for the operation and maintenance of E.H.T. and L.T. underground and overhead systems, service work in an Urban district, location and repair of minor faults, negotiations with consumers, etc.

The salary will be in accordance with Class F, Grade 7, of the N.J.B. Schedule, commencing at £479 per annum (re-classification to Class G in the near future is probable). The appointment will be subject to the Local Government Superannuation Act, 1937, and the person selected will be required to pass a medical examination.

Applications, giving full details of training and experience, accompanied by copies of two recent testimonials, and endorsed "Assistant Mains Engineer," to reach the Borough Electrical Engineer and Manager, Electric House, London Road, Southend-on-Sea, not later than 17th February, 1947. Canvassing will disqualify.

ARCHIBALD GLEN,

Town Clerk.

Municipal Buildings,
SOUTHEND-ON-SEA.

ELECTRICIAN take Electrical responsibility under Company's Engineer. Cranes, Excavators, Industrial Motors. Cables. Permanent comfortable job. Pension Fund. Grays, Essex, area. Give full particulars with fixed weekly wage required.—Box 1.D.U., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

CITY OF MANCHESTER ELECTRICITY
DEPARTMENT.WANTED FOR DUTIES IN POWER
STATIONS:

ONE COMBUSTION ENGINEER, at a salary in accordance with Class J, Grade 9, of the N.J.B. Schedule (£425 p.a. to commence).

Applicants must have had previous experience of efficient combustion of low grade fuel in water-tube boilers fitted with mechanical stokers.

ONE CONTROL ROOM ENGINEER, at a salary in accordance with Class J, Grade 10a, of the N.J.B. Schedule (£335 p.a. to commence).

ONE CONTROL ROOM ENGINEER, at a salary in accordance with Class K, Grade 10a, of the N.J.B. Schedule (£357 p.a. to commence).

Candidates for all positions must have served a workshop apprenticeship, and have the Higher National Certificate in Electrical Engineering or equivalent. Applicants without these qualifications because of service in H.M. Forces will be considered.

The appointments are subject to the City Council Superannuation Scheme, and the successful candidates will be required to pass a medical examination.

Applications giving full particulars of age, technical training and experience, together with copies of recent testimonials, should be endorsed "Combustion Engineer" or "Assistant Engineer, Control Room," and addressed to Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2; and be received not later than 10 a.m. on Monday, 24th February, 1947.

Canvassing, directly or indirectly, will disqualify.

PHILIP B. DINGLE,

Town Clerk.

Town Hall, MANCHESTER, 2.
January, 1947.

CITY OF MANCHESTER.

ELECTRICITY DEPARTMENT.

APPPLICATIONS are invited for the position of OVERHEAD LINESMAN (POWER). Applicants must have had a wide experience of E.H.V. (up to 11 kV) and L.V. overhead lines and services, mural wiring and general maintenance.

Conditions of service and rate of pay will be in accordance with the D.J.I.C. Schedule No. 3, North-Western Area, Zone A, at present 29.6d. per hour; and the successful applicant will be required to join the Manchester Corporation Superannuation Scheme.

Applications, stating age, details of experience and present employment—endorsed "Overhead Linesman (Power)"—are to be addressed to the Chief Engineer and Manager, Electricity Department, Town Hall, P.O. Box 493, Manchester, 2, and delivered not later than 10 a.m. on Monday, 17th February, 1947.

Canvassing, directly or indirectly, will disqualify.

PHILIP B. DINGLE,

Town Clerk.

Town Hall,
MANCHESTER, 2.
February, 1947.

BOROUGH POLYTECHNIC,

Borough Road, S.E.1.

FULL-TIME LECTURER IN THE DEPARTMENT OF ELECTRICAL ENGINEERING.

THE Governors invite applications for the above-named post. Candidates should be qualified to teach Electrical Engineering to degree standard for the Higher National Certificate. Salary—Burnham Scale. Forms of application and conditions of appointment may be obtained by sending a stamped addressed envelope to the undersigned.

DOUGLAS H. INGALL,

Principal.

SITUATIONS VACANT

COUNTY COUNCIL OF DUMFRIES.

ASSISTANT DISTRICT ENGINEER.

THE Council invite applications for appointment of assistant district engineer. Applicants must have had a sound technical training and experience of the operation and maintenance of H.V. and L.V. overhead distribution systems and rural development work.

The salary will be in accordance with the N.J.B. Schedule, Class F, Grade 8A, at present £413 rising to £429 per annum. The appointment will be subject to the Local Government Superannuation (Scotland) Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications stating age, qualifications and experience, together with names and addresses of three persons who will furnish references, if necessary, must be forwarded to the undersigned not later than 21st February, 1947.

J. C. GRANT,
County Clerk.

County Buildings, DUMFRIES.

24th January, 1947.

SUPERVISING electrical engineer required for steelworks in S. Wales to maintain approximately 3,000 kW of A.C. and D.C. equipment and instal new sub-station under supervision of consultants, with staff of six electricians. Sound knowledge of motor control gear and distribution necessary. Organising ability essential. Commencing salary £500 to £600 a year.—Apply Mackness and Shipley, Parliament Mansions, Westminster, S.W.1.

ELECTRICAL Contractors' Manager required by progressive London Company. Write stating age, experience, salary required, to Box L.D.T., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

WORKS MANAGER for Wire Mill in Manchester. Must be a practical man with experience in drawing Nickel Chrome. Excellent prospects for man with initiative. Box L.D.T., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

MAINTENANCE Fitter or Electrical Fitter wanted for varied mechanical and electrical work.—Arlington Plastics Development Ltd., 15/27, Gee Street, London, E.C.1.

DESIGNER required by British National Electrics Ltd., near Glasgow (Johnson and Phillips Ltd.). Experience in design of modern electric cookers essential. Applications in writing stating age, experience and salary required to be addressed to Johnson and Phillips Ltd., Charlton, London, S.E.7.

ARMATURE Winders required, also Charge-hand or Foreman, also Improvers for fractional motors up to 50 h.p. Standard rates, good prospects.—D.C. Engineering, Sherborne, Dorset.

FOREMAN required by electrical contractors, experienced in cable laying, jointing and overhead line work. Vacancy in Midlands or London district.—Box L.D.K., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

YOUNG Electrical Engineer, B.Sc. honours, required for development laboratory of large electrical concern, S.W. London area. Some experience electronics essential. Apply in writing, stating age, experience and salary required, to—Personnel Manager, 45, Nightingale Lane, S.W.2.

ASSISTANT Engineer required by Electrical Contractors, experienced in Cable Laying, Jointing and Overhead Line Work. Vacancy in Midlands or London District.—Box L.D.P., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

FOR SALE

FOR SALE—Small Tube Benders. Can be carried in toolbag; suitable for plumbers, electricians, etc.—Write C.S. Ltd., Staffa Works, Staffa Road, E.10.

OIL HYDRAULIC TUBE BENDERS and Formers. New condition. Packed in wood or metal carrying boxes.—Write C.S. Ltd., Staffa Road, Leyton, E.10.

SECTIONAL Wooden Buildings, suitable for Bungalows, Garages, Garden Sheds, Offices, Workshops, etc.; buildings made to your specifications; write for list.—Philip Stowe, Joiner and Sectional Wood Builder, Cross Stone Road Works, Halifax Road, Todmorden, Phone 136, Lancs.

FUSES, 35-amp., 3s. doz., 50s. gross; cash with order, post paid.—Gorhard, 5, Milton Road, Ickenham, Uxbridge, Middx.

ALL LARGE BUILDINGS SOLD—We can offer a few new timber-framed asbestos-clad huts, sizes 8 ft. to 6 ft., 16 ft. by 8 ft. and 20 ft. by 12 ft. Full particulars on request. No purchase licence required.—D. McMaster and Co., Mount Bures Works, 21c, Bures, near Colchester. Telephone: Bures 351/2.

14 300 amp. G.E.C. Oil Circuit Breakers, 3 300 volt 3 phase; 12 120/5 Current Transformers; 30 50/5 Current Transformers; 8 120/5 Ammeters; 1 3300/110 volt Chamberlain and Hookham type 7 P 3 Potential Transformer.—Box L.D.V., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

TIME SHEETS—Our stock-printed Time Sheets are remarkably cheap compared with specially printed ones. On decent quality 8 in. by 10 in. paper.—100, 3s. 6d.; 500, 15s.; 1,000, £1 7s. 6d. Post Free. Send for sample.—F. H. Brown Ltd., P.O. Box 26, Burnley, Lancs.

CRYPTON Rectifier, input 50 cycles, 400 volts. Output 460 volts, 25 a. D.C.; also 3-h.p. B.T.H. Motor and Panel Control, 400 volts D.C., variable speed 400-1,600 r.p.m.—The Prospect Laundry Co. Ltd., Cheetham Street, Cheetham, Manchester, 8.

WIRE—Large quantities in perfect condition. Glass-covered Wire, 15, 16, 17, 18, 19, 20, 21, 22 s.w.g.; Double Cotton-covered, 10, 17, 18, 19, 21, 22, 23 s.w.g. Delivery from stock.—James Beresford and Son Ltd., Mackadown Lane, Marston Green, Birmingham.

2 KW, 8 gal. Copper-lined Boilers, 230 or 110 v., 3-heat control, £5 each.—Pearce, 66, Great Percy Street, London, W.C.1 (near Angel).

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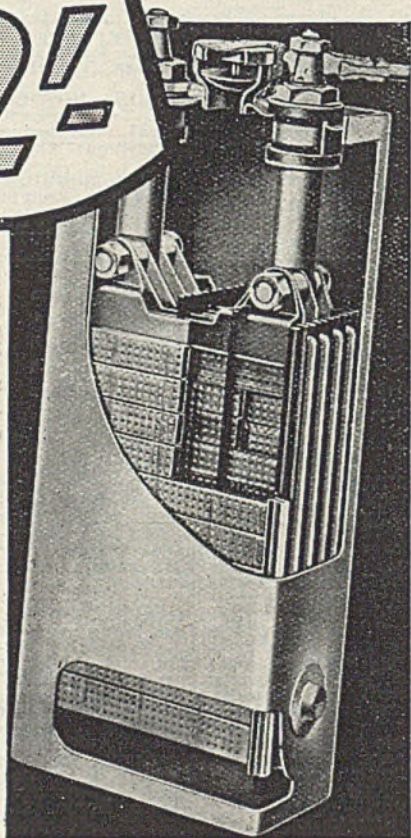
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The Debate

MOVING the Second Reading of the Electricity Bill in the Commons on Monday, Mr. E. SHINWELL, Minister of Fuel and Power, claimed, among other things, that the supply industry, particularly on the distribution side, must be regarded as completely out of date, and no matter what Government had assumed office in July, 1945, it would have been compelled to introduce legislation to reorganise the industry. Such a claim is, we presume, based on the McGowan report on the one hand and on the reports made to the Minister in the Coalition Government by such bodies as the I.M.E.A., the power companies' organisations, the London J.E.A., and so on. Be that as it may, Mr. SHINWELL claimed that reorganisation of the industry was expected by everyone, and put such expectancy as a reason for nationalisation, irrespective of the disruption which such revolutionary legislation will create, not only in the supply industry itself, but also in the ancillary industries.

In THE ELECTRICIAN of January 17 warning was given of the dangers in the Bill, particular attention being drawn to the powers to manufacture to be vested in the Central Authority. That such warning was not misplaced was indicated on Monday, when Mr. SHINWELL, referring to the proposed set-up, said that he was not prepared to start new boards on their career without the necessary powers to secure supplies of suitable equipment and appliances at reasonable prices, and that there must be one body

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responsible for the construction and operation of all power stations; the Central Authority and the Area Boards must therefore have power to manufacture.

Employment and Export Dangers

IF this proposal is permitted to become law, not only will the supply industry be nationalised, but a large measure of the heavy engineering manufacturing capacity of the country may too, become Government-operated, as may also many of those manufacturing interests concerned with domestic appliances. What Mr. SHINWELL imagines will happen in such circumstances to the existing electrical engineering industry is not clear, but it is reasonable to suppose that under the proposals many of its present activities may be reduced, with a contraction of the employment potential. These in their turn may be reflected in a falling away of export trade in that many of the present shipments of capital goods are the result of technical experience with equipment and machinery first tried out in the country's power stations, with the co-operation of both company and municipal undertakings.

Mr. Shinwell and the Companies

IN defence of the manufacturing measure in the Bill, Mr. SHINWELL said, among other things, that many of the companies have had such powers, though they have not exercised them. The companies probably secured their ends, the Minister implied, by interlocking directorates and "special arrangements" with the suppliers of equipment "not always disclosed to the public." The new Boards must be protected, otherwise they might "encounter difficulties in obtaining reasonably satisfactory terms." This part of Mr. SHINWELL's address was full of suspicion and, in view of the seriousness of its charge against the industry, should not be allowed to go unchallenged. Working arrangements between electricity supply and the manufacturing side of electrical engineering are designed to raise thermal efficiency, to reduce generation costs and finally lower the rate per unit charged to the public. If Mr. SHINWELL has any doubt on this point, he has only to compare the average cost of current fifteen

years ago with what it is to-day; the latter price, let it be remembered, having been reached despite the astronomical rise in coal and other raw material charges. In any case, on what grounds can Mr. SHINWELL justify giving to the Central Authority those powers which in the hands of private concerns he regards as being against the public interest? In what way can the consumer be protected against excessive manufacturing costs of the C.E.A. being passed on to the unit charge in an attempt to recover any losses incurred?

Attitude of the House

IF there is any justification for nationalisation, it must be based on a betterment of the supply industry from a consumers' point of view, yet neither the Bill nor the debate offers the slightest hope in this respect. The Bill itself was shown by Mr. SHINWELL on Monday to be nothing more than the expression of a political ambition and completely ignores the national welfare where industries ancillary to electricity supply are concerned. As to the debate, speakers seemed to be more concerned with finance and compensation than with technical achievement, while those speakers who championed the consumer were not only few, but lacking in aggression. The attitude of the House at the opening address seemed to suggest that there was little interest in the Bill, for after the Opposition had moved for its total rejection, members on both sides thinned out, and subsequent speakers were heard mostly by those who hoped in their turn to speak. The proceedings heard from the public gallery were calm and lacking that enthusiasm which we had hoped to see displayed by both supporters and opposers of the Bill, suggesting thereby that not all Members are, perhaps, as fully aware of its implications as they ought to be.

Power of the Minister

THE Bill as presented at its Second Reading is badly framed and, if we must have nationalisation, should be redrawn to bring it within sound engineering economics. Such generalities as are made in its present form with respect to manufacture should be reworded so as to make their intentions perfectly clear, and the powers which the Minister of Fuel desires to assume should be so

qualified that Parliament and not the Minister shall have the final word. As the Bill now stands, the supply industry is more likely to become the plaything of the Minister rather than the servant of the State, and it must be redrawn. Better if it were dropped altogether. Discussion of recent inadequacies of supply are mainly irrelevant, in that their main cause is war-time restriction on expansion of generating capacity; poor quality and low stocks of coal are other contributory factors. To use present difficulties in argument for the Bill is indefensible.

Opinions at Wallasey

WHILE paying tribute to the satisfactory progress of electrical development in the town, most speakers at the jubilee dinner of the Wallasey undertaking last week were unable to resist the temptation offered by the first electrical occasion since the publication of the Electricity Bill, to ventilate their views on nationalisation. If the true motive of the function was a little obscured thereby, it was, however, none the less interesting on that account. Celebrations of the type at Wallasey last week will fall due for several years to come and we suggest that, if and when Area Boards take the place of the corporations in shouldering responsibility for supply, those in charge should not lose sight of such milestones in the history of electricity service. The views expressed at Wallasey with respect to nationalisation were such as to imply that local authorities generally may, through their organisation in the I.M.E.A., seek ways and means whereby pressure may be brought to bear on the Minister of Fuel to permit them to have some voice in the future management of the industry. The views ventilated were admittedly more personal than official, but since their authors may quite possibly have further things to say at the Central Hall meeting on February 20, we may yet see the municipalities as solid in their opinion as the companies have declared themselves to be. It is true that the local authority undertakings are in most cases in disagreement with the Bill for reasons different from those of the company undertakings, but the fact that there is an "off the record" disagreement of considerable depth suggests that the corporations will, when their delegates get together

officially later this month, have a few things to say about the Bill, as critical in their nature as are those already made known by the companies.

Electrical Research

SOME indication of the value and scope of the work of the E.R.A. will be found in an abstract in this issue of the annual report of the association, further views upon which latter will possibly be ventilated at the annual luncheon to be held next Friday. With regard to the future and uncertainty as to the impact which the Electricity Bill will have upon the association, the Council are of the opinion that, since the E.R.A. represents a national asset of no mean importance, its preservation must be accepted as a necessary hypothesis, and its development as a proper subject for future planning. A point of view with which no one in the industry—not even those who have but an elementary knowledge of the work of the association—will fail to agree; but what of finance? Among the chief supporters of the E.R.A. is the supply industry and, bearing in mind the phrasing of the Electricity Bill with respect to the duty of the Central Authority, and in some circumstances the Area Boards, to conduct and assist research, is it reasonable to suppose that the contributions made by the supply industry as at present constituted may be continued and increased under the new set up, if and when the Bill becomes law?

Need for More Money

THE income of the E.R.A. has during the past year improved so far as to meet the present scale of working, but as full as this may be, post-war shortages are acting as a limiting factor. Plans for the future, as represented by the already well-known Leatherhead project, however, require considerable capital expenditure and a much higher rate of annual revenue if that full measure of service which past work of the association has shown to be necessary for the good of the industry, is to be continued. Researches undertaken by the association are both fundamental and applied, and so soon as the restrictions on building and other facilities are relaxed, a greater degree of balance must be infused; preparation for which is already being made in the plans for Leatherhead.

The Bill in Debate

We give below the substance of the remarks made by the Minister of Fuel and Power, Mr. E. Shinwell, in the House of Commons on Monday, when he introduced the Electricity Bill for Second Reading. The debate which followed on Monday and Tuesday is also given in abstract. Heard from the Public Gallery of the Commons, the opening proceedings did not appear to attract more than an average attendance, and at the conclusion of the Opposition speaker's motion for rejection of the Bill, the House thinned out until there remained few more than those who themselves wished to speak. The debate on Tuesday evening was livelier and substantial argument against the Bill was put forward. Put to the vote the motion for rejection was defeated by 175, 165 being for the rejection and 340 against. The Bill was then read a Second Time. A motion to commit the Bill to a Committee of the whole House was negatived by 330 votes to 169—Government majority 161.

OPENING the debate on the Second Reading of the Electricity Bill on Monday, the Minister of Fuel and Power (Mr. Shinwell) said that the supply of electricity and, in particular, its distribution, was at present organised on a basis which must be regarded as completely out of date. Whatever Government had assumed office in 1945 would have been compelled to introduce legislation to re-organise the distributive side of the industry.

The municipal undertakings regarded the supply of electricity as a public service. The companies regarded it solely as a business enterprise, the success of which was determined by profits. "One of the criticisms of the Bill," Mr. Shinwell said, "is that the Central Authority will have power to manufacture electrical plant and fittings, and that they and the area boards will have power to sell, hire or instal electrical fittings. In some quarters it is regarded as monstrous that these public bodies should manufacture electrical plant and fittings. It is, therefore, necessary to explain why we are giving the electricity boards such power. At present, many private companies in the industry have power in their articles of association to manufacture plant or fittings, and I regard it as the right policy to give to their successors similar powers.

"I understand," he continued, "that the companies have not exercised these powers, but while they have not done so directly, there has been a close connection between the supply and the manufacturing sides of the electricity industry. The device of interlocking directorates is quite well known."

Equally, he proceeded, the selling and installation of electrical appliances was an essential part of the work of the boards. The great expansion of electricity which would emerge from the activities of the boards would assist electrical contractors in various ways, and if there were firms

who wished to co-operate with the boards by acting as their agents or by undertaking the work of installation, there was no reason why they should not enter into agreements for that purpose.

About 20 per cent. of the local authorities, Mr. Shinwell went on, regarded their undertakings as a means of contributing towards the relief of rates. The transfer of undertakings under the Bill was a form of transfer from one kind of public ownership to another, and local authorities would not wish to make any profit out of the transaction. As regarded the private companies, the problem of determining their assets was almost unexampled in its difficulties, and he had come to the conclusion that the only possible method to be adopted was the one embodied in the Bill. This method was not only practicable but fair, and even generous.

"It is estimated," the Minister said, "that of the £700 million to be made available for development, at least £200 million will be required for power stations alone. About £400 million will be required for improving the distribution network and a substantial proportion of that will be used in the development of supplies to the countryside." The Bill, he concluded, made an indispensable service a national concern, available, as soon as physical difficulties were overcome, for industrial and domestic use at a price strictly related to costs. In every respect it was a Bill designed for public well-being, and he could confidently recommend it to the House.

Mr. R. S. Hudson, speaking for the Opposition, said that in 20 years he had never heard a Minister give such an inadequate explanation of a measure. Anyone defending the Bill ought to endeavour to show that the benefits would be greater than those which reasonably could be expected to accrue from the present development plans, both of private companies and

of municipalities. Secondly, it was essential to show that those benefits would outweigh the disadvantages which were bound to result from the dislocation of the industry.

Where did the Bill improve present conditions? It did not mention generation and, so far as transmission was concerned, there was no improvement, because that was already owned by the Central Board. No statutory safeguards for the consumer against undue preference were inserted, and the protection which they had now was destroyed. So far as tariffs were concerned, the consumer was at the mercy of the area boards, and there would be more faith in the consultative councils if they were appointed by outside bodies, and were not to be merely "stooges" of the Minister.

Dealing with the compensation clauses, Mr. Hudson said that it did not follow that the total value of shares quoted on the Stock Exchange accurately represented the real assets of a company: further, the Chancellor of the Exchequer proposed to pay shareholders pre-election Stock Exchange quotations, but in depreciated currency. A contrast existed, in the case of municipalities, between the provident local authority, which had steadily expanded its services, and yet amortised its debt, and the improvident authority, which had kept charges low.

"To sum up," Mr. Hudson declared, "this Bill is one more example of the Government's passion for over-centralisation. Two-thirds of it is an attack on non-profit-making local authority enterprise. Many of its provisions are grossly unfair and, of all the nationalisation measures hitherto introduced by this Government, this will do the most harm to the revival of industry and the increase of production."

Mr. Henry Nicholls, in a maiden speech said that although approving of the Bill in principle, he thought it might be made even more attractive. He suggested an independent tribunal for appeals, and he would like to know if the 70 references giving the Minister power to intervene meant the Minister or the Ministry. It was hardly right that some subordinate at the Ministry should have authority to interfere with the technically competent individuals trying to provide the service lower down the scale.

Col. Lancaster said that, as a consumer,

he wanted to see many of the recommendations of the Bill carried out, but he did not think it was necessary for that reason to introduce a Bill which took away from a consumer the vital safeguard of competition or the ability to secure power for himself by his own arrangements.

Speaking as an electrical engineer, Mr. Palmer said that the Bill meant that the design and structure of power stations could follow standard lines and that manufacturers would not be burdened with a variety of separate specifications. The Bill completed and rounded off the 1926 Act, and brought hope of standardisation of voltages, tariffs and, maybe, retail charges, for considerable areas. It put things on the only possible political basis—that was, public ownership.

Mr. Macpherson said that the power of the Minister to order the Central Authority to withhold information about ministerial directions enabled him to deceive the public entirely. The Bill was completely unnecessary, and he maintained that the interests of the consumer were not sufficiently safeguarded. So far, there had not been a single argument put forward which could justify the sweeping changes proposed.

At this point, the Secretary of State for Scotland (Mr. Westwood) intervened to give an account of the Bill as it referred to Scotland, and Commander Galbraith, following, said that the scheme proposed dividing Scotland into three parts, and made the southern part of the country into what were really English provinces.

Speaking for the Liberal Party, Mr. Wadsworth said that they, in the main, supported the Bill. He hoped that present conditions would not cause a delay in making arrangements for new stations, and it was quite clear, he thought, that plans should be made immediately for the electrification of farms.

Mr. Blyton said that municipalities complained very bitterly of the financial burden which would fall on ratepayers on the vesting date, and he asked the Minister to give a little more compensation to assist towns so placed.

Mr. G. Williams said that the Minister had given no promise of cheap electricity. To enable the Government to carry out their scheme successfully, they were going to fleece the electricity corporations.

Mr. Cook hoped that the Minister would reconsider the compensation, and pay on a basis of capital expenditure less depre-

Of the £700 million to be made available to the British Electricity Authority for development purposes, Mr. Shinwell states, at least £200 million will be required for power stations alone.

About £400 million will be required for improving the distribution network, and this will be used in the development of rural supplies.

action over the whole of the industry.

Mr. Goodrich, welcoming the manufacturing clauses, said that it was well known to those who gave out tenders that the firm or contractor who was to have the contract was informed in advance to that effect by his colleagues.

Mr. Birch thought the Government had broken faith with their own bondholders, and had perpetrated a swindle on shareholders which they dare not submit to arbitration.

On the second day, the debate was resumed by Mr. Pickthorn, who said that he was surprised to hear it said that all workers were in favour of the Bill. Would consumers have a guaranteed right to get current at the same rate as comparable people? Were there to be price ceilings, and any right of appeal to independent tribunals? If there was one section of the industry that was open to criticism, it was the Central Electricity Board. The planners decided in the first year of war that the generation capacity needed during the war would be considerably less than in peace, and it turned out to be more.

Mr. J. Lewis said that under public ownership there was a guarantee to provide all amenities in the national interest. The greatest benefit would accrue in the field of distribution, although some economy would be effected in the general administration of the industry. The Opposition had failed to realise, on compensation, that there was an element of monopoly value in the prices at which the shares existed.

Sir Arnold Gridley, saying that he had been actively engaged in the electricity industry for nearly 50 years, claimed that the industry had put up a performance over the years that had been surpassed by none. No arguments advanced in support of the Bill showed the slightest justification for nationalising an industry which was already so largely under public ownership and control. In the powers it sought, the Bill was entirely outside the Government's electricity mandate. It asked the House to accept a plan which was utterly at variance with expert advice given in reports by Government Committees. The Government had made a faulty diagnosis of the indisposition of the industry, and quack remedies were prescribed by quack doctors.

A RETROGRADE STEP

Mr. Elliot said that in particular the destruction of the great municipal undertakings was a retrograde and not a progressive step. "The views on compensation of the Glasgow Corporation," he said, "would make the companies' mouths water until they drooled upon their beards. Instead of a compensation of £2 340 000, it is said that they should receive

£12 400 000 for the undertaking. Glasgow has borrowed £11 670 000 and repaid nearly £9 000 000, and is left with a debt of £2 870 000. The Tory city of Birmingham has borrowed £24 238 000 and repaid £8 600 000. Their debt is £13 570 000, and Labour members will have a pretty stiff task explaining to the people of Glasgow why the Tory city of Birmingham is getting away with over £13 000 000 and they are only getting a little over £2 000 000."

CAVALIER TREATMENT

Mr. Burden said that the Bill proposed a somewhat cavalier treatment for local authorities. Their undertakings were to be taken over on terms that the Minister would not dare to propose to private enterprise. The local authorities were ready to come into any national plan which would help to bring the blessings of electricity to the whole community, but they ought not to be put in a worse financial position because their profitable undertakings must now form part of a national plan. The Minister should ensure that members of local authorities now owning electricity undertakings were appointed on the Area Boards as of right, and thus maintain direct representation between the community and the governing body of the industry.

Mr. Boyd Carpenter said that the habitual arguments against nationalisation could not be used in the case of the electricity industry. What case was there for transferring undertakings from one form of public ownership to a monstrous operation which, if the precedent of the Coal Board was followed, would be completely isolated from criticism?

Mr. H. Roberts maintained that local authorities should be compensated for the loss of the equity in their undertakings. To rob them of their assets was unpardonable. The purpose of this confiscatory measure, as applied to the public authorities and private enterprise, was to bolster up unsound finance and enable a profit to be shown on a fictitiously reduced capital.

Making the reply for the Government, Mr. Gaitskel (Parliamentary Secretary, Ministry of Fuel and Power) said that the Boards would honour recent agreements with the trade unions, and Joint Industrial Councils would continue, so discussions would be necessary between the unions and the Boards on modifications. Replying to the criticism that Area Boards would compete with small traders in selling electrical appliances, Mr. Gaitskel said that the consumer would be free to go elsewhere if he chose. Non-statutory undertakings were deliberately left out of the Bill. They primarily supplied themselves.

(Continued on p. 438).

The Wallasey Jubilee

Views on Implications of the Bill to Local Authorities

AS one of the first public functions to be held by a municipal authority since the publication of the Electricity Bill, the jubilee celebrations of the Wallasey undertaking, on January 29, understandably held more than local interest. Speakers showed considerable divergence of viewpoint on the Bill as a whole, but there was, however, fairly general agreement that the proposed treatment of local authorities was unfair.

The celebrations opened, as indicated in THE ELECTRICIAN last week, with a luncheon, at which many electrical personalities from the north-western area were present, and this was followed by a tour of the generating station and main sub-station, under the guidance of the engineer and manager, Mr. W. G. Forster, and his deputy, Mr. J. H. Osborn.

A member of the party for whom this tour had a special significance was Mr. Gilbert Starkey, late mains engineer, who had been present at the opening ceremony in 1897.

In the evening, some 200 guests were entertained at dinner. The first toast was proposed by Sir John Kennedy, deputy-chairman of the Electricity Commission, who began by reviewing the progress made in the last 50 years. Electricity, he thought, had been the most beneficial of scientific advances, and so far as the supply industry was concerned, there was as yet no prospect or risk of saturation.

The Wallasey undertaking, Sir John continued, had a good record, but the average consumption of 400 units per annum per head, against a national average of 700, showed that there was still room for expansion.

"I notice," Sir John said, "that the Electricity Commissioners are to be dissolved, but trust it will be a painless process." Under the Bill, local authorities would not have a direct financial interest, but the borough would still be responsible for the interests of consumers, and this would have to be maintained. It would still be possible, he hoped—if necessary

by amendment—to keep local interests in mind.

With regard to rate relief, Sir John went on, this was a vexed question, and some consumers might ask why they should subsidise the rates. He then outlined some of the advantages of unifica-



Guests inspecting the switchboard. Left to right: ALD. GILL, chairman of the Electricity Committee, SIR WILLIAM WALKER, ALD. KING, the Mayor, and COUNC. BAKER

tion which would take place under the Bill, particularly in the matter of charges. The divorcement of generation from distribution, he said, appeared inevitable, and a single authority would be able to site and operate a station without certain of the difficulties which arose at present.

Turning to rural distribution, he thought that rural and urban areas should be integrated, but this did not necessarily mean that urban areas should subsidise the others.

Responding, the Mayor (Ald. B. G. King) said that he knew the part electricity had played in the growth of the town, which had trebled its population in 50 years. He agreed that there was still a wide field for expansion, and he hoped

that all the benefits that electricity could bring would soon be available to the lower wage-earning classes. Local consumers had jumped at the chance of hire schemes, etc., and he hoped the idea would be widened in scope.

The vice-chairman of the Electricity Committee, Counc. Allison, referred to the decreased cost of electricity at a time when almost all other costs had increased, and reviewed some of the steps that the undertaking had taken to meet anticipated growth in demand. The reserve fund, he said, was nearly £100 000, and the capital debt only one quarter the value of the undertaking. In this respect, the borough could stand comparison with many others. When the Government nationalised electricity, Counc. Allison continued, they would take over from Wallasey a flourishing and efficient undertaking. He was, however, concerned about the terms of the Bill. The borough would expect reasonably generous compensation and would strongly resent spoliation. Large parliamentary majorities should take note, he concluded, that any injustice they committed must be righted in later years.

The next speaker was Sir William Walker, who said that after listening to speeches about the efficiency of the industry, one wondered why it was necessary to nationalise it at all. But it would prosper under any auspices. He thought it was a calamity that half the new houses were being supplied with gas, this despite the fact that polls had shown 70 per cent. of occupants preferred electricity.

The area of the country where rural supplies were not available, Sir William said, was very small, and in some few cases the towns would have to give assistance, but he would object to increasing the cost to highly-rated town dwellers in order to lower the cost to lowly-rated consumers in rural areas.

CASE AGAINST COMPENSATION TERMS

Under the Bill, it seemed likely that the I.M.E.A. and the E.D.A. might pass out of existence. These valuable organisations, however, had to be retained somehow. The I.M.E.A. must present the case of the local authorities against the proposed compensation terms. His own undertaking, Manchester, for instance, had assets of £16½ million and a debt of only £6 millions. Local authorities should not be handed over in this manner, and it was evident that much of the Bill had not been thought out.

Its worst feature, Sir William thought, was that the Minister was mentioned no less than 79 times, and when one talked of "the Minister," one meant "Ministry," and that, in turn, meant civil service—for an industry that had known

freedom in the past. The capable men already in the industry should be left to use their own judgment, and it would be a disaster if civil servants had control, which might throw the industry back for a generation. There was no guarantee that the Minister would appoint to his boards people who had any experience of supply. A big fight was ahead, and he asked all to back up the I.M.E.A. in its efforts to improve the Bill before it became law.

I.M.E.A.'S VIEWPOINT

Mr. J. S. Pickles (president, I.M.E.A.) said that municipal organisations felt that public ownership must prevail, but ownership by local authorities had many virtues and the small place that the Bill provided for them was, the I.M.E.A. felt, insufficient. The Bill was, in any case, inevitable, but the I.M.E.A. had prepared a memorandum suggesting some improvements. He asked for everybody's support, because if more attention were paid to local authorities, the Bill would be more successful and nationalisation would get off to a better start.

"Our Guests" was proposed by Ald. C. G. E. Dingle, and Ald. Mrs. Gregory (E.A.W., West Ham), responding, said that despite Sir William Walker's pessimism, some good was sure to come out of the Bill. In any case, the women of Britain were still looking to the electrical industry for the things they needed, no matter who ran it.

The final speaker was Mr. C. T. S. Arnett (N.W. area manager, C.E.B.), who referred to the recent White Paper on "Economic Considerations" and agreed that the position of Great Britain was extremely serious. One of the gravest difficulties was man-power, and he appealed to all who had any influence to impress upon M.P.'s that those who built and ran power stations and the other basic industries should be given a great deal of priority.

During the evening, musical entertainment was provided against a pleasing decoration scheme using coloured fluorescent tubes, installed by members of the electricity department.

Work on the hydro-electric development schemes at Kintyre and Arran by the North of Scotland Hydro Electric Board is expected to begin shortly. At Arran the Board hope to have power for the island by the end of the year. The plan is to run a h.t. overhead line round the coast and already electric fittings and wiring are being installed in readiness. The scheme at Kintyre, which aims at providing electricity for the greater proportion of farms and villages in the landward area, has been approved by the Kintyre Divisional Committee.

MODERN SWITCHGEAR—VII

by R. N. BUTTREY, M.Sc.TECH., A.M.I.E.E.

Comparison of Oil Circuit-Breaker Types.—In this, Part VII* of the series, is given a comparison of the various types of oil circuit-breaker made on the following basis: 1. Performance; 2. Accessibility and Maintenance; 3. Economies in Manufacture; 4. Oil content and overall dimensions. The oil content influences not only initial and service costs, but also maintenance, when oil drainage is necessary, and fire risk.

Performance.—The development of efficient arc-control devices has made it possible to simplify breaker construction and employ single-break operation on oil circuit-breakers over the whole range of normal power station and sub-station practice. When the vertical single-break type of gear, employing an arc-control device, was introduced some years ago, it was shown that a second gap on the

taken on one break only. On this basis, it follows that all duties carried out on orthodox double-break circuit-breakers which do not employ any means for distributing voltage between breaks, can be satisfied with the single-break circuit-breaker and it is becoming customary to employ single-break operation on e.h.t. oil circuit-breakers up to 132 kV.

The performance requirements of a modern oil circuit-breaker may be briefly

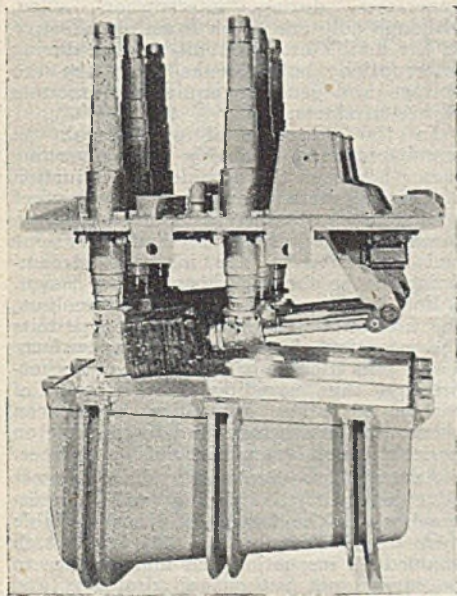


Fig. 1—Horizontal single-break, low-oil content circuit breaker, 1 000 MVA, 33 kV

orthodox two-break switch could be omitted, since under most fault conditions, at least 80 per cent. of the duty was

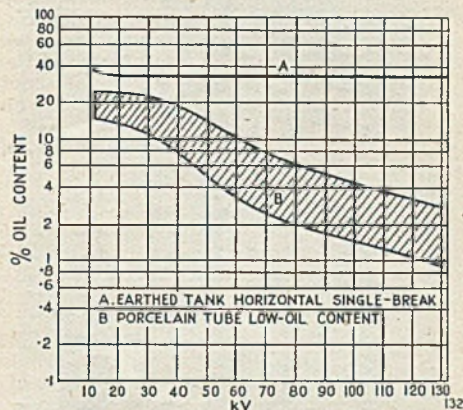


Fig. 2—Oil contents of single-break circuit breaker compared with round tank, double-break oil circuit breaker

summarised as: (a) Satisfactory handling of normal and short-circuit currents, including the phenomena associated with short-circuit electro-magnetic forces. (b) Efficient high-speed interruption on all currents likely to be encountered in service, including transformer magnetising currents, line charging currents, and heavy short-circuit currents, within a short period of time to minimise system disturbances. The operating (total-break) time of a circuit-breaker consists of the opening time, which is the time from initiation of the tripping impulse to separation of circuit-breaker contacts and the arcing time (the total duration of the arc drawn after separation of contacts). The sum of these two durations is termed the total-break time and circuit-breakers are generally expected to fall within the "high speed" category; i.e., the total break time not exceeding 0.1 secs. For e.h.t. circuit-breakers above 44 kV, where short circuit outputs at present extend up to 2 500 MVA and are expected to increase to twice this value, much shorter

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

total-break times are aimed at in order to reduce system disturbances to a minimum. Three-cycle operating times, consisting of an opening time of $1\frac{1}{2}$ cycles and a smaller arcing time, are now possible

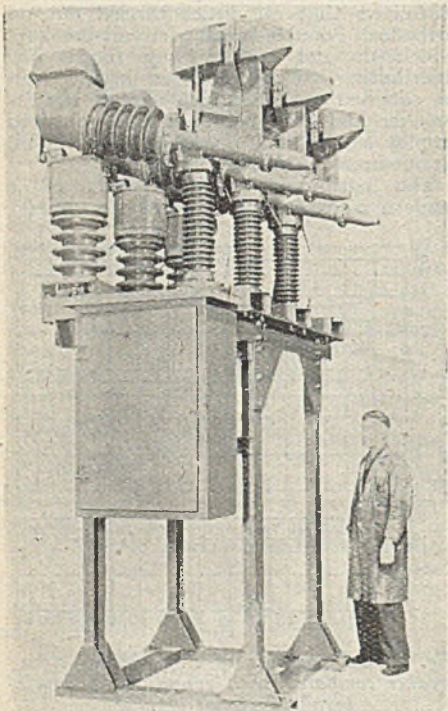


Fig. 3—Outdoor low-oil content circuit-breaker, 1 500 MVA, 33 kV and 44kV

up to 132 kV. (c) Satisfactory insulation strength under normal, switching, and lightning over-voltage conditions.

In addition to the requisite insulation levels which have already been agreed upon by the various standards bodies, adequate insulation between circuit-breaker contacts during circuit interruption is necessary, especially during interruption of line charging currents where restrikes may cause appreciable over-voltages. Whilst, in such a case, the over-voltages arising are generally within the limits for which a circuit-breaker installation must be designed to satisfy other kinds of normal switching over-voltages, restrikes on c.h.t. overhead lines may produce excessive short-time values of charging current sufficient to cause damage to arc-control devices.

The above conditions require, in addition to efficient arc-control, high-speed contact movements and the minimising of

electro-magnetic influences on a circuit-breaker operation, which conditions are most easily satisfied in the single-break type of oil circuit-breaker.

In considering the requirements associated with electro-magnetic forces, it is interesting to note that B.S. 116/1937 recommends the adoption of power closing devices when short-circuit currents greater than 10 kA are to be dealt with. In practice, this recommendation applies essentially to circuit-breakers in which the presence of electro-magnetic forces renders it impossible to close by hand on maximum short-circuit currents, or there is a danger of contacts welding unless closed home at a speed unattainable by manual operation. In the single-break types of circuit-breaker in which, as has been shown earlier, the undesirable effects of electro-magnetic forces can be eliminated, it may be of advantage to fit fault-current release devices in order to limit system disturbances to a minimum when closing on to faults.

A further advantage of the single-break design is the considerable reduction in quantity of gas and other arc products generated during interruption since, although only one break is mainly effective in the double-break circuit-breaker during interruption, both breaks share the arc voltage and generate equivalent amounts of arc products.

In the adoption of single-break oil circuit-breakers, probably the governing factor has been the considerable reduction of moving masses, enabling high contact speeds to be obtained with only moderate mechanical requirements, and the same end is assisted by the inherent streamlining of the moving parts in this design.

For indoor metal-clad circuit-breakers, the horizontal single-break type permits the retention of vertical, bushing surfaces as on the double-break type of circuit-breaker, thus avoiding the deposit of carbon or other impurities which can occur, and which may lead to tracking on horizontal non-ceramic insulating surfaces.

Accessibility.—Probably the greatest advantage of the double-break circuit-breaker was the feature of the removable tank on breakers up to 66 kV which enabled all inspection and maintenance to be carried out without oil drainage, and the horizontal type of single-break circuit-breaker (Fig. 1) permits the retention of this feature. Another outstanding advantage has been the provision for removing contacts and carrying out of maintenance on these without interfering with arc-control devices in any way.

Economics in Manufacture.—In addition to the saving in manufacturing costs resulting from (a) halving of the number of contacts and arc control devices; (b)

reduction in mechanical requirements due to almost complete elimination of electro-magnetic effects, and inherent reduction in weight of moving parts; (c) reduction in overall size of structure, the reduction in arc products, gases, etc., the single-break design permits the use of much smaller air-cushion spaces in a circuit-breaker top plate, thereby permitting a reduction in insulator length except where current transformer accommodation has to be provided within the circuit-breaker. This shortening of insulator lengths has been found valuable in reducing mechanical stresses on insulators, permitting the more economical and superior insulating material—porcelain—to be employed in circuit-breakers on rupturing capacities hitherto never achieved except with paper bushings.

Oil Content and Overall Dimensions.—

Whilst the employment of the single-break principle results in considerable reduction in oil content without any special shaping of tanks, there is a great difference in the oil content of single-break breakers employing, (a) earthed metal tanks for indoor metal-clad assemblies and (b) live tanks, i.e., insulating tube assemblies for outdoor use.

Fig. 2 shows the relative amounts of oil required on single-break circuit-breakers compared with orthodox double-break circuit-breakers. Curve A shows that the horizontal single-break circuit-breakers employ approximately 33 per cent. of the oil required in the orthodox double-break type.

It is of interest to note in Fig. 2 that there is a great divergence in quantity of oil employed in outdoor circuit-breakers of the insulated tube type, the range of values given covering "low oil content" and oil minimum circuit-breakers. With regard to curve B, a design of outdoor oil circuit-breaker employing the porcelain body tube is shown in Fig. 3 and has a total oil content of 24 gal. for a rating of 1 500 MVA, 44 kV.

Savings in overall dimensions are mainly achieved on the horizontal single-break design by the greater ease with which the simple form of tank can be employed to follow closely the internal configuration of live parts as, for example, with a shallow rectangular tank, or semi-tubular tanks enclosing each phase, and also the reduction of size of dome in the top plate (as mentioned above) resulting from the reduced gases generated by the arc.

Whilst single-break oil circuit-breakers have been applied, up to the present, for three-phase line voltages up to 132 kV, higher voltages are more economically dealt with by the provision of two or more breaks in series. In considering the orthodox type of double-break oil circuit-

breaker under such conditions, it is necessary to weigh the advantage of the simple provision of two breaks of the latter, which may be fully utilised by employing some means to equalise voltage across

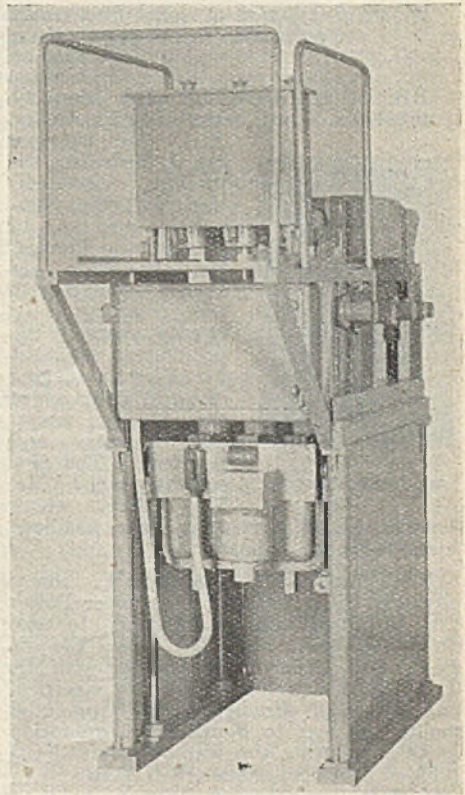


Fig. 4—Duplicate bus-bar 33kV metal-clad unit, incorporating horizontal single-break low-oil content circuit breaker

breaks during circuit interruption, against the inherent advantages of the single-break type, employing multi-break arc-control devices, which include considerably reduced oil content and lightness of moving parts necessary for high speed operation.

In the application of indoor metal-clad circuit-breakers, the problems of accessibility and maintenance provide a bias in favour of the removable tank, and Fig. 4 illustrates a metal-clad 33 kV, duplicate busbar unit employing the circuit-breaker shown in Fig. 1. Such a unit incorporates the established feature of vertical isolation of the circuit-breaker, with off-load transfer busbar selection.

• Electrical Personalities •

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

MR. S. BROUGHTON, has been appointed managing director of Electrolux, Ltd. He succeeds Mr. J. Scrivener, the present vice-chairman and the company's original managing director. Mr. Broughton has been associated with the company for twenty years in the positions of assistant to the managing director, manager of export sales, assistant secretary and secretary. The new secretary will be Mr. M. Aitken, whose



MR. S. BROUGHTON

business life of over twenty years has been spent with the company.

MR. HAROLD BRADSHAW, mains engineer with the West Gloucester Power Co., Ltd., has sailed for Cyprus, to take an appointment with the Nicosia Electric Power Co. Receiving his training with Mr. J. E. Starkie, a former Burnley electrical engineer, Mr. Bradshaw was appointed mains engineer to Southport Corporation in 1938. During the war he attained the rank of lieutenant-commander, R.N.V.R.

THE HON. MRS. GAMAGE, wife of Mr. Leslie Gamage (vice-chairman of the General Electric Co., Ltd.), on January 25, was again hostess at the G.E.C. head office junior staff annual social. Nearly 100 young people sat down to an excellent lunch in the canteen at Magnet House, Kingsway, London, after which they were taken by motor coach to Olympia to see Bertram Mills' circus.

MR. W. M. RATCLIFFE, owing to ill-health, has relinquished his position as managing director of Heenan and Froude, Ltd. He will continue to serve the company as joint managing director with Mr. F. J.

Fielding, who has been appointed to share that office. Mr. A. H. Langford, who has been associated with the company for 35 years—16 years as works manager and three years as general manager—and Mr. R. V. Rowles, who has been connected with the subsidiary, Fielding and Platt, Ltd., for 30 years, including 11 years as a director, have both been elected directors of Heenan and Froude, Ltd.

MR. E. F. SCHOFIELD, mains assistant at Blackburn, has been appointed assistant mains engineer in the Luton electricity department.

MR. H. F. HUTCHINSON has been appointed by the London Transport Board as publicity officer. He was educated at the Liverpool Institute and Corpus Christi College, Oxford, where he took an honours degree in modern history.

MR. W. L. TREGONING, who was recently appointed a joint managing director of the Jackson Electric Stove Co., Ltd., has been released for a period of twelve months to the Government to take up a senior executive position with the German Control Commission.

MR. H. HARRISON, deputy borough electrical engineer of Tynemouth, has been appointed borough electrical engineer in succession to Mr. J. B. Glen who has retired. Mr. Harrison began his connection with the electricity supply industry before the 1914-18 war when he was with



Members of the G.E.C. junior staff at Magnet House about to board motor coaches in Kingsway, on their way to the Olympia circus

Whitby Council electricity department. He was afterwards with the North-Eastern Electric Supply Co., Ltd., and later with Bolton Corporation for 13 years. In 1935 he was appointed mains engineer at Tynemouth, and some time afterwards was promoted to deputy borough electrical engineer.

MR. H. T. CARR, acting publicity officer for the L.P.T.B., has retired after 40 years' service with the Board and its predecessors. Mr. Carr joined the Bakerloo Railway in 1906—the year it was opened—as a draughtsman in the engineer's office. His connection with the Underground publicity department began in 1909, when he took charge of it.

DR. R. C. GOODING WILLIAMS has joined the North American Philips Co., Inc., of New York, U.S.A., as an executive engineer. Dr. Williams went to America for the purpose of gaining experience in American industrial developments in the electrical and allied fields and to become acquainted with their manufacturing methods. He has had wide experience in the field of radio and industrial electronics, and has held executive posts with Murphy Radio, Ltd. He is a prominent member of the Radio Section of the I.E.E.

SIR JOHN ANDERSON, the president, at the annual luncheon of the Parliamentary and Scientific Committee, held at the Savoy Hotel, London, on January 30, commended the help the Government is giving to scientific study and development. He said that the increase in the number of students enrolled at universities was an encouraging indication of progress. It had been achieved in a material degree by the representations made by the Committee. Sir Clifford Paterson, head of the research organisation of the General Electric Co., Ltd., in describing the progress of research in the electrical industry in recent years, said he believed that the new fluorescent tubes would provide our source of lighting in the future. "They are very good now," he said, "but they are going to be improved still further."

MR. JOHN GARNETT POTTS retired on Monday, February 3, from the post of electrical engineer and manager of the Bury (Lancs.) Corporation, which he had held for 24 years. He received his early training in electrical engineering with Ferranti, Ltd., at Hollinwood, and Mather and Platt, Ltd., Manchester. His first appointment with the electricity supply industry was as a pupil-improver with the Salford Corporation, by whom he was appointed later as an assistant engineer. For two years he was a charge engineer with the Mersey Railway Co., and he also had two years as an engineer-in-charge

with the North Wales Power Co. at the Cwm Dyli station at the base of Snowdon. Subsequently he was a charge engineer at the Birkenhead power station. He went to Bury Corporation as a charge engineer at the Rochdale Road station in 1910, and the same year was made clerk of works in charge of the installation of plant at the Chamber Hall power station, then being constructed. When that work was completed two years later, Mr. Potts was appointed resident engineer in charge of the station.

Obituary

CAPTAIN ARTHUR JAMES MAYNE, formerly chief electrical engineer, Aldershot Command, on February 2, aged 76 years. Educated at Tettenhall College, Wolverhampton, and Mason College, Birmingham, he served his apprenticeship with G. E. Belliss and Co. (now Belliss and Morcom, Ltd.), at Birmingham. He became assistant works manager for Arthur B. Gill and Co., Lewisham, and then a partner in the firm of New and Mayne, electrical engineers, Westminster. From February, 1894, to August, 1897, he was managing director of the Woking Electric Supply Co., and in 1898 he was appointed chief electrical engineer to the War Department, Aldershot Command, a position he held until his retirement in 1935. After the 1914-18 war he was awarded the O.B.E. He became an associate member of the I.E.E. in 1899 and a full member in 1913.

I.E.E. London Students

AT a meeting of the I.E.E. London Students' Section on January 28, Mr. P. H. J. Johnson presented a paper on "The Principles of Manual and Automatic Telephone Exchanges."

The author outlined the principles of the methods used by the Post Office for the interconnection of telephone subscribers, dealing first with the manual exchange, showing how communication between any two subscribers was effected. The system employed was described and illustrated by slides and demonstrations.

The advantages of automatic systems to the subscriber were explained.

The one-hundred line, one-thousand line and ten-thousand line automatic exchange systems were dealt with in a comprehensive way, each particular system being illustrated by means of both slides and demonstrations. Some outline of the more complicated apparatus required to enable connection to be made to neighbouring exchanges in an area such as the London telephone area, i.e., the director system, were given by the author.

Brighton's £14 Million Station

OPPOSITION TO SITE OF PROPOSED EXTENSION AT SOUTHWICK

THAT the £14 000 000 power station, 900 ft. long, 300 ft. wide and 120 ft. high, with two 350 ft. chimneys which the Brighton Corporation proposes to erect at Southwick, would present an enormous obstacle to the view of the sea was argued at the public inquiry, held at Brighton Town Hall, on January 30, into the Council's application for consent to the first half of the scheme. This provides for the installation of three turbo-aiternator sets, each having a maximum continuous rating of 52 500 kW, and six boiler units, each having a maximum continuous evaporative capacity of 320 000 lbs. of steam per hour, with the necessary ancillary plant, buildings and civil engineering works, to be completed by 1950 at a cost of £7 500 000.

Sir Cyril Hurcomb, chairman of the Electricity Commission, presided, and sitting with him were Mr. E. Fitzgibbon, of the Ministry of Town and Country Planning, and Mr. Morley New, of the Electricity Commission.

The application was opposed by Southwick Urban Council and also by two fishermen.

Sir Cyril Hurcomb said he did not want elaborate evidence of the need for installing additional generating plant, everybody had ample evidence that there was a shortage of power plant and a great deal would be required to make it good.

Mr. Erskine Simes, who appeared for Southwick Urban Council, explained that he was concerned only with the question of siting and the protection of amenities.

The Town Clerk, Mr. J. G. Drew, opening the case for the Corporation, said the site of the projected extension adjoined the existing power station. Two important factors in the choice of this site were that the unlimited cooling facilities of the open sea could be tapped and that the supply of coal could be wholly seaborne. Dealing with the "grit nuisance" of which one objector complained, the Town Clerk said the power station adjoined a number of other industrial works and he thought he could show that the power station was not to blame.

Mr. Erskine Simes, said his clients were not going to ask that the station should not be put up in that spot at all, but that the site should be moved to the east of the existing station.

Mr. H. Pryce-Jones, engineer and manager of the Brighton electricity undertaking, and chief engineer of the proposed extension, said that when preparing the

plans, he considered the site on the east side of the present station and rejected it on technical grounds alone.

Mr. John Hacking, chief engineer of the Central Electricity Board also gave evidence for the Corporation.

Evidence for Southwick Urban Council was given by Mr. A. G. W. Penney (Chairman of the Council), Mr. G. E. Payne, a town planning expert, Mr. K. H. Tuson, a consulting engineer, and the two fishermen.

The inquiry was concluded and the site was then inspected.

(The Bill in Debate—concluded from p. 430)

but they would compete with Area Boards and supply consumers. The Government, he said, could not wait any longer because the local authorities were not in a position to exercise franchise rights over a very wide field and in the next five or 10 years, there was bound to be a considerable development and very heavy capital expenditure.

The House divided and there voted: for the reject on, 165; against, 340; a Government majority of 175. A motion to commit the Bill to a committee of the whole House was negatived by 330 votes to 169—Government majority, 161.

The House went into Committee on the money resolution in connection with the Bill. The resolution authorises for development in the industry a sum not exceeding £700 000 000.

Mr. W. G. Hall (Financial Secretary to the Treasury) said that the Government did not know what the amount for compensation would be. On the best estimate, they believed that approximately £350 000 000 would be required to compensate boards and companies and between £180 000 000 and £200 000 000 to meet outstanding liabilities on loans and interest for local authorities.

Mr. Hudson moved an amendment to reduce the sum in the resolution to £400 000 000.

Mr. Hall said that the figure was reached by a five-year programme prepared by the C.E.B. £200 000 000 was for generating, and approximately £400 000 000 for distribution, and a further £100 000 000 for standardisation and equipment in rural areas. Another £100 000 000 related to the North of Scotland.

The amendment was negatived by 287 votes to 122, and resolution agreed.

VIEWS ON THE WIRING CODES

TWO further Codes of Practice concerning electrical installations have now been issued in draft form to interested individuals and bodies for comment. As one of the former, the writer expresses the hope that it may be many moons before these documents are issued in final form as an authoritative guide to the planning of installations.

These are not the days for any attempt to re-introduce semi-luxury standards for wiring installations. At a time when the Government White Paper exhorts us to "modernise, improvise, and exercise the strictest economy in raw materials," any Code that omits the consideration of light-gauge close-joint steel conduit for small house wiring is divorced from reality. In "Electric Wiring Systems," one of the Draft Codes, para. 302 suggests two grades only of conduit—brazed or welded light-gauge with lug-grip continuity, and heavy-gauge screwed steel conduit systems. Long experience has shown that cheaper grades of conduit are adequate for small house wiring, and close-joint conduit is described in B.S.S. 31; its omission from consideration can hardly be described as a drafting error.

Vulcanised rubber and polyvinyl-chloride insulated cables are suggested as suitable for use with conduit systems, but the advantage of the smaller-diameter unbraided p.v.c. cable is thrown away in the parity rating with v.i.r. cables in relation to conduit capacity. As all practical people know, up to 50 per cent. more unbraided p.v.c. cables can conveniently be drawn into given conduit sizes, and at this time this advantage should be retained. Alternatively, smaller conduits may be used for a given number of conductors, and with a serious and continuing steel shortage our planners must take a realistic view of the position.

CONDUIT CAPACITY

The Codes follow the old stereotyped lines regarding steel conduit continuity with grip fittings—the lug-type fitting is accepted but "conduit systems using pin-grip conduit fittings are unsuitable" (paragraph 504). The writer disagrees most profoundly with the whole conclusion, as it would have the effect of excluding from general use the well-known and efficient "Terra Grip" system, obviously a "pin-grip" type. It is time that the industry ceased without complaint to accept as good practice the fling away of an already dangerously thin steel conduit wall to provide continuity inside a lug-type fitting—

The opinions herein expressed on the Codes of Practice abstracted in last week's issue, are those of "Supervisor" and are not necessarily endorsed by the Editor. Criticism is lodged against the potential cost of the schemes suggested in the Codes and the view is put forward that installation standards should be brought more in line with those now obtaining in the building industry.

the interior of which, by the way, is rarely similarly stripped of enamel—unless it at the same time demands a careful repainting of the exposed section of filed conduit. A pin-grip fitting which cleans its own spot is much to be preferred, and of course any good lug-type fitting would do the same if left alone. Whoever started the conduit-filing idea has much to answer for.

RADIO INTERFERENCE

The writer feels that it is no function of a wiring system to provide protection against mains-borne radio interference—even if it were capable of doing so—but the Codes seem rather obsessed with the idea. Reading these, one would gather that all consumers with tough-rubber or insulated-conduit wiring systems were completely blotted out with mains-borne radio interference, but that consumers with steel conduit installations enjoyed complete immunity. We know quite well that the reverse is likely to be as true, and in view of the comparative unimportance of the matter, radio interference suppression should not be cited as a factor in any choice between wiring systems.

The worst cases of radio interference experienced by the writer have been due to faulty continuity of metal-clad wiring systems, and there is no reliable evidence to show that such systems have any advantage over insulated systems in the matter of interference suppression—quite the contrary, in fact. The proper place to apply suppression is at the source, by proper means, and not by installing steel conduit wiring systems where alternative systems would be more desirable. The Codes are misleading in giving the impression that there is some virtue in metal-clad systems in this matter of interference suppression.

One or two matters of drafting should receive attention, chiefly an indication that appropriate tables apply to both v.i.r. and p.v.c. cables. At present, Table 801, capacity of conduits, mentions v.i.r. cables only, but the text indicates that the two

types of cable are to be considered on the same basis. The abbreviations "v.r.i." and "p.v.c." look odd when used conjointly; one can say "v.r." and "p.v.c.," or even "v.i.r." and "p.v.c.," but logically "v.r.i." should be accompanied with "p.v.c.i." when the final initial is intended to indicate the word "insulated."

The most interesting feature of "Electrical Installations (General)," however, is the abandonment of any requirement for the use of the voltage-operated earth leakage circuit breaker. Presumably nationalised electricity will not behave in the very reprehensible way associated with the old kind, as para. 513 says: "The only practicable means of ensuring freedom from danger arising from the occurrence of current leakage is to adopt means whereby the leakage current itself is made to operate a protective device arranged to disconnect the affected circuit from its source of supply." As is, or should be, well known, the voltage operated job is independent of the leakage current, which may well be passing to earth over some other point than the well-prepared path.

In general, the draft Codes tend to strengthen the writer's long-held opinion that the preparation of electrical installation rules and regulations, whether intended as suggestions or definite directions, should be a matter for electrical installation people alone—that is, the planners and supervisors of installations, the electrical contractors and wiring

departments of supply authorities—whereby a little less academic and a great deal more practical experience might be tapped. Even the wireman should not be excluded from the councils, as there is nobody more closely in touch with the problems than he.

It seems that we are for too long perpetuating the formation of rules and regulations round the real or imaginary shortcomings of rubber cables, so that these have come to dominate our ideas. This attitude might have been defensible in the old groping days, but, born of long experience, an established technique should now be available, and in which, in common with us all, our cables might expect a little rougher treatment. It is imperative that installations should be simplified and cheapened, but unfortunately the tendency seems all in the other direction. With another example before us, we might beware lest direction towards rationalisation comes from outside.

The almost indecent haste with which war-time relaxations were withdrawn, at a time when abandonment could not be justified, has not escaped notice elsewhere. The new Codes have a chance to rectify the position, and in view of present-day needs, we should realise that the old luxury standards, however desirable when there was plenty of material and labour, have gone with the wind, and attempts to re-introduce them must fail. Building, living and all standards are down; house wiring must take its place in line.

Canadian Water Power

THE annual review of water-power development and hydro-electric distribution in Canada, which has been issued by the Dominion Water and Power Bureau, Department of Mines and Resources, stresses the progress that was made in the transition to normal peace-time economy during 1946.

Reflecting partly the large increase in water-power capacity made during war years, and partly post-war construction difficulties, new installations put into operation during the year totalled only 27 760 h.p. However, at the year's end a total capacity of over 400 000 h.p. was under active construction in several important projects distributed across the country, and preliminary work or investigations were under way on projects involving an additional 600 000 h.p.

The dislocations resulting from cessation of war demands have not proved to be as severe as were anticipated and the high level of industrial activity, combined with

growing domestic loads, has largely absorbed a potential surplus of power; in some districts primary demand threatens to exceed supply. The output of electricity during the first ten months of 1946 slightly exceeded that generated during war years.

An auspicious beginning has been made on an extensive post-war programme of supplying service to farms and small communities, although 1946 plans were somewhat curtailed by material and labour shortages.

Among further reports containing scientific and technical intelligence from German industry, now available at the Stationery Office, are the following:—B.I.O.S. 781, Some German Synthetic-Resin Moulding Plants and Processes (4s. 6d.); B.I.O.S. 951, the Magnetophon Sound Recording and Reproducing System (10s.).

Work of the E.R.A.

PROGRESS IN DIELECTRICS AND SWITCHGEAR

AN interesting account of the research work carried out during the first full year of peace is contained in the annual report of the British Electrical and Allied Industries Research Association, which covers the twelve months ending on September 30, 1946. Describing the progress which was made, during the year, towards more permanent financial arrangements with the Ministry of Supply and the Admiralty, the report opens with a review of the arrangements made for liaison with Government and industrial research organisations and with the majority of British universities. A new research section on the grindability of coal was formed, and reorganisation produced three new or modified sections on insulated cables, overhead lines and on security problems (including earthing). Facilities were improved by new installations, such as an X-ray structure analysis equipment and by a considerable accession from Government disposals of apparatus, machine tools and equipment.

Plans for the future, the report states, require considerable capital expenditure and a much higher scale of annual revenue to render a full and complete service. Accordingly, both special capital contribution and increased annual contributions must be envisaged, and it is anticipated that proposals to this effect will be made by the Council of the Association in the near future.

SWITCHGEAR CONTROL DEVICES

Turning to research activities, the report claims that in switchgear, remarkable success may be said to have been achieved on the engineering side. For example, arc control devices licensed by the Association have an aggregate breaking capacity in excess of 1 500 million kVA—roughly the equivalent of 1 000 circuit-breakers of the large 132 kV type used on the grid. The gas-blast and oil-blast methods introduced by the E.R.A. largely form, from an international point of view, the forefront of circuit-breaker development. The fundamental physical basis is the theory of the electric arc and associated discharges. While the E.R.A. has made several notable contributions to this theory, it is only comparatively recently that basic progress has been made.

Research into circuit-breaker problems has included the study of arc phenomena at the interruption of small currents, and

work on the investigation of the glow-arc and arc-glow transitions has afforded valuable insight into the characteristic of this transition, and disclosed what appear to be hitherto unsuspected possibilities. Laboratory tests, using a 10 000 kW generator, have been carried out on an experimental air-blast breaker, and, at proving stations, further tests were made. A programme covering the preparation of a critical résumé on h.t. fuses has been prepared, and work is proceeding on the arc energy liberated in a fuse in an alternating current circuit. A patent is being filed covering a novel form of fuse element, which shows promise of possessing a high breaking capacity.

Compared with the engineering progress made on switchgear, the report states, dielectrics present an almost converse picture. A large part of the theory of dielectric breakdown is now a solved problem; the outlines of the remainder have been clearly drawn and the E.R.A. has made great progress in fundamental theory. The general picture of dielectric properties has been filled in and their qualitative dependence upon molecular or solid structure is clear, while in some sections a truly quantitative theory of electric properties in terms of solid structure exists.

SHAPE OF RESONANCE LINES

A general theory of the shape of resonance lines has been developed, and its effect on dielectric loss discussed. This theory shows that an old-established formula for the resonance band-width due to Lorentz is incorrect. Investigations into intrinsic electric strength and the general theory of breakdown in amorphous solids are in progress, and work on discharges in h.f. cables is being continued. It is hoped ultimately to elucidate the mechanism by which these discharges cause failure at stresses very much lower than the short time strength of the dielectric. Other researches in the dielectric field include the effect of corona, the organo-silicon polymers, tracking and gaseous discharge phenomena. Engineering progress in dielectrics, however, is considered to have been less spectacular than that in switchgear.

In the field of insulations, two new programmes of research on mica were approved during the year. The subjects to be investigated are, first, the determination of the true or intrinsic power factor of higher quality ruby mica, and secondly, the

improvement in breakdown strength of mica capacitors obtainable by special impregnating materials selected for the purpose of reducing edge discharges. After work on insulating oils, it has been recommended to the British Standards Institution that an acidity test be applied after sludging, with a limit for the acidity. It has also been recommended that the present two classes of oil be replaced by a single class with a maximum sludge value of 0.8 per cent., and that the limit for electric strength be raised to 35 kV.

Work carried out on cables and overhead lines includes investigation into the charring of cable papers under short-circuit conditions and the current ratings of cables in ships and underground. A critical résumé on earthing, which is expected to be available in draft from early this year, will include a comprehensive survey of all previous E.R.A. investigations of this subject. Regarding the earthing of installations to water mains, the report states that concrete mains have been found unsuitable for this purpose, while research on earthing to metal mains is in abeyance. Investigation of the performance and properties of earthing clamps for metal water pipes has been concluded, and design details of a satisfactory clamp have been developed.

PROPERTIES OF STEAM

Consideration has been given during the year to the question of further research on the properties of steam. It was felt desirable that higher temperatures and pressures should be explored, perhaps up to 1 200° F. in the first instance. In view of the interest of turbine makers in gas turbines, the Committee also had in mind the extension of the work to the various materials used in such plant. Work on the creep and corrosion of steels at high temperatures has indicated that failure occurs more rapidly in high temperature creep tests in steam and hydrogen than in air or in a vacuum. In view of the trouble experienced in some power stations due to cracking of molybdenum steel piping employed in high temperature service, a memorandum has been prepared and published, drawing attention to measures which should be observed to reduce this risk.

Investigations into electricity supply technology have included a survey into the comparative characteristics of loads produced by the principal classes of consumers. A detailed scheme has been formulated, under which it is proposed to arrange for large groups of new dwellings to be equipped with various combinations and types of appliances, and for comprehensive load and consumption measure-

ments to be made, with a view to establishing in a scientific manner what is the economically most desirable equipment. Large-scale application of statistical methods has been carried into effect by organising a sampling survey of domestic supply conditions, in which about 100 authorised undertakers with over 3 000 000 domestic consumers are participating. A number of undertakers is also collaborating into a comprehensive programme of researches into tariffs, in order to study the correlation, if any, between the possible fixed charges bases of domestic two-part tariffs and relevant electrical quantities, such as installed load, annual maximum demand and annual kWh consumption.

ELECTRICAL INTERFERENCE

A series of tests were carried out during the year on the L.M.S. Railway's Euston-Watford electrified line, with a view to reducing inductive communication interference. The system is supplied from either of two alternators having widely different reactances, and a comparison was made between them. Tests were made under normal 12-phase operating conditions and also with a phase shift applied to half the sub-stations to give quasi 24-phase operation, a method which is showing distinct promise for the reduction of harmonics.

The study of magnetic materials included a series of researches into electric sheet steel, carried out at the Cavendish Laboratory, where considerable improvements have been effected to the technique of measuring loss in short strips. Extensive experiments have been made on the high temperature vacuum annealing process for reducing overall losses. These experiments have brought out a number of points of importance for the industrial use of the process; the improvement is mainly due to the removal of carbon, and this depends on diffusion through the steel: over-prolonged heating removes silicon and is harmful. In connection with the industrial use of the process, the investigators have collaborated with the steel-makers in some large-scale experiments in a large vacuum furnace, and the preliminary results, though encouraging, have raised a number of practical difficulties.

The section working on rural electrification problems has carried out work on agricultural and horticultural applications of electricity, and a report on the electrical pre-heating of tomato-house soil has been prepared. Further observations of the effect of soil warming in unheated tomato houses during the growing period are now being made.

Electrical Machine Design

Teaching Methods Discussed at Meeting of I.E.E.

THE criticism that the principles of electrical design as taught in colleges and textbooks did not completely line up with the principles used in design offices in industry was made by Mr. Laurence H. A. Carr in a paper on "The Teaching of the Principles of Electrical Machine Design," read and discussed at a meeting of the I.E.E. on January 30. The author indicated how, in his opinion, such teaching could with advantage be modified and amplified so as to be of greater service to those entering industry.

The causes leading to the differences were considered in the paper, and the difficulties experienced by college students on their first entry to a design office were analysed. The general considerations which should affect the arrangement of a design course such as logical sequence, mathematical outlook and the effect of practical considerations were discussed. The necessity for students to have a full knowledge of the theory of electrical machines prior to undertaking a course on design was stressed.

The more important subjects dealt with in a design course were treated individually and the underlying principles discussed. Considerable attention was devoted to the need for a full understanding of the nature of the physical phenomena concerned. In particular, armature reaction and leakage reactance and their physical background were dealt with in detail. Fallacies in theory, and the corresponding mis-statements which appear in many textbooks with regard to iron loss and the leakage reactance of end-windings were exposed, and more accurate information was put forward. Particulars suitable for inclusion in a design course were supplied with regard to unbalanced magnetic pull, stray loss, and the crawling of induction motors.

Recommended methods of calculation were given, together with constants determined from experience, and the paper concluded with a table of loading figures and temperature-rise formulæ which it was hoped would be of service to teachers.

BRIGADIER F. T. CHAPMAN recalled that in 1928 the Board of Education published a pamphlet on the teaching of electrical machine design in which they pointed out that classes were often engaged on the

design of machines much larger than any to which they had access in the laboratory, and suggesting that they should begin by making calculations on machines of which they had full details, which were in their laboratories and on which they could make tests. If he were re-writing that pamphlet he said, he would emphasise the importance of laboratory work to back up the classes in design, using machines specially prepared for the purpose, with the aid of which students could carry out experiments which would lead them to understand, for instance, what the stray losses were and how they arose, instead of falling back on empirical formulæ.

DR. J. H. WALKER (British Thomson-Houston Co., Ltd.) suggested that not more than 5 per cent. of the students to whom the principles of electrical machine design were taught would ultimately find themselves in the design office of some manufacturing firm. To the remainder, the design information imparted would be of little or no value. Moreover, for some years he and others had found that among the best recruits in their design offices were those who had been trained in the Engineering School at Cambridge University, where the course did not include any subject which came under the heading of design, but where the students were thoroughly trained in the fundamental principles which had to be applied to machine design. The teaching of design as a subject tended to turn out people who were capable of designing a machine like the last one, but who were unable to handle fundamental problems. Ultimately, he thought, all the universities would have to separate the sheep from the goats and have one class for those who would provide 95 per cent. of the engineers, and an honours or special course for those who would ultimately provide the recruitment for the real designers.

MR. S. NEVILLE (Metropolitan-Vickers Electrical Co., Ltd.) emphasised that explanations of the working of electrical machines must be made to depend on the smallest possible number of basic ideas. It might be said that an electrical machine worked by virtue of the interaction of a number of conductors carrying electric currents which were electron streams, so that teaching should begin with the inter-

action between electrons or charges at rest (the old electrostatics), or in uniform motion (the magnetic forces), or in accelerated movement (the electromagnetic or transformer action well known in machines). It should be made clear that a magnetic field was simply a mathematically convenient way of describing the effects of electric current at a distance from the conductor. An understanding of the way an e.m.f. was produced was a good test of sound teaching. In the present state of knowledge it might be said that an e.m.f. could be produced either by a change of the total magnetic field through a circuit, or by the movement of a material body through a magnetic field. The student should be shown that every problem could be analysed on one or other of those two bases with identical results. The fact that this was so suggested that those two apparently separate ways of producing an e.m.f. could be reduced to a single basic explanation, and he suggested this as a promising field for study. The main point in the teaching of fundamentals must be to put before the student a picture of space and of matter and of electrical action which was self-consistent and which held good in the electronic field as well as in that of machine design, and which was at least not wildly inconsistent with modern physical research. The explanations must be such that they could be actually visualised by the student. For example, to explain the nature of broadcasting in a way which allowed the student to form a real physical picture, he thought it must be assumed that there were electric charges and currents in empty space. Textbook explanations of radiation were in the form of a mathematical statement only, which did not convince the student. Another instance of inadequate methods of teaching concerned the case of two parallel wires carrying equal electric currents in the same direction. There was no relative motion either between the two pieces of copper or between the two electron streams, but a very appreciable magnetic force was produced there. The only explanation depended upon the electrostatic attraction of the negative electrons in the one wire for the equal positive charges in the other, that force being slightly augmented because of the relative movement of the negative electrons with respect to the positive. The Einsteinian relativity factor increased that force, and it was that slight increase which accounted for the whole magnetic attraction of the two wires. If that were so, some statement about special relativity intelligible to a student should be a preliminary to

the teaching of the theory of machines, and it seemed to follow that an astute thinker, contemplating this well-known attraction of two wires, could have deduced Einstein's special theory many years ago.

PROFESSOR W. J. JOHN (Queen Mary College) referred to the very big changes which had taken place in the teaching of electrical machine design in the University of London, and probably elsewhere, in recent years. It was felt, he said, that since large numbers of the students would never be designers, there was no justification for teaching elaborate design calculations in a university course, and the emphasis was now on the principles of electrical machines. The course should aim not at turning a student into a designer, but at teaching him fundamental principles about the operation of machines. There was likely to be a further change in that direction, because many students had come back from the Forces with a bias towards the light side of engineering and did not take kindly to the teaching of electrical machine design as it was still practised in some places; there was too much empiricism in it. A very important side of the subject was the course work. Normally this used to consist of the making of scale drawings of electrical machines. Much could be said against this, but he thought it should be retained for one term, because that ability to draw a thing that would work, that empiricism, was a very important part of the training of an engineer. For the second term, he thought students should learn to plot magnetic and electrostatic fields. For the third term, they should go into the laboratory and carry out tests on machines built to illustrate fundamental matters concerning the operation of machines.

MR. W. P. RICHARDSON (General Electric Co., Ltd.), said that where a teacher had a class of students who had spent several years in a works, and who had then become juniors in a design office, he could very well teach the matters with which the paper dealt, but it was to be hoped that no one teaching third-year students without practical experience would do so, because it would be better for them to spend their time on the real fundamentals.

MR. L. R. NIXON (J. Stone and Co.) also emphasised the need for students to be given a good grounding in fundamental principles. One subject of great importance in practical design, but which was not taught, he said, was the magnitude of the effect of cross-magnetisation in d.c. machines, while another, which was not dealt with very fully, was that of the

stability of exciters for either hand-regulator or automatic voltage regulator control.

MR. G. F. FREEMAN (West Ham Technical College) agreed that the training in the use of empirical methods which necessarily came into the teaching of design was very valuable for students; mathematics would lead them into many difficulties from which common sense and empirical calculation would extricate them. He had, he added, a great admiration for designers; they might not know how machines worked, but they certainly made them do what was required.

PROFESSOR C. L. FORTESCUE (a past president), speaking as one who had seen a good deal of the work of the technical colleges in London and the provinces, said that what Professor John had stated with regard to the present methods of teaching the subject of electrical machine design was of wide application. Ever since industry realised that it could not buy cheap designers by taking students straight from a technical college, the teaching of design as a kind of routine procedure had ceased. He was sure, however, that 95 per cent. of the students who took the subject would be able to read and absorb data of the kind given in the paper. They might not have the facts at their fingers' ends, but there was no reason why they should; it would be ten years before they had to take the responsibility of designing machines.

MR. J. F. SHIPLEY said he had gone into industry straight from college, and as a junior trouble engineer he found in those days that about 5 per cent. of all the machines that went out of the works had troubles. Without the knowledge of the fundamental principles which he had been taught in college he would not have been able to find out what those troubles were. When he became chief of the troubles department he found that his company had designers who sometimes made mistakes, and he remembered 4 000 small motors, all wrong, being turned out owing to someone having forgotten to multiply by two. He did not know of a single first-class firm in which very serious mistakes had not been made. To the user of machines also a knowledge of the fundamental principles was very valuable, particularly overseas, where one had to deal with machines from all over the world, which would hardly ever be of the right voltage, the right frequency or the right speed, and which would have to be made suitable for the duties which they had to perform. Such knowledge was also of great value to the consultant, who in

addition to advising his client ought to see fair play between client and manufacturer and where necessary act as peace-maker. Every mistake in the design of a machine led to trouble, and might give rise to a lawsuit. It was for the consultant to bring the two sides together, reducing the complaint on one side and raising the promise on the other. The commercial aspect of the knowledge of design was also important. It was necessary to know the commercial and mechanical limitations under which the designer was working, to back up one's fundamental knowledge.

MR. H. WEST (Metropolitan-Vickers), who said that it had been his privilege for some years to choose designers of electrical machinery, expressed the opinion that the best teacher of design was experience; it was only when one designed a machine which when built and tested failed to meet the design conditions that one really started to learn design. In his view designers were born, not made. One reason why the colleges should restrict themselves to fundamental principles and not try to teach design in too much detail was that the job of the industrial designer was to produce apparatus which was commercially saleable. That would depend not only on fundamental principles, but on the ratio of the costs of copper and iron and on the cost of labour; where labour was expensive but material was cheap one would get rather a bulky design, easily put together, but where those conditions were reversed the designer would try to attain the last degree of output from a given amount of material.

MR. J. M. BURNETT suggested that there was a tendency in university teaching for the teacher to make the bulk of his course grow as his own knowledge grew; but it was unreasonable to expect a student in two years to learn as much as his teacher in twenty. He thought that when learning design students might be taught a good deal more about simple electrical apparatus and about the magnetic and electrical properties of materials, and in particular the fundamental principles of electromagnetism; the time to learn machine design was subsequent to university education.

MR. LAURENCE CARR replied briefly to the discussion, and emphasised that he was in agreement with what had been said about the teaching of the fundamentals. If, however, design was taught it ought to be taught properly.

Correspondence

The Editor welcomes the free expression in these columns of genuine opinions on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression

Motor Protection

[TO THE EDITOR]

Sir,—With regard to Answers to Technical Questions in the issue of THE ELECTRICIAN dated January 10, the writer draws attention to the last paragraph: "For large motors where a fuse is not suitable, e.g., for power station auxiliary drives, the same principle is sometimes applied, two circuit breakers in series being used, one being given a high instantaneous setting to clear short circuits, and the other being given a low setting with a time lag to clear sustained overloads—in some cases the second is arranged to give an alarm instead of tripping the circuit."

The writer has had a considerable amount of experience both with 3.3 kV and 415 V power station switchgear for auxiliaries, and the general layout consists of several breakers on a switchboard controlling the various motors, and say one incoming breaker. If all these breakers were fitted with ordinary overload coils and time lags, there would be no reliable discrimination between the incoming and motor breakers, and if a fault occurred on a circuit controlled by a motor breaker, then either the motor breaker and/or the incoming breaker would trip, depending upon the time required for the mechanism to trip it.

If the incoming breaker happened to trip first then a serious shut-down could occur.

In the case of 3.3 kV auxiliary drives which is present-day practice for most auxiliary drives, such as fans and pumps, the ideal method of protection appears to be a form of relay to cater for ordinary overload protection; high set overload trips for the motor panels; and for the incoming breaker, not high set overload trips but a form of induction type relay with a definite minimum time feature, primarily for the purpose of clearing busbar faults or to trip the incoming breaker as a last resource should the motor protective gear fail to operate with a fault on the apparatus it controls.

Summarising, it is seen that the high set overload trips would be fitted to motor panels only.

Referring to 415 V switchgear, there would possibly be main switchboards fitted with breakers and induction type relays to act as back-up protection and main feeders

to smaller switchboards with small breakers, the latter protected by h.r.c. fuses as mentioned in the answer.

Yours faithfully,

Birmingham.

H. T. STRATTON.

Electricity in Soil Warming

[TO THE EDITOR]

Sir,—The article in THE ELECTRICIAN of January 24, giving an account of a survey of the applications of one make of soil warming equipment will be particularly interesting to E.R.A. members as being evidence of the practical application of E.R.A. work to which they have contributed. If, during these somewhat difficult times one maker has placed a thousand soil warming sets in operation, there must over all makes be an appreciable number of sets in operation in this country.

At the same time, however, I hardly think that the implication of the concluding words in the article should be allowed to pass without comment. These draw the conclusion from the survey that "larger installations would be economically practicable." This would certainly seem to imply that the application of soil warming to commercial practice can now be taken in hand. In actual fact, of course, large-scale commercial soil warming has been expanding steadily since the first issue of the E.R.A. report on the subject in 1942. Indeed, while the report was primarily intended for small scale and amateur production, the possibilities appealed to commercial growers and they have been foremost in the subsequent developments.

If my own experience in a limited part of the country can be taken as a fair sample, there must now be all over the country between one hundred and two hundred commercial installations of appreciable size. I am myself in touch with installations already connected, or waiting delivery of materials, covering areas up to as much as $\frac{3}{4}$ -acre. All these take the form of transformer fed low-voltage systems in the development of which and arising from the E.R.A.'s work, we would appear to be further ahead than any other country.

Yours faithfully,

C. A. CAMERON BROWN.

Rural Development Superintendent.
Edmundsons Electricity Corporation, Ltd.

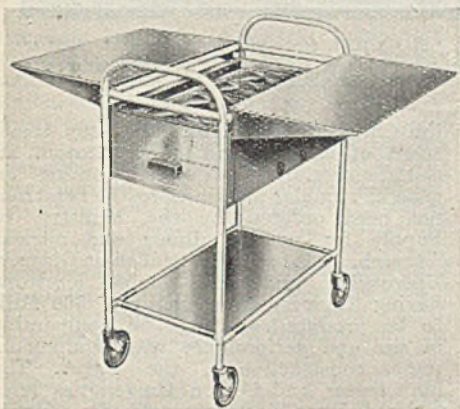
Equipment and Appliances

Precision Lathe

Of interest to those who have occasion to perform precision turning operations for instrument repair, etc., will be a new micro-lathe, the Model 10, introduced by Messrs. Pultra, Ltd., of Manchester. The lathe-bed is 10 in. long and the headstock is designed to take standard 8 mm. collets. The accessories supplied with the lathe, complete in a hardwood case, include a set of eight collets, ranging from 0.4 mm. to 2 mm., five step chucks and a taper bore collet including male and female centres. The Pultra 10 may be driven by a universal motor, complete with foot-controlled resistance, hand drive or a foot pedal.

Electric Food Server

Familiar for some time as a useful accessory in hospitals and institutions, the electrically-heated food trolley has been adapted by L. G. Hawkins and Co., Ltd., of Drury Lane, London, W.C.2, into an "Electric Hostess" suitable for domestic use. Employing a 200 W heating element, the trolley is of aluminium tubular construction and runs on ball-bearing rubber tyred wheels. With it, the makers state, it is possible to prepare the evening meal during the early afternoon, store it in the four two-pint Pyrex food containers and serve it up, in perfect condition, when required. Plate warming compartments at



View of the food server with the covers open. Two socket outlets may be seen on the right

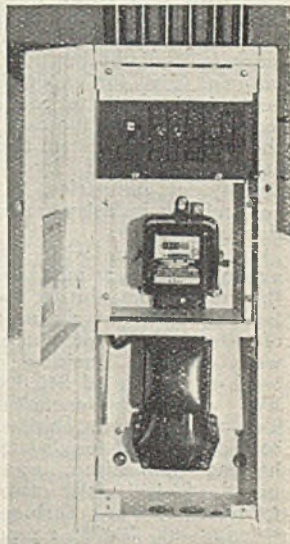
either end have a capacity of 12 plates, and two socket outlets on the side of the trolley permit other electric appliances, such as toasters and percolators, to be used at the same time. The illustration shows the trolley with the lids open: in

this position, it will provide table accommodation for two people.

House Service Panel

Among the smaller products of South Wales Switchgear, Ltd., of Blackwood.

Mon., is a house service panel, one arrangement of which is illustrated below. Complying with B.S. requirements, the panel is designed to be built into a wall and is made so that all the main assemblies can be removed without nuts falling into the back of the box, the nuts being held by captive pressings. Leaving the fuse assembly, fuse mask, sealing box and cut-outs and meter trays to be supplied later by the electricity undertaker, the shell can be fitted into the wall when the house is being built, the lower end being removable from the inside, even though built into the wall. This feature enables the supply cable to be brought forward for easy connection and sealing. Provision is made for "under the eaves" wiring, looping of main cables, and arrangements are also made for side entry. Any type of quarterly meter may be accommodated in the meter tray, and it is suggested that by keeping a few spare trays, the supply authority could drill these as required at their works and fit the new meter to be supplied. The assembly could then be taken to the site and screwed in position with a minimum of disturbance. The current rating of the unit, which is suitable for a.c. mains only, is 60 A, and four 30 A fuses for power and two 5A fuses for lighting are available. A substantial earth block is provided so that if lead-covered outgoing cables are used, or t.r.s. with separate earthing conductors, these can be securely earthed.



The house service panel: one way of mounting

What Manufacturers Are Doing—VI

Metrovick Work and Progress in 1946—New Products

THE first year of post-war reconstruction, reports the Metropolitan-Vickers Electrical Co., Ltd., was one of intense activity. The outstanding feature was the large proportion of work for overseas markets, contributing substantially to the national drive for export business. Other notable trends were the heavy demands for equipment to increase the capacity of the British grid system and the specialised attention required by a comprehensive variety of industries, in particular the coal mining industry under its modernisation programme.

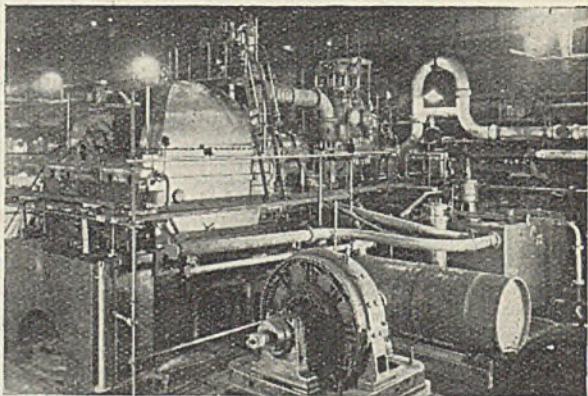
In connection with the expansion programme for the grid system, during the last year a further six units of 50 000 kW, or more, were ordered, making a total of 16 sets of 840 000 kW aggregate capacity. Two turbine units shipped to the U.S.S.R. for district heating application, comprised 25 000 kW two-cylinder pass-out turbines running at 3 000 r.p.m. with direct-coupled alternators; the inlet conditions were 398 lb./sq. in. abs., 750° F., with a pass-out steam pressure of 85 to 114 lb./sq. in. and a steam quantity of 330 000 lb./hr. Work is in progress on more than sixty turbo-generators of a total capacity of some two million kVA and ranging in size from 1 500 kW to 60 000 kW and in voltage from 3 to 33 kV.

Three 33 333 kVA 11 000 V 167 r.p.m., vertical shaft, waterwheel generators, shipped to New Zealand, each weighing 330 tons, with an overall diameter of 34 ft., were the largest of their kind built in Great Britain. Work is in progress on vertical shaft generators for Finland, Portugal, India and Australia. Horizontal shaft waterwheel generators include three each of 32 000 kVA at 428 r.p.m. Orders for almost 100 000 h.p. of large induction and synchronous induction motors were received.

There was an exceptionally heavy demand for transformers with no diminution in the variety of applications. The first order obtained for 220 kV power transformers comprised a 100 MVA three-

phase bank for the Royal Netherlands electricity supply; this will form an inter-connecting link between the Dutch 150 kV and the German 220 kV systems. The switchgear development programme was continued and extended during the year, despite an unprecedented volume of orders for established indoor and outdoor types. Air-blast circuit-breakers, Metrosil surge diverters, and new designs of KOB and AIR switchgear all passed from the development to the production stage.

A 20 MeV betatron is being supplied to



A 25 000 kW, 3 000 r.p.m. two-cylinder, pass-out turbine for a district heating system in U.S.S.R., undergoing tests in the works

the Christie Hospital for the X-ray treatment of cancer, and a synchrotron, an electron-accelerating device working on generally similar principles to the betatron, has been ordered by the Ministry of Supply for use in atomic and nuclear research. This will be installed at Glasgow University, and will enable electrons having the very large energy of 300 MeV to be produced. It will be comparable in size and performance with equipments under construction in the U.S.A. The Manchester and Ceylon Universities have ordered large electromagnets for cosmic ray research. Development work continued on electron diffraction apparatus. The development of a range of h.v. rectifier units for dust precipitation has been completed. These have outputs up to 150 kV d.c. and current ratings of from 1 to 400 mA, and are for outdoor installation.

In Parliament

Some Electrical Questions Asked and Answered

Plant Availability.—Replying to Commander Galbraith, Mr. Shinwell said that the loss in capacity of generating plant which was out of action on account of maintenance, repair, etc., at the present time was 14.7 per cent. of the total capacity, compared with 5.7 per cent. in 1938. The loss due to unsuitable coal at present was calculated at 3 per cent.

Future Generating Capacity.—Commander Galbraith asked the Minister of Fuel and Power what extra generating capacity would be available in Great Britain in 1949, 1950 and 1951, respectively; and whether he estimated that such increases in capacity would meet all estimated increases of demand, together with a reasonable margin. Mr. Shinwell replied that it was estimated that the additional capacity which would be available for public supply would be 2 600 MW by the end of 1949, 4 460 MW by the end of 1950 and 5 660 MW by the end of 1951. These increases would not be sufficient to meet the increase of demand until the winter of 1950-51, but should then be sufficient, provided certain obsolete plant were still kept in commission.

Government Scientific Policy.—Asked by Sir W. Wakefield whether he would make a further statement on the central Government machinery for dealing with broad scientific questions, Mr. Arthur Greenwood stated that during the war there was established a Scientific Advisory Committee, consisting of officers of the Royal Society and the heads of Government research organisations, which advised the Government on general or specific scientific questions. The establishment of the Defence Research Policy Committee had already been notified, and it had now been decided to set up on the civil side an advisory council on scientific policy to advise the Lord President in the exercise of his responsibility for the formulation and execution of Government scientific policy. The chairman would be Sir Henry Tizard, who was also chairman of the Defence Committee, and the staffs of the two bodies would work in close association. The council would include the heads of the principal Government scientific organisations and a number of scientists from outside the Government service.

Coal Quality.—In the course of oral answers to questions on the quality of coal made available to power stations, Mr. Shinwell said that during the last 18 months all possible steps had been taken to enable the coal mines to provide suitable

qualities, but the quantity required was greatly in excess of what it was before the war and was still increasing. It would be some time before the quality could be restored to pre-war standards. Mr. Shinwell agreed that there was some substance in a statement by Sir Arnold Gridley, that if the mines supplied the class of coal for which the boiler-houses were designed, the existing plants in those stations would be able to supply another 400 000 h.p. at peak load, but said that coal-owners had, in the past, been unable to provide the necessary facilities for screening and washing. The latest figures of stocks held by the supply industry, the Minister said, were 1 293 156 tons, as compared with 2 315 911 tons held a year ago. In view of the many variable factors, he could not forecast stocks for early March, but power station requirements of coal had the highest priority.

Electrical Statistics

THE weekly average consumption of coal by authorised electricity undertakings in December, according to the thirteenth Monthly Digest of Statistics, was 626 000 tons, compared with 584 000 tons in November, and 528 000 tons in December, 1945, and constituted a record. Distributed stocks of coal held by authorised electricity undertakings fell from 2 138 000 tons in November to 1 610 000 tons in December. In December, 1945, stocks amounted to 2 876 000. Electricity generated rose from 3 938 million kWh in November to 4 372 million kWh in December, compared with 3 675 million kWh in December, 1945.

The production of electrical appliances classed as building components for housing, showed an appreciable falling off in December, the figures being: cookers, 15.4 thousands as against 18.6 thousands in November; wash-boilers, 18.8 thousands against 24.0 thousands; immersion water heaters, 36.5 thousands against 41.4 thousands; and meters, 105.3 thousands against 136.0 thousands. The figures for December, 1945, were: cookers, 8.6 thousands; wash-boilers, 8.0 thousands; immersion water heaters, 21.2 thousands; meters, 58.2 thousands.

The number of radio sets produced rose from 153 000 in October to 176 000 in November. Of the latter 123 000 were for the home civilian market. Television sets produced increased from 1 334 in October to 1 725 in November. The figures for December are not yet available.

Answers to Technical Questions

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

What is the two-reaction theory used in the treatment of synchronous machines?

The two-reaction theory provides a means of dealing theoretically with the behaviour of a synchronous machine when the reluctance of the magnetic circuit

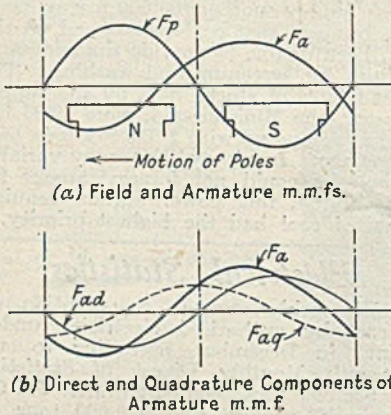


Fig. 1

varies at different points around the air gap, as in the salient pole machine. It was first suggested by Blondel and developed in a practical form by Doherty and Nickle.

Consider a salient pole generator, of which one pole pair is shown in Fig. 1a—the m.m.f. produced by the pole ampere turns can, if assumed to be sinusoidal, be represented by the curve F_p . Its maximum value occurs opposite the poles and it is, therefore, said to be acting in the

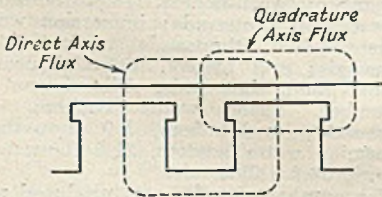


Fig. 2—Direct and quadrature axis fluxes

pole or direct axis of the machine. The armature m.m.f. which may also be assumed to be sinusoidally distributed will, if the power factor is lagging, occupy a

position as shown by the curve F_a . This armature m.m.f. may be resolved into two components as shown in Fig. 1b, one component F_{ad} acts along the pole or direct axis and the other F_{aq} acts along an axis passing through the interpolar space, this being known as the quadrature axis. If there were no field excitation the direct axis component F_{ad} would send a flux round the main magnetic circuit of the machine as shown in Fig. 2, while the quadrature axis component F_{aq} would send a flux round the quadrature axis as shown.

The total armature current may be

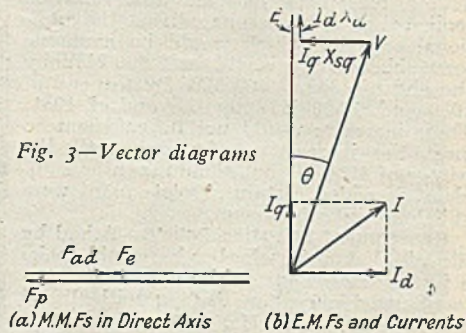


Fig. 3—Vector diagrams

resolved into two components I_d producing F_{ad} and I_q producing F_{aq} .

Vector diagrams can now be constructed for the machine based on these quantities. Fig. 1 shows that the direct-axis armature m.m.f. is exactly opposed to the pole m.m.f. so that the resultant m.m.f. acting round the direct axis of the machine can be obtained as shown in Fig. 3a. This resultant m.m.f. F_c sets up a flux in the direct axis and causes an e.m.f. E to be generated, the magnitude of E being obtained from the open-circuit characteristic of the machine. E is drawn as shown in Fig. 3b 90° lagging on F_c . The components of the armature current may also be drawn, I being in the same direction as F_{ad} and I_q at 90° to it and therefore in phase with E . The direct axis component of the current will also set up a leakage flux across the tops of the armature slots in the usual way and there will consequently be a reactance drop $I_p X_d$ where X_d is the armature leakage reactance in the direct axis. This must be subtracted from the e.m.f. generated in order to obtain the terminal voltage. The

quadrature component of current sets up the quadrature axis flux as shown in Fig. 2 and this can be treated as being quite independent of the main flux in the machine since it follows a different path. The flux is partly a true leakage flux passing across the tops of the slots and partly a flux passing through the pole as indicated, but since it is independent of the main flux it can all be treated like the leakage flux and he said to set up a reactance drop $I_q X_q$ where X_q is the reactance resulting from the interlinkage between

the armature winding and the whole of the quadrature axis flux. Subtracting this voltage drop, as well as $I_a X_d$ from the e.m.f. generated gives the terminal voltage as shown, resistance being neglected for simplicity.

If the load were removed the generated e.m.f. E would lie along V , as there would be no voltage drops, so that the angle θ represents the angular displacement of the rotor relative to its no-load position when the machine is put on load.—E. O. T.

Industrial Information

Doncaster Engineering Exhibition

The Doncaster Engineering Society is holding its second exhibition of the "Products of Engineering made in Doncaster," in the Doncaster Technical College hall, from Saturday, February 15, to Saturday, February 22, inclusive. About twenty firms and the Doncaster Model Engineering Society are participating. The exhibition will open at 3 p.m. on February 15, and will be open on each successive weekday from 10 a.m. until 9 p.m. Admission will be free.

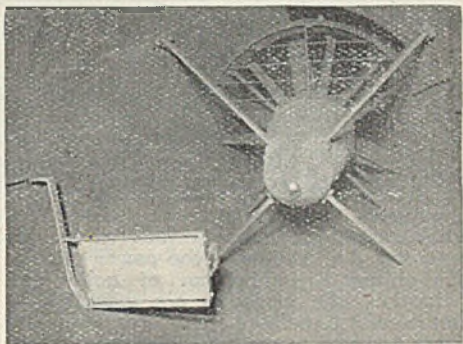
Aswan Hydro-Electric Scheme

Tenders for the Aswan Dam hydro-electric scheme were opened in Cairo on January 30. Offers were received for either the complete scheme or part of it from firms in the United Kingdom, France, Belgium, Sweden, Czechoslovakia and the United States. The lowest tender for the complete scheme was from the British Thomson-Houston Co., Ltd., and the English Electric Export and Trading Company, working in co-operation. Their price was £E7 000 000, and thus well below the Egyptian Government's estimate of £E10 500 000, including buildings and other works estimated at £E1 500 000. Offers were also received from five other British firms—Ferranti, Ltd., Crompton Parkinson, Ltd., A. Reyrolle and Co., Ltd., the General Electric Company, New York, and the Hackbridge Electric Construction Company. The Westinghouse Electric International Company, of New York, submitted a tender for \$20 000 000 (£5 000 000) for the delivery of material only.

Control Device for Fan Motors

To prevent the overloading of a ventilating fan motor circuit due to reverse air currents created by trains in London Transport tunnels, a device has been designed to keep the starter circuit opened as long as air currents which tend to rotate the fan in the contrary direction are flowing. A hinged flap or vane is mounted in

the ventilation air passage, and a contact arm is fixed to this flap. The arm completes the control circuit through two spring contacts. When the air flow is in



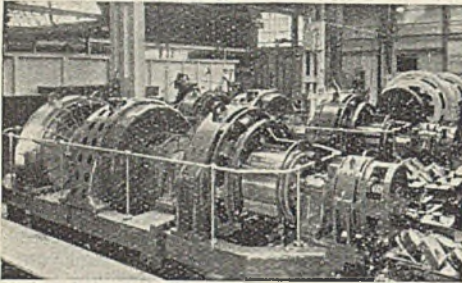
General view of a fan motor and flap control device in a ventilating shaft of a London Transport tunnel

the direction for normal running, the flap is pressed forward and contact is made; when the flow is reversed, the flap is drawn back and the circuit is opened. A spring holds the flap in the open circuit position until the air flow has built up to a certain pressure. This gives the fan rotor time to stop before current can be switched on. When the fan motor is running, it is sufficiently powerful to overcome the complete reversal effects of the train draughts.

Motor Generator Sets for Film Studios

For the new Metro-Goldwyn-Mayer British Studios at Boreham Wood, a comprehensive electrical power plant is now being installed by Crompton Parkinson, Ltd. To provide the d.c. supply for stage lighting and power, six 500 kW motor-generator sets will be available, each set comprising a 740 H.P. 3 300 V a.c. auto-synchronous motor driving two d.c. generators, and an exciter for the motor field. The machines are arranged in tandem, with the motor between the two generators

and each generator has an output of 250 kW, 120 V, 2 083 A. Since there are two generators to a set, and six sets, the total current output is nearly 25 000 A. A special feature of the d.c. generators is that they have been specially designed to



Two of the six 500 kW motor generators now being installed at the M.G.M. Boreham Wood studios, on test at the Chelmsford works of Crompton Parkinson, Ltd.

give a current output with the minimum of ripple, which might otherwise cause the arc lamps to develop a hum and subsequently be picked up by microphones on the set. In the generators portable chokes are avoided, the only additional smoothing equipment being a system of laminated chokes and condensers connected to the outgoing d.c. feeders in the power station. To ensure the minimum of noise and vibration, the machines are mounted on substantial foundations and bedplates, and were designed to operate quietly by reducing magnetic hum and windage noise to low levels. Three outdoor 11/3.3 kV, 1 600 kVA transformers, manufactured by the British Electric Transformer Co., Ltd., supply the autosynchronous motors, and these are also designed and mounted to reduce noise and vibration.

L.M.S. Contract

The L.M.S. Railway Company announce that a contract has been placed with Pirelli-General Cable Works, Ltd., of Western Shore, Southampton, for the provision and installation of 38 pair carrier and voice frequency loaded telephone cables between Euston and Watford, extending to the north end of Watford tunnel (approximately 19 miles from Euston).

Car Radio Advances

Marketing plans for the new Elco car radio are now virtually complete. New features include a crackle black finish; a moulded pip to permit touch tuning incorporated on the station selector control; and provision in the pre-set tuning system for five medium-wave stations and one long-wave station, instead of four and two, respectively, in the earlier model. A high power version of CR32 to be known

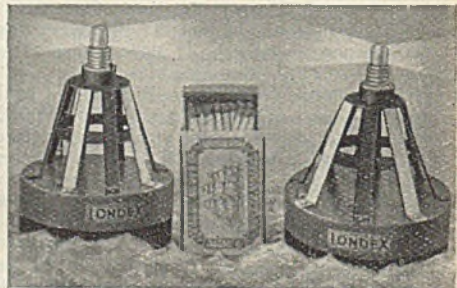
as Model CR60, is being developed to meet the requirements of large vehicles. A telescopic type aerial is shortly to be followed by an under-car aerial.

Inter-Service Radio Glossary

In an attempt to standardise the use of radio terms within the Services, a committee representing the three Services, and known as the Inter-Services Radio Circuit Symbols Committee, has drawn up an "Inter-Services Radio Glossary," a copy of which has been received. It is issued as I.R.C.S.C. Paper No. 39, and should go far to achieve its object.

Electrically Lighted Buoy

On their stand at the Shipwrights' Exhibition at the Royal Horticultural Hall, Westminster, which concludes to-morrow, February 8, Londex, Ltd., of 207, Anerley Road, Anerley, London, S.E.20, are exhibiting, for the first time, the actual elements of an electrically lighted navigation buoy, developed during the war. The main components are: an electric accumulator of special construction, capable of withstanding severe conditions; and an electric flasher, adjustable to give any specified "on" and "off" flashing character, with a newly designed automatic night/day switch, based on the photo-electric principle; and a small lantern, fitted with a special filament lamp, mounted inside a lens. Also exhibited are the two smallest electric buoys in existence, comparable in size to that of a matchbox. They are floating in a tank containing sea water, and their lights, intermittently flashing, are controlled by the method of passing an electric current



Miniature electric buoys actuated by current passed through sea water, at the Shipwrights' Exhibition

through the sea water. This exhibit demonstrates the remote control of electrically lighted buoys through sea water, dispensing with radio control or the use of cables, mainly employed in connection with Londex seadrome flarepath lighting, and designed by Dr. W. L. Stern, technical director of Londex, Ltd., with the co-

operation of Mr. A. P. Besson, chief research engineer and Mr. J. V. Dossett, who is in charge of the navigation department.

Decorative Fluorescent Lamps

A lighting scheme employing fluorescent tubular lamps in decorative fittings has been adopted for Chatham Town Hall. This installation is of special significance in that it demonstrates the ability of the designer to harmonise the latest form of lighting with interiors of traditional character. The fittings of gilt metalwork and champagne-flashed opal glass, were specially designed by the General Electric Co., Ltd., and were installed by the Kent Electric Power Co. of Rochester. In the main hall are five pendants, each 6 ft. 9 in. in length and 3 ft. 6 in. wide. They can be lowered to floor level for lamp replacement and maintenance. Each pendant accommodates ten 5 ft. Osram 80 W fluorescent lamps and all the auxiliary gear. There are also twelve wall features in recesses between the pilasters, each housing two 5 ft. Osram 80 W tubes, the auxiliary gear being located remotely. In addition, there are three two-lamp fittings underneath the gallery and three one-lamp fittings over the stage, flush-mounted on the ceilings. The Council Chamber is illuminated by two pendants, each measuring 6 ft. by 2 ft. 6 in. These are of gilt metalwork and champagne-flashed opal glass, with the addition of reeded glass and moulded glass panels. Each pendant accommodates five 5 ft. 80 W lamps. A high level of illumination is evenly distributed throughout the building. In the main hall and Council Chamber it is of the order of 7-8 lumens per sq. ft.

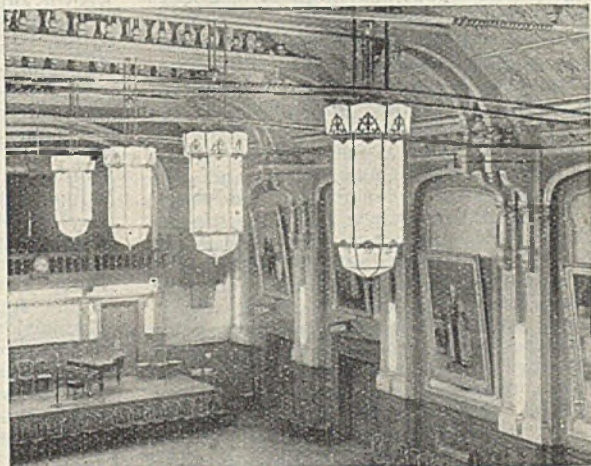
Aluminium Development Association

The address of the Aluminium Development Association, formerly 67, Brook Street, London, W.1, is now 33, Grosvenor Street, London, W.1. The telephone number, Mayfair 7501/8, remains the same.

E.D.A. Bulletin

The current issue of the Bulletin published by the British Electrical Development Association contains reports of the first of the series of sales lecture-meetings, inaugurated jointly by the South-East, East, Eastern, Greater London and

Southern Committees, and the conference of architects and electrical engineers arranged by the E.D.A. (Northern Counties Area) at Newcastle-on-Tyne; the main points of the memorandum of the Electricity Supply Industry on the Report of the Fuel and Power Advisory Council on Domestic Fuel Policy; an account of



The main hall at Chatham Town Hall, showing the specially designed pendants, each of which accommodates ten 5-ft. Osram 80-W fluorescent lamps

the Chester electricity undertaking's golden jubilee, and news from the areas.

Electrical Travellers

The annual luncheon of the Electrical Trades' Commercial Travellers' Association will be held at the Connaught Rooms, Great Queen Street, London, on February 21, at 12.30 for 1 p.m.

New Fluorescent Lamp

A new form of fluorescent tube—290 cm. in length and 20 mm. in diameter (known as the "9 ft. 6 in. lamp")—is now going into production at the works of the Metropolitan-Vickers Electrical Co., Ltd., Manchester. These tubes, with a loading of 70 W, will normally be mounted in sets of three operated by cascade transformers, the running voltage being approximately 630 V. The tubes are of the cold-cathode instant-starting type, and will be available in "Warm White," "Intermediate White" and "Daylight" colours.

Electric Cookers

The main theme of the E.A.W. on the first two pages of the "Cheerful Rationing" card, issued by the association, for the next few months will be that of electric cookers, commencing this month with the boiling plate and general care of the cooker. The recipes for a simple dinner

to be cooked on one boiling plate are followed by general hints on the cooking of eggs and girdle or Welsh bakestone scones.

E.D.A. Annual Luncheon

The annual luncheon of the British Electrical Development Association will take place immediately prior to the association's annual meeting at the Connaught Rooms, Great Queen Street, London, W.C.2, at 12.30 for 1 p.m., on Friday, March 21.

Manchester Students

On Wednesday evening, Mr. C. P. Beardsall, of Ferranti, Ltd., addressed the Manchester Association of Engineers' Students Section, at Manchester, on the subject of light engineering and the development of radar in war and peace. With the aid of lantern slides the speaker gave a vivid picture of the work which his firm and others in the district undertook to meet the needs of the country at war. Time fuses, gun-fire control equipment; radar in many forms, now being developed for peace-time use, were described, and a wide field of light precision engineering was covered. "Every fighting ship in the Navy," said Mr.

Beardsall, "carries some item of equipment made by Ferranti, including the latest H.M.S. VANGUARD."

Trade Publications Received

An illustrated leaflet issued by the Air Conditioning and Engineering, Ltd., 3, Bayley Street, Tottenham Court Road, London, W.C.1, describing their "Aircon" electric unit heater.

Positax pamphlet No. 1, issued by the British Rubber Development Board, 19, Fenchurch Street, London, E.C.1, dealing with a new form of natural rubber latex with reversed charge.

A publication entitled, "Steady Bushes for Swiss Type Automatics," issued by Protolite, Ltd., Central House, Upper Woburn Place, London. It gives a table showing standard types of "Prolite" steady bushes in regular production.

An attractive illustrated publication giving historical and other information of the Lancashire Dynamo and Crypto organisation, particulars of the products of the various factories of the group, and the addresses of associated companies, sales and service offices and agencies overseas.

The Batti-Wallahs' Society

MR. HUGH QUIGLEY was the guest-speaker at the monthly luncheon of the Batti-Wallahs' Society, London, on January 30, when the president, Mr. P. V. Hunter, was in the chair. Mr. M. Whitgift, the mate, explained that owing to the need for fuel economy, the port and starboard lights which are always a feature at these functions were forbidden on grounds of their being decorative.

Mr. Quigley took for his subject "Industrial Reconstruction in 1947," and said that in the beginning of 1930, the Chancellor of Germany, Dr. Brüning, carried out a series of decrees aimed at the restriction of both the subject and economic activity, which were identical to the decrees now being carried out by the Labour Government. World depression and world war resulted. Economic industrial reconstruction was so excessively complicated that it could only be approached with the greatest care and delicacy. It was still true that certain economic factors had certain results, which could not be eliminated by a ukase or a special Order in Council.

He did not believe that the Government would suddenly abandon all controls. They would adhere to their policy so long as they could, even if it meant economic disturbance. The question then was how much time would they have

to sort out an economic system on the new basis, so that it could function with a fair degree of efficiency? He did not think they would have more than eighteen months.

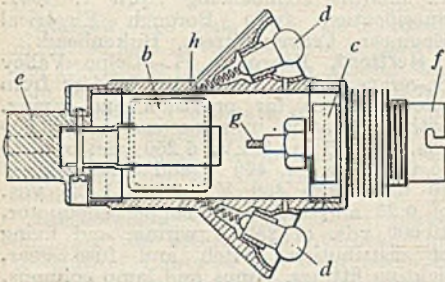
The export trade would continue to increase or maintain its position for, he thought, about eighteen months; then it would tend to decline. At the end of that time, with our dollar loan possibly exhausted, we would be confronted with the problem of maintaining the population of Great Britain from our own resources—a problem which should have been faced squarely at the beginning of the war. He did not believe it was possible for any Government so to control the economic system that it would avoid slumps and booms. He did not believe we would be able to continue much longer in the policy of concentration of industrial activity without disastrous results, and he felt that we should soon have to work out a single progressive scheme for the complete development of our natural resources. It was now eighteen months since the war came to an end, and we had not yet begun to look at the problem.

Mr. Whitgift introduced two new members, Mr. Robert Crawford and Mr. H. J. Allcock, and announced that the speaker at the next luncheon on February 27 would be Sir Hartley Shawcross.

Electrical Inventions

Nursery Lamps

A dual-purpose lamp holder is described, which is said to be suitable for use in nurseries, etc., where only a subdued light is normally required after dark. The fitting contains a reduction transformer *b*, the primary of which is normally in series with a mains voltage lamp held in *f*, and which can be short-circuited by a switch *c*. In the secondary circuit of the transformer are one or more low voltage, low consumption lamps *d*; these will light when the short-circuiting switch is open. When the switch, which can be operated



by a lever *g*, is closed, the mains voltage lamp is energised. In the other position, the current passing through the transformer primary is too small to light the larger lamp.

J. H. Runbaken. Application date, May 7, 1945. No. 583 259.

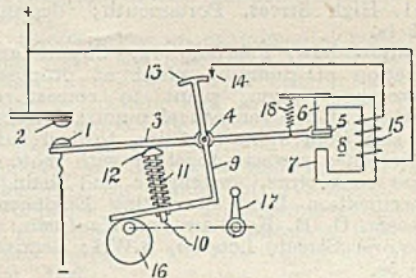
Snap Acting Traction Switch

The construction described is said to provide a snap-acting switch, particularly suitable for electric traction motor control. Referring to the diagram, it will be seen that, if the main switch contacts 1 and 2 are fully opened, the auxiliary contacts 13 and 14 will also be opened and the electromagnet 8 de-energised. The armature 5 attached to the contact-carrying lever 3 will lie at the pole 6 of the magnet. When the switch is to be closed, force is applied to the operating member 9 by a cam 16 actuated by a handle 17. The initial displacement of the member 9 about its pivot 4 will close the contacts 13, 14, and energise the magnet, and the armature 5 will be held against the pole 6. As a result, the lever 3 is restrained from rotating to close the main contacts. Under the force applied to the member 9 carrying the pivot 4, the head 12 of the spring-loaded rod 10 will engage with the lever 3, so that compressive stress is built up in the spring 11. When rotation of 9 is suffi-

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.

cient to cause the segment 13 to move beyond the co-operating contact finger 14, the magnet will be de-energised, and the level 3 will be free to move, under the action of the spring, in such a direction as to close the main contacts 1 and 2 with an abrupt motion. The auxiliary switch, operating the electromagnet, is also employed to open the contacts with a snap-action when the controlling force is released from the member 9.

In a suggested modification to the system described, adapted for use in drum-controller types of switchgear, the L-shaped lever 9 is omitted and the auxiliary switch 13, 14 consists of a pair of co-operating contacts on the drum controller. The head 12 can then be engaged by a cam of the controller in order to compress the spring 11.



Among the advantages claimed for the invention are that the possibility of indeterminate contact pressure due to partial closure of the switch contacts is obviated and that the speed of closure and opening is not dependent upon the rate at which the cam shaft is moved. Sequential switching can thus be effected, not with a series of jerks, but by a continuous smooth movement of the camshafts.

W. T. Gray and Metropolitan-Vickers Electrical Co., Ltd. Application date, October 18, 1944. No. 583 331.

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:—

Richmond, Yorks., February 10.—Supply and laying of approximately 1 100 yds. of cable. Specification from Borough Electrical Engineer, Corporation Offices, Richmond, Yorks.

Cheadle and Gatley, February 10.—Supply and delivery during 12 months ending March 31, 1948, of: p.i. cables for mains and services, electric lamp bulbs, electric meters, street lighting standards and fittings. Particulars from Engineer and Manager, Electricity Department, 19, High Street, Cheadle, Dorset.

Portsmouth, February 12.—Supply, delivery and erection of: distribution system diagram, generating station works auxiliaries, control and indication diagram, automatic telephone equipment. Specifications from Engineer and Manager, Electricity Undertaking, 111, High Street, Portsmouth; deposit, £1 ls.

Portsmouth, February 12.—Supply, delivery and erection of two 230 V, 200 A.h., stationary lead-acid accumulators, each fitted with charging equipment, for switchboard and emergency lighting duties. Particulars from Engineer and Manager, Electricity Undertaking, 111, High Street, Portsmouth; deposit, £1 ls.

Audenshaw, February 12.—Supply and erection of pumping plant at proposed sewerage station, plant to consist of battery of five centrifugal pumps, varying in size from 3 in. to 5 in., to deal with unscreened sewage, together with motors, pipe connectors, switchgear and fittings. Specification from Consulting Engineers, Messrs. G. B. Kershaw and Kaufman, 1, Victoria Street, London, S.W.1; deposit, £5 5s.

Plympton St. Mary, February 14.—Supply and delivery of: (a) overhead line materials; (b) street lighting equipment; (c) e.h.t. switchgear; (d) house wiring materials; (e) tools. Particulars from Clerk to the R.D.C., Council Offices, Plympton.

Whitby, February 15.—Supply and delivery of two 1 000kVA, 6 600-3 300/420/240 V three-phase transformers. Specification from Electrical Engineer and Manager, Electricity Department, 63, Baxtergate, Whitby.

Oldham, February 15.—Purchase and removal from stores of approximately 600

ld. coin 5 A, 230 V, 50 cycles a.c. p.p. meters and 1 000 ls. coin 5 A, 230 V, 50 cycles a.c. p.p. meters, mainly consisting of Ferranti, type f.c.b., fitted with 20 A switches. Particulars from Chief Engineer and Manager, Electricity Department, Oldham.

Stockport, February 17.—Supply and delivery to generating station of one medium-duty centralised control radial drilling machine. Specification from Borough Electrical Engineer, Electricity Offices, 23, Tiviot Dale, Stockport.

Birkenhead, February 17.—Supply and delivery of electric lamps over a period of 12 months commencing April 1, 1947. Specification from Borough Electrical Engineer, Craven Street, Birkenhead.

Hertford, February 17.—Colne Valley Sewerage Board will invite tenders from selected firms for provision and laying, with excavation in some cases, of 5 900 yds. of 0.15 in. 3 kV, 6 250 yds. of 0.25 to 0.007 sw. in. 460 V and 5 500 yds. of 10 to 3 core 460 V cables, 1 325 yds. of 0.25 and 0.05 bare copper conductor, 10 000 yds. of 250 V wiring, and fixing of distribution switch and fuse gear, lighting fittings, lamps and lamp columns. Selected list will be limited to 12-18 names, and qualified contractors are invited to apply for inclusion. Application forms from Consulting Engineers, Messrs. Stanford Fawcett and Partners, 53, Victoria Street, London, S.W.1.

Belfast, February 21.—Supply of switchgear, meters, transformers, accessories, domestic appliances, etc. (Advertised in our last issue.) Particulars from City Electrical Engineer and General Manager, East Bridge Street, Belfast.

Manchester, February 22.—Supply, delivery and installation at various substations of: (a) 110 V batteries and charging equipments, and (b) 50 V batteries and charging equipments. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2.

Southend-on-Sea, March 13.—Supply of new electrically-operated rolling stock, composed of four seven-coach train sets complete, suitable for use on pier electric railway, 550 V d.c. Particulars from Piermaster and Foreshore Manager, Pier Hill Buildings, Southend-on-Sea; deposit, £2 2s.

Weymouth and Melcombe Regis.—Supply and delivery of p.i. cable for period of 12 months commencing April 1, 1947. Specification from Borough Electrical Engineer, Electric House, Westham Road, Weymouth.

Electricity Supply

Battersea.—A reactor and switchgear, supplied by the General Electric Co., Ltd., are to be installed at a cost of £14 000.

Guildford.—Nine transformers are to be purchased at an estimated cost of £4 750, in order to meet growing demands.

Poplar.—Sanction to borrow £4 243 000 for the new power station has been granted to the Electricity Committee.

Tynemouth.—The Town Council has decided to object to the manufacturing and financial clauses in the Electricity Bill.

Glasgow.—To cope with the increasing industrial load in various parts of the city, the Electricity Committee is seeking sanction to borrow £130 740 for extensions.

Fulham.—An estimate of £170 000 for the further standardisation and reinforcement of the local distribution system has been approved by the Electricity Committee.

Guiseborough.—A Council resolution opposing the erection of overhead lines to Hulton Lowercross has been rescinded, after the Council had been informed by the North-Eastern Electric Supply Co., Ltd., that, in view of their decision, plans for supplying the area had been cancelled.

Bethesda (N. Wales).—On the recommendation of their consulting electrical engineer, the Council has decided to press the North Wales Power Co. to erect an additional sub-station to allow for a considerable increase in consumption owing to new factory and housing schemes.

Middlesbrough.—Expenditure contemplated includes £19 000 for electric mains and sub-station extensions, £7 765 for meters and meter testing equipment, £1 820 for new vehicles for the electricity department, and £6 550 for hire purchase apparatus.

Todmorden.—The Electrical Engineer has been asked to prepare estimates for the provision of extended services to outlying districts. Sanction to borrow £2 000 for meters, £5 000 for mains and services and £2 000 for sub-station equipment has been obtained.

Barnard Castle.—The plans of the North-Eastern Electric Supply Co., Ltd., for supplying electricity to Hamsterley and Bedburn, have been approved. The firm is also to supply the Staindrop housing site, and the Council has drawn their attention to the supply required at Lynesack and Softley.

Darlington.—Application has been made for sanction to borrow £47 906 for the lay-

ing of h.t. cables from Salutation Corner to the water-works, and from the generating station to Springfield, Neasham Road and Yarm Road. Traction sub-stations are to be erected at Stone Bridge, Northgate, West Crescent and Willow Road.

Aberdeen.—An application for facilities for a radio relay in Aberdeen has been rejected by the Streets and Works Committee. Permission was sought by an Essex firm to establish a wireless relay station with the necessary wiring to service the city, offering a choice of four programmes.

Llandudno.—The adoption of a new two-part (lighting and power) tariff throughout the district is to be considered. This follows a decision to ask the Commissioners' approval to charge tenants of prefabricated houses 4d. a unit, in view of the fact that the houses have only one meter and the charge had previously been on the higher lighting rate.

Bermundsey.—After considering methods of switching on and off street lamps, most of which are at present controlled by hand, the Electricity Committee is of opinion that the time-switch method is the best for local requirements, and is to arrange a trial installation in order to obtain a more intimate knowledge of the practical application of this method, at a cost of £470.

Exeter.—For an experimental period of one year, the Electricity Committee has withdrawn the hire purchase scheme for electric cookers and introduced a plain hire scheme. It has also approved a scheme for the extension of the switch gallery at the power station, and has accepted the tender of £13 600 of the Yorkshire Electric Transformer Co., Ltd., for transformers in connection with the bulk supply to the Exe Valley Electricity Co., Ltd.

Stoke Newington.—The Electricity Committee, which takes bulk supply from Hackney, is to increase the capacity of the transmission line. The scheme provides for the purchase from the Central Electricity Board of three 10 000 kW pool transformers and the laying of an additional cable. This plant will provide for a maximum load of 21 000 kW, the estimated cost being £17 458. Housing estate supply at Woodberry Down will cost £1 681.

London.—The Metropolitan Water Board has considered a report by the Chief Engineer concerning the machinery which

should be installed in the construction and reconstruction of well stations and repumping stations. As a result of a careful review of the relative merits of steam, oil and electricity from the grid, as prime movers at these stations under varying loads, and as regards electricity with different tariffs, the Board is of opinion that the normal drive should be by means of purchased electric power, with Diesel engines for stand-by and load relieving purposes.

Shipley.—At a cost of £3 963 the Electricity Committee is to instal an additional high-pressure feeder from Clarence Road sub-station to Nab Wood sub-station.

Manchester.—Sanction to borrow £6 742 900 for the construction of the Carrington power station, is being sought by the Electricity Committee. The initial installation will comprise two 60 MW turbo-alternators, four 360 000 lbs. per hour pulverised fuel boilers, and electrostatic filters. Messrs. C. S. Allott and Son have been appointed civil engineering consultants.

Accrington.—The Corporation is seeking an assurance from the Ministry of Fuel, in view of the nationalisation of the electricity industry, that it will be reimbursed for any expenditure in erecting the £5 000 000 power station at Huncoat. The Central Electricity Board cannot give any assurance "as it may go out of existence when the generating stations come under national ownership." Plans for the station

include proposals for a pithead coaling station at Huncoat Colliery and water supplies from Habergham shaft and the Leeds-Liverpool Canal.

London.—The London and Home Counties J.E.A. has been informed that applications have been made to the Electricity Commissioners for consent to the establishment of the following main transmission lines: London Power Co., Ltd., 22 kV, three-core mains, together with pilot, control and telephone cables, between the Brompton, Alpha Place and Amberley Road distributing stations, to deal with future load requirements at these stations, at an estimated cost of £315 000, together with switchgear at Amberley Road, at £14 000; Metropolitan Electric Supply Co., Ltd., 25 kV, three-core transmission line, together with pilot and control cables, from the sub-station at Station Road, Taplow, to the electricity works of Maidenhead Corporation, at an estimated cost of £27 830. This latter cable is required to deal with increases of load in the Maidenhead area. The Northmet Power Co., Ltd., have applied for consent to three lines from Willesden and one between Brimsdown, Barnet and Rowley Lane. The Commissioners have issued their consent to the establishment, by the London Power Co., Ltd., of a 22 kV transmission line from Battersea generating station to the Horseferry Road distributing station.

Appeal Against the Bill

AN appeal to the Government not to expose industry and commerce, at this time, to the uncertainties and hazards which the passing of the Electricity Bill would involve, is made to-day in a memorandum issued by the London Chamber of Commerce.

The memorandum, which has been submitted to the Prime Minister, the Minister of Fuel and Power and the President of the Board of Trade, says the Chamber makes the appeal "in the light of the warnings given by the Government as to the critical state of the economic life of the country; and the appeals made to all sections of the community to abandon secondary objectives in order to concentrate on the task of preserving that life."

After pointing out that the objectives set out in the Explanatory and Financial Memorandum of the Bill were already in process of being realised without nationalisation, the Chamber expresses the belief that the introduction of a new and untried system must inevitably result, for the time being, in confusion, hesitation and misunderstandings.

Moreover, a nationalised concern will

certainly employ a relatively larger administrative staff than a public company and, as the nation's "biggest problem is the almost universal shortage of manpower," in the words of a recent White Paper, it is clearly of paramount importance to avoid the diversion of labour from actual production to administration.

The proposal to give the Central Authority power to "manufacture electrical plant and electrical fittings," and to "sell, hire, or otherwise supply electrical plant and electrical fittings and to instal, repair, maintain or remove any such plant or fittings" would enable the Government to use the full weight of the State to put a large number of small concerns completely out of business.

The argument for nationalisation, that electricity supply is by its nature monopolistic, cannot be advanced in the case of such activities, which to a large extent are carried out by the "small man," and the Chamber believes that the taking of powers to deprive people of their livelihood without compensation is quite indefensible, whether the businesses are large or small.

Company News

REDFERN'S RUBBER WORKS, LTD. Final dividend of 5% on ord. plus bonus of 5% (mkg. 15% less tax) payable February 15. Final div. for preceding year was 6½%, plus 2% bonus, making total of 12%.

ANGLO-PORTUGUESE TELEPHONE CO., LTD. A five-year plan, designed to bring up to date work which fell into arrears during the war, is announced by the company, and will begin this year. The plan is estimated to cost \$2 000 000, a considerable part of which will be represented by the cost of materials exported from Britain. The company states that orders placed before hostilities ended, coupled with Portugal's prosperity and a brisker demand for telephones than ever, augurs a bright future. Large quantities of telephone equipment were received from manufacturing firms in Great Britain during 1946.

R. A. LISTER AND CO., LTD. Accts. show net prft., after deprecn. etc., of £408 63.0 (£406 434). Consolidated current assets of £4 283 600 (£2 735 000) incl. cash of £1 424 000 (£398 000), increase being largely due to new capital raised during the year. Net current assets, £3 206 000 (£1 829 000) In his statement to shareholders, the Chairman said that substantial capital expenditure was in hand for increasing production in the five main factories of the group. Since the close of the financial year, an E.P.T. post-war refund of £70 879 had been received, which would be spent on re-equipment. A further refund was likely for the period from October 1, 1944, to December 31, 1945.

SIMMONDS ACCESSORIES, LTD. Electric and General Industrial Trusts has acquired the whole of the capital in Simmonds Accessories, Ltd., and Simmonds Products. During the war, the Simmonds group operated two factories, one on the Great West Road, London, and a large Government factory on the Treforest trading estate, Cardiff. During the past year, plant and personnel have been moved to the Treforest factory, which is at present employing 1 170 workpeople, and it is hoped, with extensions of plant, to employ up to 1 800. Sir Oliver Simmonds has retained his interest in Simmonds Development Corporation, Ltd., with offices and a factory in the London area. The directors of Electric and General Industrial Trusts are Mr. C. W. Hayward, chairman and managing director, and Mr. E. J. Fearn. The purchase price of the undertaking has not been disclosed.

TUBE INVESTMENTS, LTD. Further development of the company's electrical interests during the year was referred to by the Chairman and Managing Director (Mr. I. A. R. Stedeford) at the annual meeting. In July last, he said, the subsidiary, Simplex Electric Co., Ltd., took over on a rental basis a modern Government factory of nearly half-a-million square feet, near Stoke-on-Trent. They were in production there already on a moderate scale, and they intended to take full advantage of the opportunities this factory offered for the economic mass-production of "Creda" electrical appliances. The old "Creda" factories would be used, for the time being, for more specialised lines and for electrical research and development, including the building of prototypes. There would be a still greater flow of electric cookers, fires and water heaters in the country. The business of A. P. Lundberg and Sons, manufacturers of electric switches, etc., had also been acquired, and this would make them much less dependent upon others for components of this kind, of which there was at present a serious shortage.

Metal Prices

	Monday, Price	February 3 Inc. Dec.
Copper—		
Best Selected (nom.)...per ton	£115 10 0	— —
Electro Wire bars	£117 0 0	— —
H.C. Wires, basis	£133 0 0	— —
Sheet	£153 10 0	— —
Bronze Electrical quality		
1% Tin—		
Wire (Telephone) basis per ton	£154 15 0	— —
Brass (60/40)—		
Rod basis	1s. 0½d.	— —
Wire	1s. 5d.	— —
Iron and Steel—		
Pig Iron (R. Coast Hematite No. 1) ...per ton	£8 10 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	£70 0 0	— —
Foreign and Colonial... ..	£71 10 0	— —
Tin—		
Ingot (minimum of 99.9% purity)	£384 0 0	— —
Wire, basisper lb.	4s. 10½d.	— —
Aluminium Ingots ...per ton	£72 15 0	— —
Spelter	£70 0 0	— —
Mercury (spot)per bott.	£21 0 0	— —

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

Commercial Information

Mortgages and Charges

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

WALMER ELECTRICAL APPLIANCES, LTD., London, W.—December 24, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge.

SWEDISH ERICSSON CO., LTD., London, W., electricians.—December 31, mortgage, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Anarth Lodge, Outlands Road, Walton-on-Thames, and fixtures.

MACHINE TOOL ELECTRICS, LTD., Leigh-on-Sea.—December 23, mortgage, to National Provincial Bank, Ltd., securing all moneys due or to become due to the Bank; charged on factory, London Road, Leigh-on-Sea, with plant, fixtures, etc.

INDUSTRIAL ELECTRICAL CO., LTD., London, N.—December 24, charge to Westminster Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Connars Stores, Commercial Road, Penryn, including fixtures. *£5 200. July 2, 1946.

L. M. K. MANUFACTURING CO., LTD., Brentford, electrical engineers.—December 20, charge, to Westminster Bank, Ltd., securing all moneys due or to become due to the Bank; charged on property in Harlequin Avenue, Isleworth, including fixtures. *Nil. April 18, 1945.

Coming Events

Friday, February 7 (To-day)

I.E.E.—London. Measurements Section. Discussion: "What Has the Electrical Instrument Industry to Learn From Developments in Continental Practice?" Opened by F. E. J. Ockenden and G. N. Harding. 5.30 p.m.

I.E.E., S. MIDLAND CENTRE.—Birmingham. At the Grand Hotel. Annual Dinner and Presidential Visit. 6.30 p.m.

ILLUMINATING ENGINEERING SOCIETY.—Birmingham. "Some Recent Trends in Day-lighting," W. A. Allen. 6 p.m.

INSTITUTION OF MECHANICAL ENGINEERS.—London. Discussion: "Basic Principles of Automatic Control Systems," Prof. A. Porter. 5.30 p.m.

Saturday, February 8

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. Visit to Sir W. G. Armstrong Whitworth (Ironfounders), Ltd., Gateshead.

I.E.E., SOUTHERN CENTRE.—Southend. At the South Parade Pavilion. Faraday Lecture: "The Generation and Wholesale Distribution of Electricity," J. Hacking. 3 p.m.

Monday, February 10

I.E.E., N. EASTERN CENTRE.—Newcastle-on-Tyne. "Growing Importance of Plastics in the Electrical Industry," G. E. Haefely. 6.15 p.m.

I.E.E., MERSEY AND N. WALES STUDENTS' SECTION.—Liverpool. At the Royal Institution. "Trends in Telecommunications," A. H. Mumford. 6.45 p.m.

Tuesday, February 11

I.E.E., N. MIDLAND CENTRE.—Leeds. "A Survey of the Development of Radar," R. A. Smith. 6 p.m.

I.E.E., E. MIDLAND CENTRE.—Nottingham. At the Demonstration Theatre, City Gas Department. "Power Supply for Generating Station Auxiliary Services," W. Szwander. 6.30 p.m.

I.E.E., N. IRELAND CENTRE.—Belfast. "Industrial Applications of Electronic Techniques," H. A. Thomas. 6.45 p.m.

BRITISH KINEMATOGRAPH SOCIETY.—Manchester. "Uses and Maintenance of Storage Batteries," J. D. Wright. 10.30 a.m.

INSTITUTION OF POST OFFICE ELECTRICAL ENGINEERS.—London. "Development of Telephone Transmission Over Lines in the Last 40 Years," R. M. Chamney. 5 p.m.

Wednesday, February 12

I.E.E.—London. Transmission Section. "The Operational Characteristics of Modern H.V. Wood-Pole Lines," G. T. Garwood. 5.30 p.m.

I.E.E., SCOTTISH CENTRE.—Edinburgh. "A Survey of the Development of Radar," R. A. Smith. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—Sheffield. At the Royal Victoria Hotel. Presidential Address: "Inspection," Maj-Gen. Sproull. 7.15 p.m.

THE BRITISH COUNCIL.—Manchester. At the British Council House, George Street. From a series of lectures on Factory Welfare: "Apprenticeship Schemes," K. R. Evans, Metropolitan-Vickers Electrical Co., Ltd. 9.15 a.m.

I.E.E., LONDON STUDENTS' SECTION.—London. Visit to the Mullard Radio Valve Co., Ltd., Mitcham. 2.30 p.m.

EDINBURGH ELECTRICAL SOCIETY.—Edinburgh. "Electrolytic Capacitors," J. H. Cozens. 7.30 p.m.

Thursday, February 13

I.E.E.—London. Installations Section. "Protective Finishing of Electrical Equipment," F. Widnall and R. Newbound. 5.30 p.m.

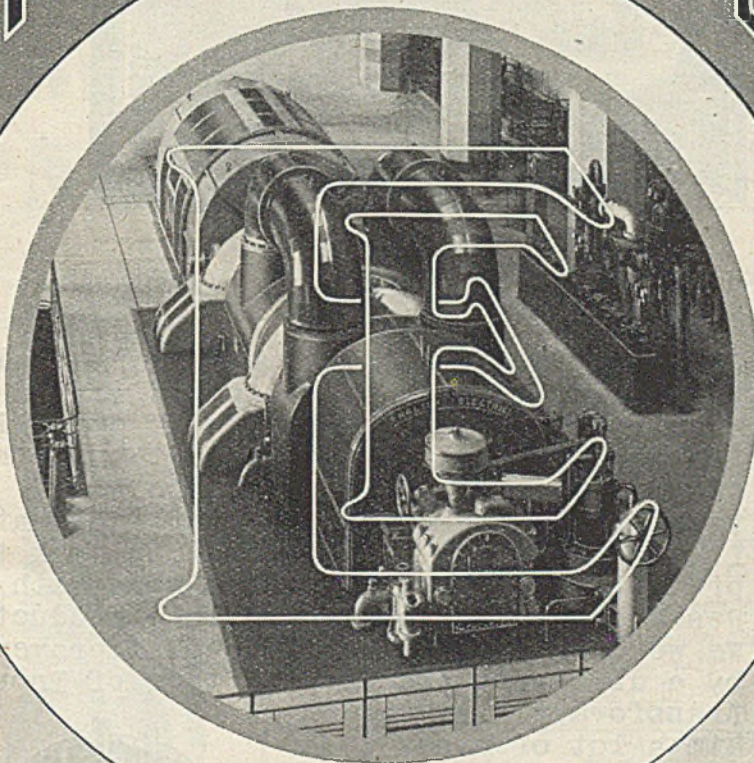
I.E.E., N. EAST SCOTLAND SUB-CENTRE.—Dundee. "Comparisons Between Gas and Electricity on the Basis of Coal Economy," P. Schiller. 7 p.m.

Friday, February 14

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. "Background Noise in Sensitive Radio Receivers," M. F. Ormiston.

I.E.E., N. EAST SCOTLAND SUB-CENTRE.—Aberdeen. "Electrical Control of Dangerous Machinery and Processes," W. Fordham Cooper. 7.30 p.m.

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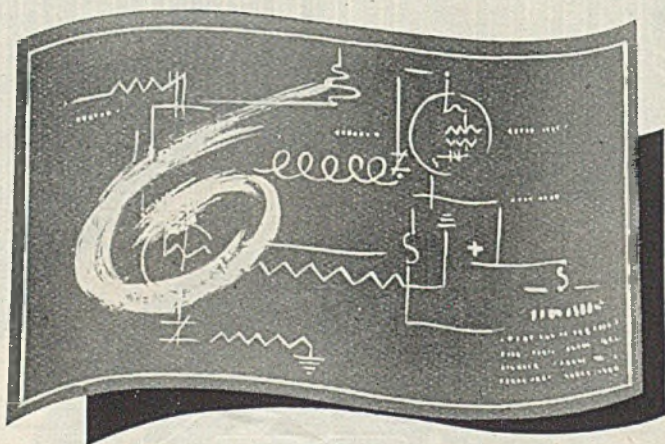
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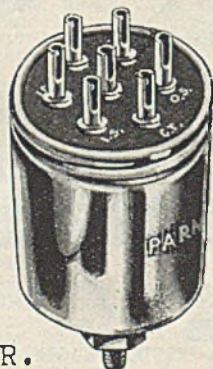
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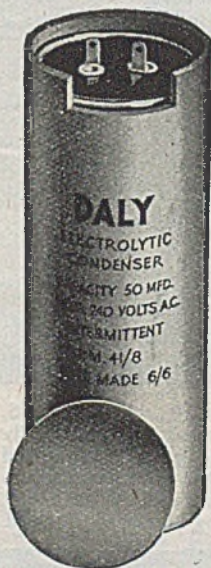
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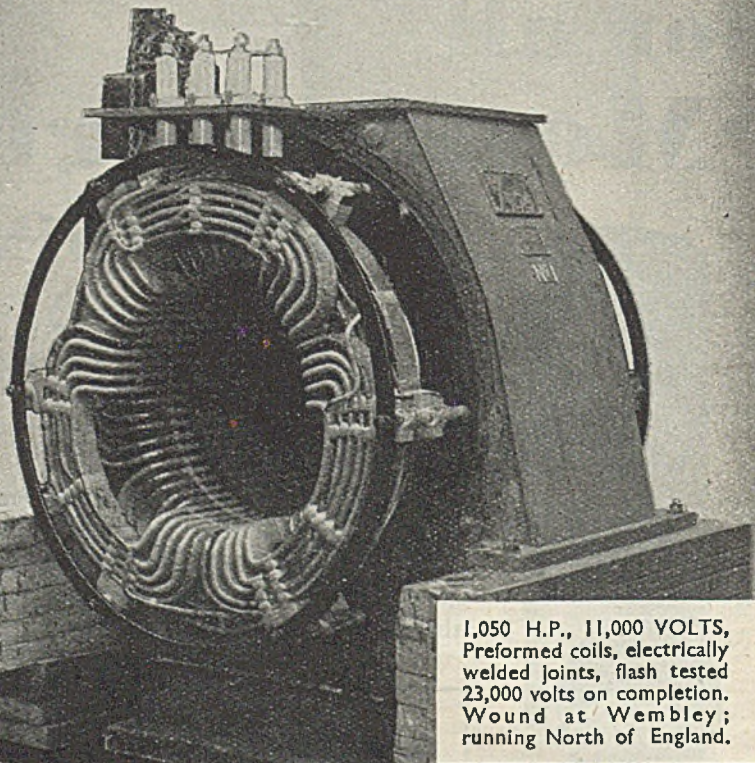
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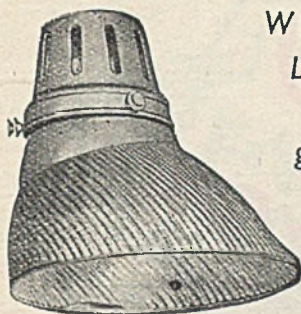
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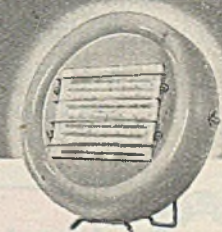
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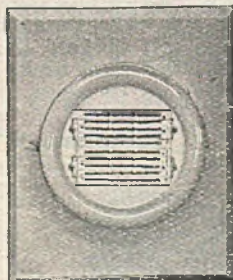
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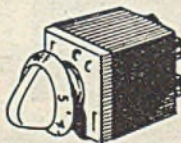
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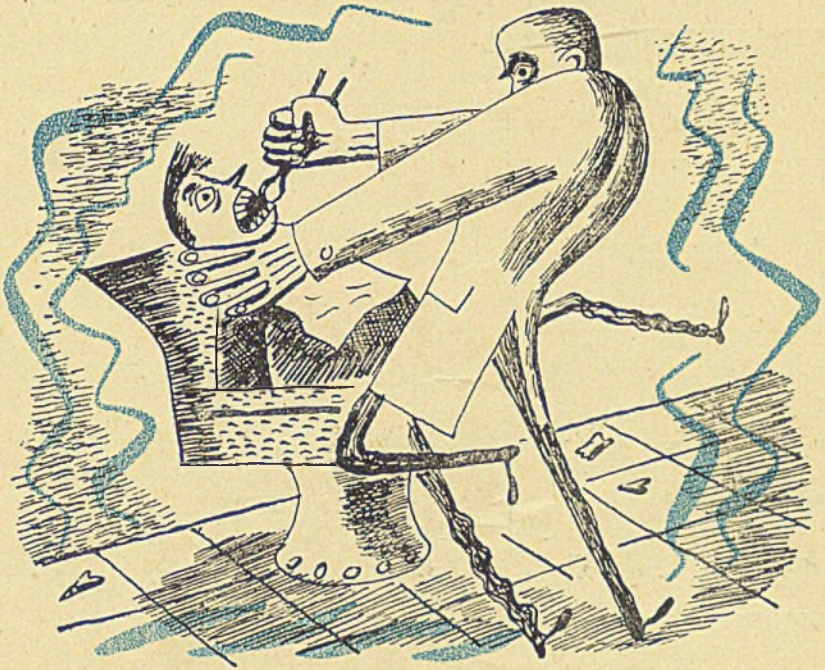
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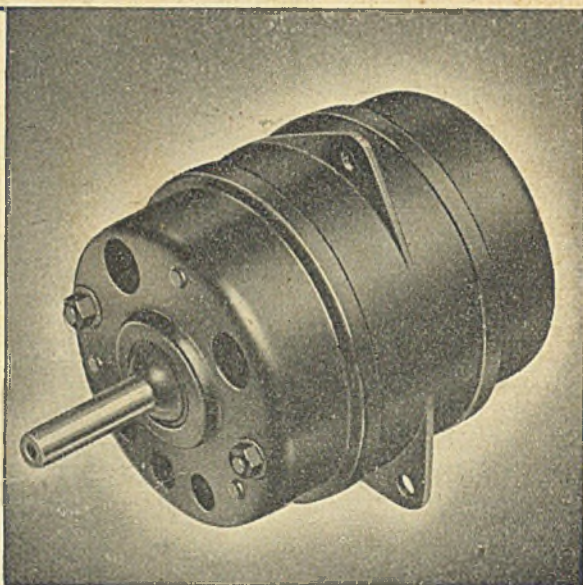


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