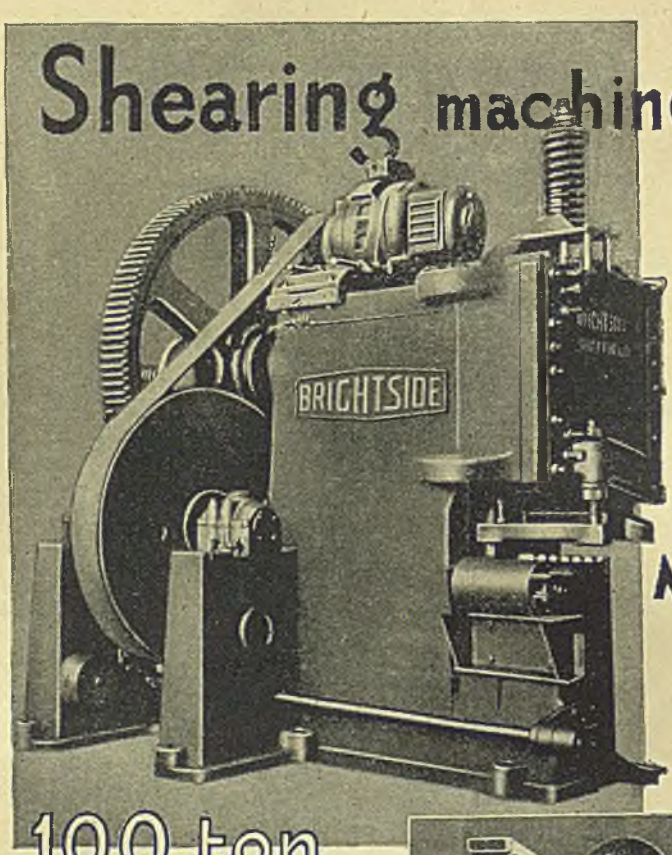
THE ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

1 NOVEMBER 1946

Shearing machine Drives



Whether you need power for the largest press or smallest guillotine, you cannot do better than specify :

METROVICK MOTORS

100 ton

Above: A Metrovick 12 h.p. slip-ring induction motor driving an open gap Brightside shearing machine. It has a 100 ton load for shearing cold bars, is fitted with a semi-automatic clutch to obtain single or continuous cuts, and is belt and spur driven

POPPY DAY NOV. 9

550 ton

Right: A 55 h.p. Metrovick Q type motor with totally-enclosed closed air circuit, driving a 550 ton Cowlishaw Walker machine for shearing billets.

METROPOLITAN Vickers ELECTRICAL CO., LTD.

TRAFFORD PARK ··· MANCHESTER 17.

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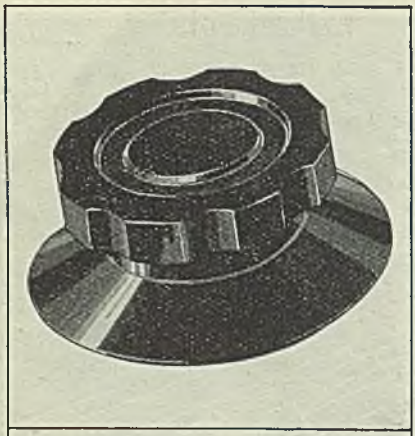
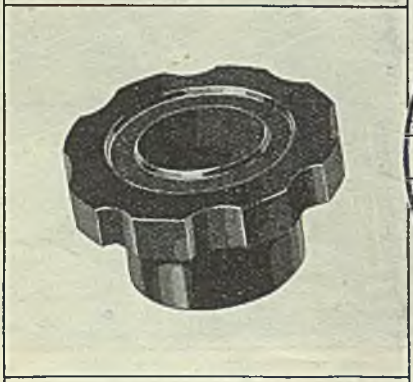
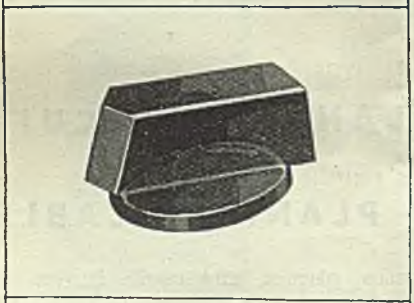
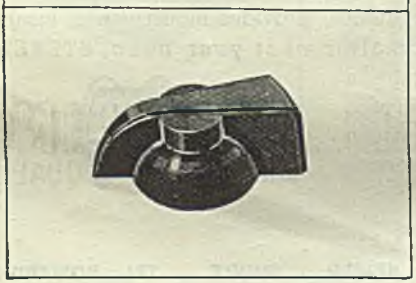
Switch to METROVICK Lighting when daylight fades

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









Moulded Knobs, Dials and Pointers

by

PAINTON & Company Limited NORTHAMPTON

Painton & Company has, from the time of its incorporation, concentrated on the manufacture and supply of electrical components of the grade required by transmission engineers in equipment designed for telephone administrations, broadcasting companies, etc.

The Knobs, Dials and Pointers illustrated are but a few of our many productions now adopted by the leading broadcasting engineers, telephone administrations and equipment manufacturers throughout the World.

May we let you have the fullest information.

PAINTON & CO. LTD.
KINGSTHORPE
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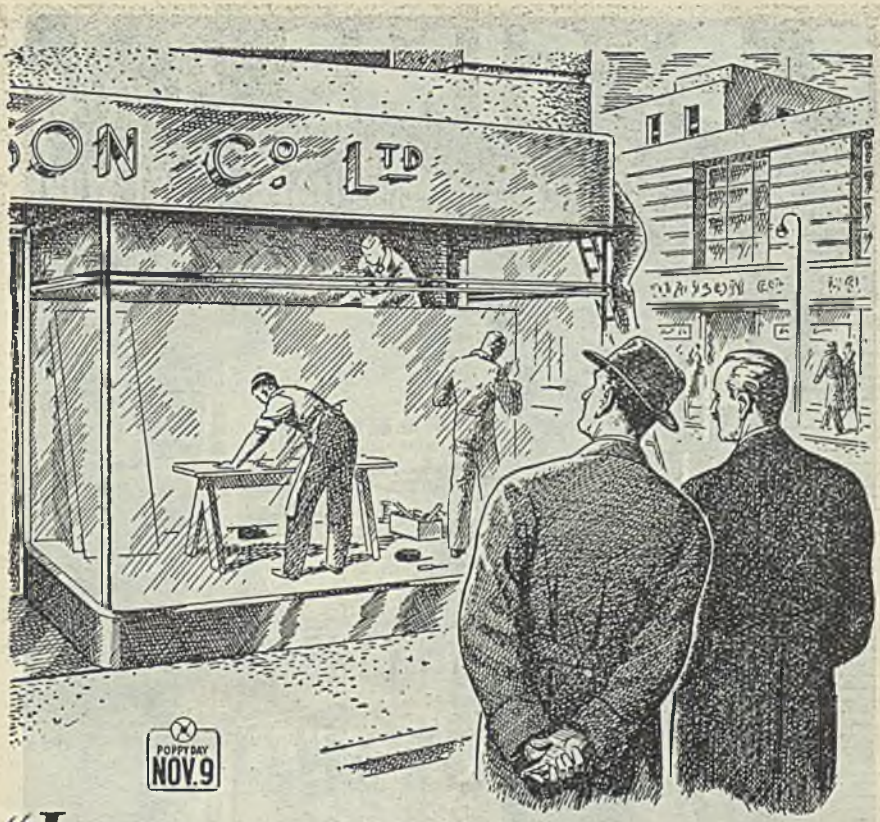


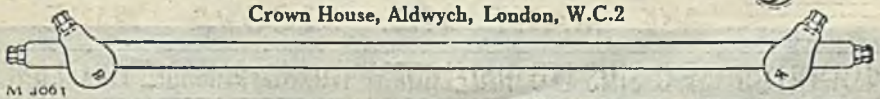
"Lighting is going to be the biggest improvement . . ."

LIGHTING ADVISORY SERVICE *All concerned with the installation or renewal of lighting are invited to communicate with our Lighting Advisory Service, Bridle Path, Watford. Telephone Watford 770*

HIS contractor very wisely got in touch with the Mazda people. Their Lighting Advisory Service sent qualified engineers to discuss plans — and eventually provided a comprehensive and practical scheme giving due emphasis to the *psychological* and *aesthetic* aspects of lighting in relation to modern selling.

MAZDA LAMPS IN MAZDALUX FITTINGS

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



M 4061

"BIG BEN" is always up to the minute, never falling a step behind or getting one in front. Unlike Big Ben, we at SANDERS—WEDNESBURY, endeavour to be always a step in front, but the abnormal conditions of today unfortunately will not permit us to keep pace with the demand for our products. Shortage of supplies, restrictions, etc. are gradually being overcome—meantime, modifications to existing ranges and entirely new designs are being planned to keep Sanders switchgear, fusegear, sockets, plugs etc., 'up to the minute.'

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

MISCELLANEOUS ADVERTISEMENTS

SITUATIONS VACANT

FIRST GARDEN CITY, LIMITED.

The following vacancies are open—

(a) **Home Service Advisor.**
Lady (single) conversant with all domestic uses of electricity and able to advise upon the selection of appliances, to hold lecture demonstrations, to visit consumers' houses, and to assist in sales development. Qualifications must include a recognised domestic science certificate and/or E.A.W. diploma. Salary £286 per annum, plus car allowance.

(b) **Clerical Assistant (Male).**
To assist with stock records, invoices, time sheets; rate of pay £5 per week of 40½ hours.

(c) **Stores Assistant (Male).**
Used to handling electrical material and routine records; rate of pay £5 per week of 47 hours.

(d) **Meter Tester.**
Used to the testing and adjustment of D.C. and A.C. meters, with some technical knowledge, if necessary suitable young man would be trained; rate of pay £5 9s. 8d. per week of 47 hours.

All the above payments are adjusted to current cost of living allowances, and the conditions, where applicable, are in accordance with National Agreements, including paid holidays, generous sick pay scheme, staff benefit retirement fund, canteen facilities. There is an acute housing shortage in the area.

Full particulars in writing to the undersigned.

W. A. BROWN,
Electrical Engineer.

Works Road,
Letchworth,
HERTFORDSHIRE.

MANCHESTER CORPORATION ELECTRICITY DEPARTMENT.

WANTED for duties in Power station:—

ONE Combustion Engineer, at a salary in accordance with Class J, Grade 9, of the N.J.B. Schedule, which is equivalent to £425, rising by two biennial increments to £445 per annum.

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

ONE Control Room Assistant Engineer, at a salary in accordance with Class J, Grade 10a, which is equivalent to £335, rising by two biennial increments to £350 per annum.

Candidates for both 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, not later than Monday, 28th October, 1946.

Canvassing, directly or indirectly, will disqualify.

PHILIP B. DINGLE,
Town Clerk.

Town Hall,
Manchester, 2.
October, 1946

SITUATIONS VACANT

CIVIL SERVICE COMMISSION.

THE Civil Service Commissioners announce that a special competition will be held for appointments as Assistant Examiner in the Patent Office under the Board of Trade. Approximately 200 vacancies will be filled by competitive interviews spread over a period of two or three years. Vacancies will be available for mathematicians, physicists, chemists, electrical engineers, mechanical engineers and persons with general scientific qualifications.

Candidates must have passed an examination qualifying for a University degree or its equivalent or hold other qualifications specified in the regulations.

Candidates must have been borne on or after the 2nd August, 1910, and have attained the age of 20 on the 1st January of the year in which they compete. Allowance will be made for service in H.M. Forces prior to 3rd. September, 1939, and for service as Established Civil Servant commencing before age 25, the latter allowance being subject to a maximum of two years.

The salary scale is £250 a year rising to £400 a year (men), £350 a year (women), plus consolidation additions varying from £78 a year (men) and £63 a year (women) at the minimum of the scale to £90 a year and £72 a year for men and women respectively at the maximum. Commencing salary will vary according to age. Subject to efficiency there is advancement after five years service to Examiner, £450 to £750 (men) and £375 to £650 (women). There are prospects of promotion to higher grades.

Candidates who have served or are serving in H.M. Forces must send in their application forms in time to reach the Civil Service Commission not later than 1st February, 1947. All other candidates must send them in by 1st December, 1946.

Copies of the Regulations and Forms of Application may be obtained from the Secretary, Civil Service Commission, Burlington Gardens, London, W.1, or from the Chief Officer, Civil Service Commission, at the following addresses, quoting 1664:—

(India) 10, Underhill Lane, Delhi.
(Egypt) 8, Sharia Tolumbat, Garden City, Cairo.
(Italy) c/o. G.H.Q., C.M.F.
(Germany) c/o. 2nd Echelon, G.H.Q.,

SCIENTIFIC CIVIL SERVICE.

THE Civil Service Commissioners invite applications for appointment to three Superintendent posts at the Royal Aircraft Establishment of the Ministry of Supply.

Candidates should be British subjects, born on or before 1st August, 1915, and not more than 50 years of age on 1st October, 1946. They should possess for two of the posts an Honours Degree in Physics, Mathematics or Engineering with—

(1) Experience of mechanical and electrical instruments, a knowledge of aircraft navigation and/or of gyroscopic equipment, or
(2) Experience in the structural problems of aircraft design.

For the third post they should possess high qualifications in light electrical engineering with experience of aeronautical electrical equipment and the electrical industry.

The appointments are permanent with superannuation benefits under the Federated Superannuation System for Universities, and are graded as Senior Principal Scientific Officer on the provincial scale £1 100 by £50—£1 300, plus a consolidation addition of £120 (men) and £955 by £50—£1 125, plus a consolidation addition of £96 (women).

Forms of application and full particulars of the appointments may be obtained on application to the Civil Service Commission, 6, Burlington Gardens, London, W.1, quoting No. 1 669, to whom completed applications must be returned not later than 14th November, 1946.

SITUATIONS VACANT

CORPORATION OF GRAVESEND.
ELECTRICITY DEPARTMENT.
Draughtsmen.

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

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

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

G. V. HARRAP, A.M.I.E.E., M.I.I.A.,
General Manager and Engineer.

SOUTHERN RAILWAY.

ELECTRICAL Engineering Assistants are required for:—

(a) Power Supply and Distribution.
(b) Electric Rolling Stock.

The qualifications required for both (a) and (b) include a University Degree or equivalent, and practical engineering workshop training.

For (a) no experience subsequent to training is necessary. Pay £275 plus present War Allowance of £72 16s. per annum.

For (b) experience is required in the design and manufacture of electric traction equipment for rolling stock. Pay up to £450 plus present War Allowance of £72 16s., according to experience.

Applications to be addressed to:—
Chief Electrical Engineer,
Southern Railway,
15, St. Thomas Street,
LONDON, S.E.1.

SOUTHERN RAILWAY.
ELECTRICAL DRAUGHTSMEN.

APPLICATIONS are invited for two Senior Draughtsmen in the London Area.

Applicants must be qualified in Electrical Engineering with Workshop training, one having experience of the layout and design of electrical traction equipment, and one having similar experience of mercury arc rectifier sub-station layout and design.

Successful candidates will be engaged on a temporary basis, but will be eligible, if suitable, for appointment to a progressive permanent position.

Salary according to qualifications and experience.

Apply in writing, stating age, qualifications and experience, to:—
Chief Electrical Engineer,
Southern Railway,
15, St. Thomas Street,
LONDON BRIDGE, S.E.1.

Surrey Education Committee.
WIMBLEDON TECHNICAL COLLEGE,
Gladstone Road, S.W.19.

WANTED.—Full-time teacher to take Mechanical Engineering Subjects up to Ordinary National Certificate standard. Some electrical experience would be an advantage. Burnham Scale.

Also required for similar grade of work, a man who can offer a few hours teaching per week, for day classes.

Application form (full-time post) and further details may be obtained from the College by sending a stamped addressed foolscap envelope to the Registrar. Those desiring consideration for part-time work may apply by letter, addressed to the undersigned.

Applications should be forwarded as soon as possible.

H. NUTTON, M.B.E., A.M.I.E.E.,
Principal.

SITUATIONS VACANT

STOKE-ON-TRENT CORPORATION ELECTRICITY DEPARTMENT.

APPOINTMENT OF DRAUGHTSMAN.

APPLICATIONS are invited from suitably qualified persons under the age of 45, for the position of DRAUGHTSMAN.

Applicants should be technically trained to at least National Certificate in Electrical Engineering standard, be experienced switchgear draughtsmen and thoroughly familiar with protective gear diagrams, sub-station layouts and equipment.

The salary and conditions of service will be in accordance with Grade 9a, Class H, of the National Joint Board Agreement (£365-£381 per annum).

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

Application forms and further details may be obtained from the General Manager, Electricity Department, 31, Kingsway, Stoke-on-Trent. Completed applications must be returned in the envelope provided so as to be received not later than Monday, 18th November, 1946.

HARRY TAYLOR.
Town Clerk.

Town Hall,
STOKE-ON-TRENT.

CENTRAL ELECTRICITY BOARD.

NORTH-WEST ENGLAND AND NORTH WALES AREA.

Electrical Fitters for Instrument Work.

THE Central Electricity Board have vacancies at their office in Manchester for two electrical fitters with skilled experience in the maintenance and repair of polyphase integrating, indicating and recording meters, etc.

Remuneration will be in accordance with the rates laid down by the Board, the present rate of pay being 28.61 pence per hour for a 47-hour week.

Applicants should state their age and give full particulars with dates of their education, training and experience.

The selected applicants will be required to pass a medical examination and to join the Board's superannuation scheme.

Applications must be submitted, in writing, adressed to the District Manager, Central Electricity Board, Grid House, Wilmslow Road, East Didsbury, Manchester 20, and be received by him not later than November 21st, 1946.

JEP/JMG.
25.10.46.

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

MAINTENANCE Engineer wanted by N.W. London Manufacturers to take charge of department. Must have experience with Machine Tool installations and all types of electrical work both light and power, and also of Hydraulic Plant.—Reply to Box 181, Phillips Advertising Ltd., 15, Wilton Road, London, S.W.1.

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

DRAUGHTSMEN, Senior and Juniors over 22, required for Power Transformers, by a large Birmingham Firm. Electrical experience desirable, but not essential.—Apply Box No. L. S. L., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

WORK WANTED

COIL Winding Capacity! Experimetal work carried out if material is supplied. Field Coils, immediate delivery.—Ajax, 7, Chesterfield Road, Finchley, N.3.

FOR SALE

SECTIONAL TIMBER BUILDINGS consisting of Army and Air Ministry huts which are completely reconditioned and equal to new.
Size: 6 ft. by 6 ft.—18 ft. by 15 ft.—36 ft. by 16 ft.—80 ft. by 19 ft.—167 ft. by 16 ft. 6 in., and others.
For many years we have been supplying buildings to several of the largest business concerns in the country.
D. McMASTER & CO., 38, Mount Bures Works, Bures, near Colchester, Essex. 'Phone: Bures 351-2.

ELECTRIC Fans (2), new, 36 in., heavy duty, 400 v., 3-phase, 50 cycles, totally enclosed motors, £26 10s. each; also 5 oil-immersed Transformers, G.E.C., 230 v.- 100 v., .5 kVA, in new condition, £6 each.—Page and Miles Ltd., 60, Western Road, Brighton, B'ton 3221.

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

50 CHARGING or lighting D.C. generators, output 30 volts 50 amps 1 500 watts. Complete with fan or cooling engine. £5 each, carriage paid.

---

250 car or electricians' inspection lamps "Lucas" fitted with plug and 6 yards of flex. Price 5s. 6d. each, carriage paid.

---

100 Tecalemit grease guns. Large size. Standard nipple type. Plastic handle.—Price 7s. 6d. each, carriage paid.
Scully Bros., Longfield Lane, Ilkestone, Derbys.

BRAIDED V.I.R. CABLE, non-association size, 2 029 in 200 yd. coils. Price 30s. per coil. In excellent condition, deliveries from stock.
COX AND DANKS LTD.,
PLANT AND MACHINERY DEPARTMENT,
FAGGS ROAD, FELTHAM, MIDDX.
'Phone: Feltham 3471.

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

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

WANTED

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

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

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

REPAIRS

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

ARMATURE ROTOR AND STATOR WINDING.—We specialise in the repair and rewind of all types of electrical machines from fractional H.P. upwards. Special departments for vacuum cleaners, dryers, portable tools, etc. All work fully guaranteed.—Walter Crane, Greencoat Electrical Works, Westgate, Wakefield. Telephone 2172.

THE

ELECTRICIAN

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MIDLANDS OFFICE:
Daimler House, Paradise Street, Birmingham
Telephone: Midlands 0784—5

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

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

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Planning What?

THE statement by the Minister of Town and Country Planning in the House of Commons with respect to the proposed power station at Llanover—recorded in last week's issue of THE ELECTRICIAN—is indicative of the negative state of mind which is developing. Over the last ten years or so any proposal for the erection of a new power station has brought about an immediate barrage of opposition from quarters whose technical understanding of generation is not always as sound as it should be in the circumstances, and from persons who, in many cases, though not likely to live in the vicinity of the station, take upon themselves the responsibility of deciding, or attempting to decide the living conditions of others.

In the case of Llanover in the Usk Valley, it is maintained that the erection of a station on the site chosen by the South Wales Power Co., Ltd., would be open to serious planning objections—whatever that may mean—and the South Wales area is thus denied, for the time being at any rate, the opportunities of employment and consumption of local coal output which the building of the station would, it is quite reasonable to expect, carry in its wake.

The Minister, Mr. SILKIN, made no explanation of what was behind his decision, but since we are told that the

erection of the station would be open to "serious planning objections," it must be inferred that some other outlet for industrial enterprise in the area is to be established. The land round the proposed site is largely agricultural in nature and the building of a power station there would not, so far as we can see, interfere in any way with either the farming now being developed, nor with any extension of land development in the future, for whatever purpose.

Short-Sighted Policy

THE power station position is such that we are critically short of generating capacity, and if the national interests are to be considered, the building of new stations should be expedited as much as possible. The deficiency in generating plant capacity and the necessity for new stations, are facts which must be as well known to the Minister of Town and Country Planning as they are to almost everybody else, for he like the rest of us is reminded of them almost every day in the broadcast warnings of possible load shedding. In the circumstances, therefore, unless Mr. SILKIN has drawn-up for the Usk Valley a development scheme which may reasonably be expected to serve the nation better than would a modern generating station in this electrical age, his interpretation of the word "planning" is different from that of the supply industry. Successful town and country planning is dependent upon an adequate electrical service and with the present critical position in generating plant being aggravated by opposition to new station sites, Mr. SILKIN is not only adding to the difficulties, but, if he would only realise it, delaying the results of his own planning.

Nuclear Research

THE statement by Prof. M. L. OLIPHANT, on Saturday last, to the effect that in the physics laboratory at Birmingham University, the foundations were being laid for a nuclear research equipment with a 30 ft. diameter magnet and an energy potential of 1 000 000 000 V, recalls the masterly account which the same author gave with regard to nuclear physics when he delivered the Kelvin Lecture last April. Whether in the interim there has been developed anything which Prof. OLIPHANT would now add to his earlier remarks we do not know, but the progress of work at Birmingham when the new equipment is installed will be watched with considerable interest. It was pointed out in the Kelvin Lecture that hitherto, not sufficient credit had been given to those who, by providing apparatus suitable for the purpose, had made it possible for the scientist to make his discoveries. With this in mind Prof. OLIPHANT may be expected when the time is opportune to make known details of the new equipment at Birmingham, and the names of those responsible for its design. Some brief details of the plant to be used at Glasgow were given in THE ELECTRICIAN of May 24 last, and the activities there, added to those at Manchester, Birmingham and elsewhere may be expected to produce results which will add to our knowledge, if they do not altogether revolutionise our whole conception of the nuclear make-up.

Two Popular Decisions

SO much interest has been shown in the "Britain Can Make It" Exhibition, that the Council of Industrial Design has decided to keep it in being until the end of the year, and the electrical industry will benefit as a result. We say this advisedly, for we know of several instances where the visiting public have seen at the exhibition an electrical appliance new to them, and have thereafter explored all possible channels in the hope of buying one. The creation of such interest though maybe embarrassing at the present time, is, nevertheless, a good thing, for with a public appreciation of what electricity can do, those responsible for municipal housing schemes will find the ratepayer critical of their schemes and in a position to suggest how best this and that can be done. It is unfortunate that the exhibition cannot be staged in the Provinces, for there, no less than in London, the public are anxious to see what new electrical appliances have been developed, while the members of municipal housing committees in the Provinces, would, by the exhibition being sent on tour, also benefit from the opportunities made available. A decision in connection with the exhibition as popular as the extension of time is likely to be, is the arrangement just announced for the exhibition to be closed to the public every Tuesday and

Friday morning on and from November 12. The reason for this is to enable school parties to visit the exhibition on Tuesdays, and so as to reserve Friday mornings for directors, managers, and buyers of industrial and commercial establishments, and foreign visitors, who will be able to obtain admission on presentation of their signed business or similar cards.

"No Crisis in Coal"

THOUGH many power stations hold coal stocks adequate for only two weeks demand or less, the Minister of Fuel sees no reason for concern in that unless industrial organisation is seriously dislocated and hundreds of factories closed down, no crisis will have been reached. Accepting this point of view as being a fact, it can only be so while the present condition of the weather obtains, and while the demand upon coal stocks remains as it is. If, however, the weather changes and transport becomes interrupted by snow or other causes, power stations will be called upon to meet their immediate needs in coal from stocks, without being able for two or more weeks to build them up with incoming supplies. Circumstances not altogether remote from such conditions obtained during the winters of the last two years, when the quality of coal used in generating stations, poor as it then was, had not deteriorated to its present level, and there is no reason to assume that the weather this winter will be any more co-operative. The industrial load last winter was appreciably less than it will be this and the risk that power stations will, in the event of interruption of coal supplies, be unable to raise steam for any prolonged period by using their existing stocks is therefore appreciably greater.

False Sense of Security

THE degree of seriousness in the coal position as Mr. SHINWELL sees it "will depend on whether the trend of output, which is now in the upward direction, is maintained, and a great deal will depend on whether we can persuade people in this country, whoever they are, wherever engaged—either in industry or in the domestic field—that for the sake of the country in the existing circumstances, they must resort to voluntary economies in the use of fuel." Again accepting this opinion as a fact, industry is, we submit, entitled to ask of the Minister of Fuel, how in those circumstances it can reasonably be expected to meet not only the demand for capital and consumer goods in the home market, but also expand the export figures? Increased industrial output involves somewhere in the process an increased fuel consumption, and if industry is to be called upon to restrict its electricity consumption, in addition to being subjected to the anticipated load sheddings of the next few months, the dislocation of which Mr. SHINWELL sees no danger, appears to us to be sufficiently feasible for adequate precautions to be taken against it. To create by public speeches a sense of security which is dependent upon the vagaries of the weather and the voluntary economy in fuel consumption by industry and the public, is altogether too risky.

B.U.'s and the Meter Reader

WHAT appears to have been one of the minor injustices of Mr. STRACHEY's bread rationing scheme was ventilated in the Commons last week, during Question Time. Brigadier LOW referred to the "appeals that had been made through many channels in the last three months" and asked the Minister of Food why coin meter collectors were not classed, for the purposes of B.U. entitlement, in the category of manual workers. Postmen, it appeared, who carried only 35 lb. in the course of their daily duties, were allowed an extra ration, while the unfortunate meter collectors, whose burdens varied between 40 and 70 lb., were placed—in this respect at least—alongside the sedentary workers. Mr. STRACHEY, replying, said that while not necessarily accepting the hon. and gallant Member's comparison, he was prepared to consider the collective appeal of meter collectors, if supported by full information and submitted through the appropriate channels, "as laid down in paragraph 4 of B.M.W. 1." The notion of a Governmental concession to those whose occupations—even if temporarily—involve the possession of too much money is not one, we feel, likely to recommend itself to other members of the present administration.

THE BODLEIAN LIBRARY

SOME FEATURES OF THE ELECTRICAL INSTALLATION

THE Bodleian Library new building at Oxford, designed by Sir Giles Gilbert Scott and opened by the King on October 24, has an electrical installation with some interesting features. It was planned to reduce to a minimum the possibility of fire from electrical causes, and incorporates a comprehensive alarm system with alarm sounders, and audible as well as luminous means of indicating the location of an outbreak of fire in any part of the building.

PROBLEMS IMPOSED BY CONSTRUCTION

The construction of the library is of an unusual character in that the reinforced concrete bookstack floors are only 3½ in. in thickness, and the closely-spaced bookstack steel framework is buried in the thickness of the floor. These floors were cast *in situ* and were not plastered on the ceiling face or screeded on the top. The whole of the conduit work had, therefore, to be laid, positioned, and fixed on the steelwork and the floor shuttering, immediately following the erection of the latter and before the concrete was poured. A large amount of the bookstack floor steelwork consists of 2½ in. angles, thus providing a ¾ in. space only for the passage of the conduits. For this reason, the whole of the conduit work had to be carefully planned before installation. Where the conduit had to cross the 2½ in. steelwork, holes were drilled to enable the conduit to pass through.

From the fuse boards, etc., the building was wired on the multiple-way distribution system, the conductors being led to the various points without joint or tapping. The wiring for all systems was carried out in heavy gauge galvanised screwed, steel conduit, no size of less than ¾ in. being used. Rectangular galvanised boxes, with malleable cast iron galvanised covers were used for conduit runs of 1 in. and over, and galvanised iron circular boxes, with heavy patterned galvanised lids were fitted to the ¾ in. runs. No tees or elbows of any description were permitted. The conduits were all bent, *in situ*.

The consulting engineers, Messrs. Dolby and Williamson, specified that all metal was to be securely and safely connected together by means of screw connections of low electrical resistance, so that the whole of the protective metal employed was electrically and mechanically continuous throughout, and connected in a dependable manner to earth. Among many demands, this requirement insisted upon all switch, plug, ceiling boxes, junction boxes and fuseboards, etc., having the conduits screwed into them, and for this purpose, the various accessories specified to have screwed spout conduit entries. The conduits had to run out on the " looping-in " system, and to be of such a size as to render it unnecessary to instal boxes in positions other than at the actual outlet points. The use of " clamp type " conduit joints consisting of a bush and back nut or socket was prohibited. All these requirements were met by the use of special screwed outlet multiple-way boxes designed by Mr. C. King, who was then chief electrical engineer and manager of the electrical department of the contractors, G. N. Haden and Sons, Ltd. Another feature of this conduit box was the means it provided for the elimination of floor traps, and the facilities it gave for the conduits to be cast *in situ* without disturbing or altering the floor reinforcing bars.

The unit employed for the lighting of the bookstacks was also designed by Mr. King in conjunction with the architect. It consists of a glass shade with its top tight to the ceiling, with opal end panels to prevent the lamp being seen when viewing down the aisles between the bookstacks, and light frosted panels on either side to enable the maximum amount of light to be distributed over the faces of the bookshelves from floor to ceiling. The units are spaced at 6 ft. centres and incorporate 60 W lamps. Various systems of direct and indirect lighting are installed, outstanding among which is that of the catalogue room general space, which is illuminated by means of lay lights in the ceiling.

HEATING ARRANGEMENTS

For the heating system, two 1 200 kW thermostatically-controlled water heaters are provided, fed from an 11 000 V 3-phase 50 cycle supply. The switching of the h.t. supply is performed by a spring-operated motor driven oil circuit-breaker. Primary and standby circulating pumps for the heating system are connected to the 400 V 3-phase mains.

Apart from the electrode boilers, the total installed load of the day and night services was calculated to be of the order of 840 kW, with a maximum demand of the order of 400 kW. The installed load of the day services was calculated to be of the order of 690 kW, made up of 380 kW for lighting, 259 kW for power and heating and 56 kW for motive power.

ELECTRICITY AND HOUSING

DISCUSSION AT SMOKE ABATEMENT CONFERENCE

THE annual conference of the National Smoke Abatement Society took place at Brighton on October 24, 25 and 26. On the first day, smoke prevention in new houses was discussed and the results of a questionnaire, designed to secure information on what is being done to implement the recommendations contained in the Housing Manual, 1944, in the housing programme now commencing, were presented to the conference.

NORTHERN PRACTICE

The replies to the questionnaire showed that in Scotland the larger local authorities were providing electric or gas points in all rooms where they were likely to be required. In a small number of instances, district heating had been under consideration, including a scheme for several hundred houses at Craigmillar, Edinburgh. A scheme for over 500 houses at the Priesthill housing estate, Glasgow had been approved by the City Council. In Northumberland and Durham, of ten councils who replied three had provided in new housing schemes electricity only, three had given a choice of gas and electricity, and four had provided both gas and electricity. Nine authorities were making provision for insulation of walls, roofs and hot water systems and one authority was making no such provision. As to district heating all councils replied that consideration had been given to the question, but none had as yet installed it.

Inquiries in the North-West area indicated that practically all the authorities were facilitating the use of gas and electricity by the provision of gas connections and electric points in all rooms where they were likely to be required for cookers, wash-boilers, fires and power. A large number of local authorities had decided to instal appliances.

Sixty-two local authorities had either not considered district heating or had not arrived at a decision; 18 had given the matter consideration, but were not taking any further action, and in only three instances were schemes proposed. Central or block heating of flats was intended in five instances only.

In the West Riding of Yorkshire, 25 authorities replied and were in agreement with the recommendations regarding the use of gas and electricity. Only two were considering district heating.

In Sheffield, electric points were being provided in living rooms and in all bedrooms for radiators. In Rotherham, gas connections and electric points were to be provided in all houses now being erected by the Council.

Sixty-four replies from authorities in the West Midlands showed that 66 per cent. were providing both gas and electricity supplies and 27 per cent. electricity without gas. Three per cent. were providing all-electric space heating. Fifty-six per cent. were using cavity walls. District heating had not been considered by 81 per cent.; of the remaining 19 per cent. who had, only two local authorities had decided to proceed with schemes, while one planned to do so later.

All the replies from twelve local authorities in the East Midlands indicated that provision was being made for electric points or gas connections in all rooms where any were likely to be required. Facilities for cooking, and the space heating of bedrooms would be by gas or electricity. In one case, immersion heater points were being provided to the hot water supply, and in another electric fires were being fixed in bedrooms. One authority referred to the saving which resulted from the provision of electric fires and the consequent omission of flues to carry off fumes. Generally, district heating or block heating for houses had not been adopted.

IN THE LONDON AREA

In Greater London, 48 out of 96 local authorities completed the questionnaire. The replies showed that 43 were providing for both gas and electricity; four for electricity only; and one was providing central heating using oil-fuelled boilers with automatic control. Thirty local authorities had not considered district heating, none had adopted it for various reasons, but two would consider it in future schemes.

Eighty replies from other areas indicated that five out of every seven authorities appeared to be making adequate provision for the use of gas and electricity, largely providing for a choice. One mentioned the convection heating of bedrooms by electricity, and four the provision of electric immersion heaters. About one quarter of the local authorities replying appeared to have given some consideration to district heating. In some cases the matter had not yet been decided; in others it had been turned down for various reasons. About half were building flats, and of those a dozen were considering, or had decided upon, the incorporation of some form of central heating, or central hot water supply.

PLASTICS IN ELECTRICAL INDUSTRY

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

THE plastics industry is at once surprisingly old and surprisingly young. Because plastics have come to be identified in the popular imagination with the ultra-modern, it is something of a shock to recall that celluloid dates from 1865 and completely synthetic plastics from 1907. On the other hand, some of the recent additions to the plastics family are new enough to be little more than names to many actually in the plastics industry.

A great part of the industry as we know it to-day dates from 1907, in which year the first heat-hardening synthetic resin was produced by Dr. Leo H. Baekeland, a Belgian chemist working in the U.S.A. This discovery was the beginning of phenolic plastics, better known to the public and engineer alike as Bakelite materials.

This article and the two succeeding contributions in the series deal with the production and applications of Bakelite plastics. The methods of manufacture of phenolic plastics adopted at the Tyseley works of Bakelite, Ltd., are described, together with some of the test methods in current use, and applications of the materials in the electrical industry.

As well as being the oldest of the modern plastics, phenolics are by far the largest individual branch of the industry and are more widely used by the electrical engineer than any other type of plastics. The electrical industry was one of the first customers for phenolics and the demands for new and better insulating materials did much to inspire the original development and subsequent progress. One of the pioneer workers in the phenolics field in this country was Sir James Swinburne, F.R.S., a past-president of the I.E.E. and the present chairman of Bakelite, Ltd. His patent on the phenol-formaldehyde reaction which yields phenolic plastics, was anticipated by Baekeland's by only one day.

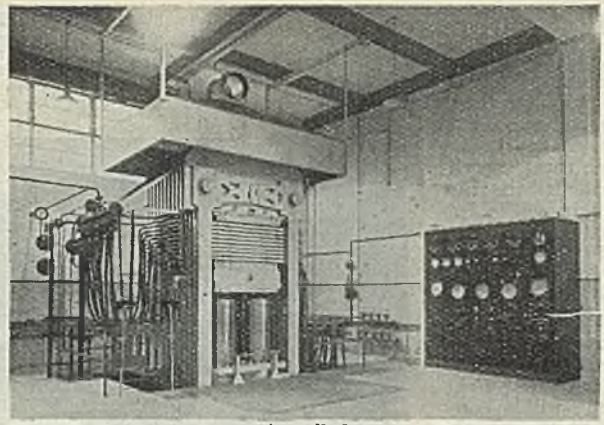
Production of Bakelite plastics of the phenolic type is largely carried on in the company's works at Tyseley, Birmingham. This factory occupies some 30 acres and produces moulding materials, laminated sheet, rod and tube, resins for insulating varnishes and cements for electric lamps, etc. The company does not itself undertake moulding, but supplies moulding powders—more than one thousand formulæ exist—to the trade moulder to convert into the finished products familiar to the electrical industry in the form of the G.P.O. telephone, switches and meter housings and a host of major and minor accessories for electrical equipment of all types.

Bakelite laminated is seen in many forms in the electrical industry, ranging from large switch panels to insulating spacers in small switches. The existing widespread applications of these materials in electrical engineering and recent interesting developments are discussed later in this series.

At Tyseley works basic chemicals—principally phenol, cresol and formaldehyde—are converted into a synthetic resin having remarkable properties. In appearance and many of its qualities, it is similar to natural resin but differs from natural resin in that it can be caused to become heat-hardening, or thermosetting. Under the continuous application of heat, the Bakelite resin first softens and then becomes hard. This hardening produced by heat is permanent. The material cannot again be softened by further heating, nor can it be dissolved in solvents. A chemical change has taken place which cannot be reversed and it is on this thermosetting property that much of the plastics moulding industry is founded. The ability to shape or mould to a required form under pressure while it is soft and to eject the finished product from the mould as a solid while still hot has saved thousands of hours of press cooling time while the moulding process has, of course, eliminated innumerable laborious machining operations.

The initial resin is not used alone for moulding purposes. Its mechanical strength is greatly improved by the addition of a "filler." In the production of Bakelite moulding material, therefore, the resin is first ground to a powder and mixed with suitable fillers. These may be wood flour, flaked mica, asbestos, fabric, etc., depending upon the properties required in the finished moulding. At this stage of the process many other chemicals—lubricants to improve release from the mould, dyes, pigments and plasticisers—are added and the whole mix is fed on to hot C.I. rolls. This operation has the effect of

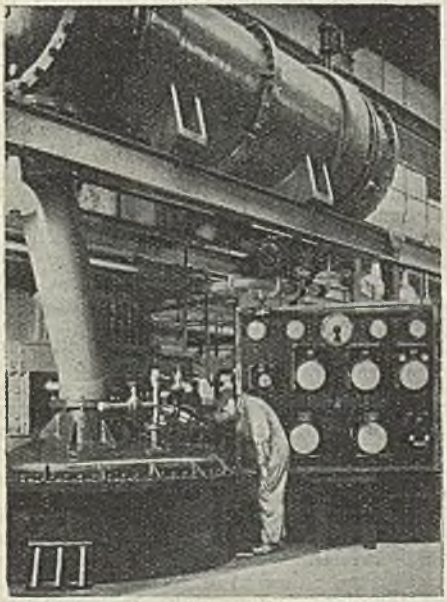
kneading and masticating the mix, ensuring complete impregnation of the other constituents by the resin and —very important—advancing the material towards that critical infusible state. The material leaves the rolls as a rubbery-looking sheet, becomes a brittle solid on cooling and is then again crushed, sifted and finally automatically fed over magnetic separators into drums ready for despatch.

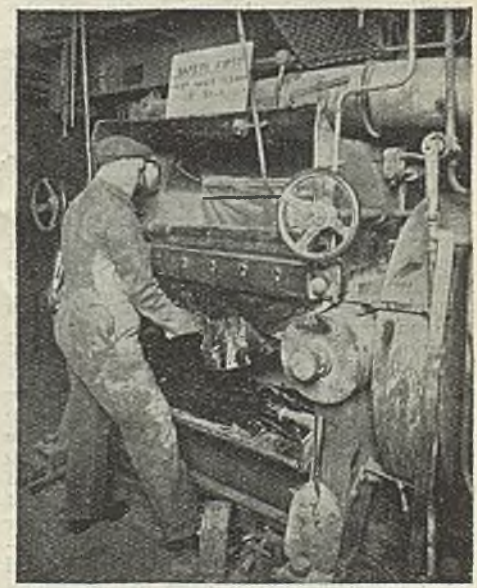


One of the latest presses installed at the Tyseley Works of Bakelite, Ltd., for the production of laminated material

The moulder has made remarkable technical progress in recent years and few jobs would now be rejected as too difficult to mould. Moulding to precision engineering limits is now practicable although this is a far more difficult task than precision in most other branches of production. It requires the closest collaboration between the moulder and the moulding material manufacturer. Any moulding for example, shrinks on cooling and allowance must be made for this fact in the making of the mould. Precision is therefore first required in the fabrication of the mould, the dimensions of which will be increased by the few thousandths of an inch representing the calculated shrinkage in the moulding material used on the known dimensions of the finished component.

It will readily be seen that precision of this nature allows the moulding material manufacturer extraordinarily little latitude for variation in his product. The material must be supplied for any particular job so that batch after batch will conform to the





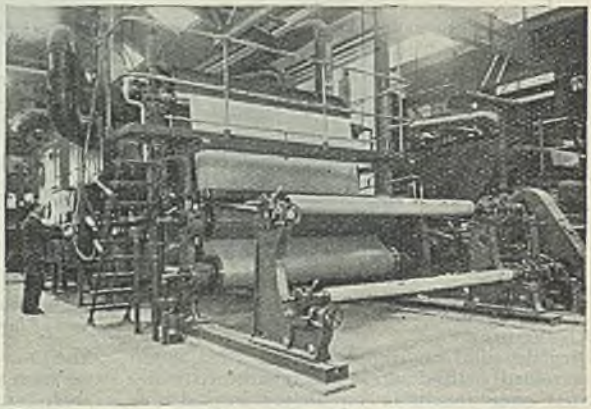
Left: The upper portion of one of the stills used for producing Bakelite resin. To ensure standardisation of product, the process is now largely automatic. Right: One of the stages in the preparation of Bakelite moulding powder where powdered resinoid, filler, pigments, plastics, etc., are kneaded together on the rolls shown

shrinkage figures originally agreed upon. This is merely one aspect of the problems confronting the plastics manufacturer. In a repetition process such as moulding, consistency of the moulding material is of paramount importance. This in its turn has led to the introduction of the most searching series of tests by the raw material manufacturers to follow their product through every stage of manufacture. Testing is thus fundamental to plastics production and in addition plastics present many problems from the testing point of view which are peculiar to themselves. The next article in this series will be concerned with a review of the various test methods in use by Bakelite, Ltd.

Technical factors which have assisted attainment of the degree of precision that can now be claimed by the moulder are high frequency pre-heating and transfer moulding. High frequency pre-heating is simply taking advantage of the hysteresis effect by placing the moulding material between two electrodes in the output circuit of a radio frequency generator. The principal advantages of high frequency preheating are that uniform heating of the moulding material is obtained, together with a far more rapid rate of production and the ability to mould thick sections which are fully cured throughout. With very thick mouldings where pre-heating is not adopted there is the danger of "baking the cake" hard on the outside while leaving the inside effectively raw.

In transfer moulding the moulding powder is fluxed by heating in a chamber preceding the mould proper and is forced under pressure into the mould while in the fluxed state. This development is of importance in many electrical applications which frequently require connecting wires, terminals, contacts or various other metal inserts to be moulded as an integral part of the component. Inserts of this type have to be set up in the mould before the moulding operation and clearly the more viscous the flow of the moulding material the greater is the likelihood of inadvertent movement or distortion of the inserts. Further, since the moulding material enters the mould in a semi-fluid state it fills all parts of the mould and actually acts as a support to the inserts as the final moulding pressure is applied. With transfer moulding delicate inserts become practicable which could never have been undertaken with the earlier method of straight compression moulding.

The principles of production of Bakelite laminated are simple. The initial resin, dissolved in a suitable spirit, is used to impregnate rolls of paper or fabric which are dried, cut up into standard size sheets and subsequently moulded into solid boards under heat and pressure.



Continuous lengths of paper fabric are fed through this impregnating machine in the production of laminated material

Although the principles used in the production of Bakelite laminated are simple, their application to its mass-production to the limits and standards of quality required has led to the introduction of elaborate equipment. The impregnating and drying process is continuous and carried out on large machines some 70 or 80 ft. in length. The rolls of paper are fed in at one end, passing through a resin bath, thence between rollers, the spacing of which controls the amount of resin left on the paper, next through a drying oven, finally to be rereeled at the far end of the machine. Problems encountered here include the adjustment of the rate of feed so that the tensile stress on the paper does not reach its breaking strength when wet, adjustment of temperature in relation to feed through the drying oven to ensure drying so that the correct degree of flow remains in the resin to give satisfactory moulding. Here again, the laboratory assists with tests on the impregnated paper to ensure that the correct limits are being observed.

In the works of Bakelite, Ltd., the rolls of impregnated paper are cut to size on automatic machines. The numbers of sheets required to make standard boards of the desired dimensions are calculated by weight. These stacks of paper or fabric sheets are then placed between polished steel plates before insertion in the press. The modern presses are all steam-heated

and are capable of a maximum pressure of 5 000 tons. Loading and unloading of the presses is achieved by means of an automatic lift and with the latest types of press at Tyseley the whole pressing operation is carried out on a pre-determined time cycle with largely automatic control throughout.

Fabrication and Tube Manufacture.—One section of the works is devoted to the production of laminated rods and tubes of circular and rectangular section. The method of manufacture in this case is basically similar to sheet production and comprises the winding of impregnated paper or fabric on to a mandrel using specially designed machines. When the required diameter or thickness has been built up, the mandrel—in the case of solid rods—is withdrawn and the embryo rod transferred to a moulding press where under heat and great pressure it is formed into a homogeneous material of approximately the right dimensions with a flash on two sides which is subsequently removed by grinding. For tubes and hollow rectangular sections the mandrel is left in position during the pressing process.

For round rods and tubes, the flash is first removed by rough grinding and then the section is reduced to the correct limits on centreless grinders. The rectangular sections are ground on surface or strip grinders to the required limits and both types are subsequently treated with Bakelite varnish and stoved.

For many of the applications in the electrical industry rods and tubes in the state they have now reached are ready for despatch, but in many other applications they require further fabrication such as cutting to length or reducing to channel sections which is done in the fabrication shop. This laminated material can readily be machined by normal metal or woodworking techniques and the fabrication of strips, sections, cutting of tubes, etc., is carried out on high speed circular saws or grinding wheels, depending upon the nature of the job.

Electrical Plant and Equipment.—The greater part of the control system used in the Tyseley factory of Bakelite, Ltd., is electrically operated and stirrers, conveyors, rolls, hoists, lifts, machining plant, etc., are all electrically driven. From the electrical engineer's viewpoint there are few applications for electrical power where electrical methods are not already in use. The biggest exception to this statement is the heating of stills, presses and rolls which jointly represent a great potential load but which are all steam heated. Electrical heating has in fact been tried for some of these processes but is not found so satisfactory as steam. The processes all demand uniformity of temperature and the avoidance of local hot spots, which is far more difficult to achieve electrically than by the existing method. The boiler equipment is modern and much of the control equipment is electrically operated.

Research and Development.—A proportion of the research activity of Bakelite, Ltd., is devoted to pure research which is of necessity largely chemical in nature. It is concerned with the chemistry of resins and the improvement of their properties, but the results of successes in this direction may well ultimately affect many manufacturing processes including those of the electrical industry. By changes in the resin formula, by changes in the formulation of the moulding material itself, different properties can be imparted to finished components accentuating certain desired qualities. This is most readily seen in, for example, the use of a mica filler in place of wood flour, to provide a moulding material with outstanding electrical properties. In general, however, one property cannot be emphasised except at the expense of another, which calls for nicety of judgment on the exact point where the balance is to be struck.

Other research activities include the improvement of existing materials. Development work on this type is frequently inspired by the demands of customers who have encountered some definite problem in their production which may be capable of solution by slight changes in the materials.

Yet another important feature of the development department's work is the experimental development of new processes and new applications of materials. In the department the manufacturing processes for all Bakelite materials are reproduced in miniature. It is thus possible to make new resins in a small development still, produce new laminated sheet on a development impregnator and development press and even to evolve a new manufacturing technique without interfering with the normal production schedule of the main works.

In view of the increasing demand for laminated plastic materials for building and interior decorating, interest will be aroused by the issue of B.S. No. 1323, Thermosetting, Synthetic-Resin, Bonded-Paper Sheet for use in the building industry. This specification covers sheet, made with phenolic-type resins, with urea or other aminoplastic type resins or with both; supplied for use as wall-board or for veneering onto wood or other surfaces in thicknesses from $\frac{1}{32}$ in. to $\frac{1}{2}$ in.

Electrical Personalities

MR. RONALD LESLIE BATLEY has been appointed superintendent engineer of generation in the Liverpool electric supply department.

MR. W. B. PARKINSON has been recommended by the Liverpool Electric Power and Lighting Committee for appointment as meter and test superintendent.

MR. A. W. ROBINSON, assistant mains engineer, is to be in charge of a consumers' service section, which is being formed by the Islington Electricity Committee.

MR. H. B. ROBIN ROWELL, chairman of Hawthorn Leslie and Co., Ltd., has been installed as president of the North-East Coast Institution of Engineers and Shipbuilders.

MR. LESLIE GAMAGE, vice-chairman and joint managing director of the General

MR. LESLIE GAMAGE *receiving a grand piano on behalf of the G.E.C. Social and Athletic Club*

Electric Co., Ltd., at a meeting of employees who had returned from the Forces and members of the Well-Wishers' Club in the lecture hall at Magnet House, Kingsway, on October 23, received a grand piano on behalf of the G.E.C. Social and Athletic Club, of which he is chairman. It had been bought with the balance remaining in the Well-Wishers' Fund (raised to provide parcels for employees serving with the Forces), after it had been closed in March, 1946, augmented by subscriptions from G.E.C. ex-Servicemen. The presentation was made by Mr. T. Dyke, joint secretary of the company.

MR. S. C. HARLING, acting electrical engineer, whose appointment as electrical engineer and manager of the Chester electricity department, in succession to the late Mr. S. E. Britton, has been approved by the Town Council, became deputy electrical engineer in 1941. Before going to Chester he was distribution engineer and acting deputy electrical engineer at Harrogate. Mr. Harling is 41 years of age.

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

MR. F. S. TAYLOR, commercial assistant in the Newcastle-on-Tyne Corporation transport and electricity undertaking, has been appointed to the newly-established post of deputy general manager. Mr. Taylor has been with the department for 15 years.

MR. ALFRED COOKE has been appointed by Barnoldswick District Council, as manager and engineer of the electricity undertaking. Formerly assistant to the deputy electrical engineer at Scarborough, Mr. Cooke served in the Royal Navy, rising to the rank of lieutenant-commander in the Electrical Branch, during the war.

MR. FRANK NICHOLLS, city electrical engineer at Leeds, is in the United States on Corporation business, studying new high-voltage generator station designs which might be usefully incorporated in the design for the new Leeds Skelton Grange power station.

MR. BASIL R. VICKERS, of the Manchester electricity department, has been appointed by the B.E.D.A. as their area officer in Scotland with headquarters in Glasgow. Mr. Vickers, who is 34 years of age, served throughout the war as an electrical officer in the R.N.V.R., and attained the rank of lieut. commander. From September, 1941, to October, 1943 — he was a liaison officer with the Russian Navy, and the technical adviser on mining, minesweeping and torpedo problems. Mr. Vickers, who was educated at the Grammar School and Technical School, Stockport, and the Manchester College of Technology, entered the services of Manchester Corporation electricity department in 1929. Latterly he specialised in space heating, industrial heating and large scale cooking problems, and after his return from the

MR. B. R. VICKERS

Navy, Mr. Vickers was engaged on a proposed district heating scheme for a new housing estate.

SIR ALEXANDER GIBB, F.R.S., after serving the Institution of Engineers-in-Charge as president since 1939, has relinquished the office and been succeeded by Sir Clifford C. Paterson, F.R.S., who will deliver his Presidential Address before the members at the G.E.C. research laboratories, North Wembley, today, November 1, at 2.30 p.m. The President has arranged for the members to tour the laboratories prior to the reading of the Address.

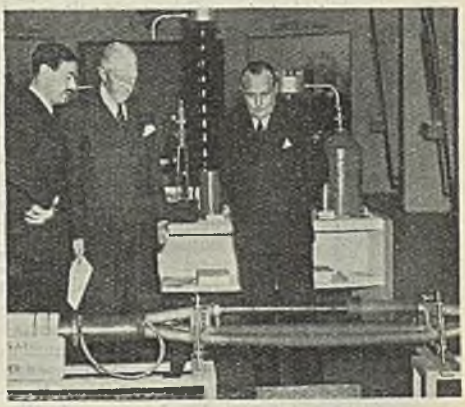
SIR ALEXANDER ROGER, chairman of British Insulated Callender's Cables, Ltd., paid a visit recently to the high voltage cable demonstration held by the company at Dorland Hall, Lower Regent Street, London, and in the photograph, reproduced on this page, he is seen discussing with Dr. L. G. Brazier (research manager) and Mr. H. J. Stone (home sales manager) the jointing of a 132 kV three-core impregnated pressure cable.

The G.E.C. Dramatic Society presented its third post-war play—"Give Me Yesterday," a comedy by Edward Percy and Reginald Denham—at Magnet House, Kingsway, London, from October 7 to 11. The story is dominated by a lovable old professor of music, Nicolai Szapary, whose ambition is to turn his protégé, Richard Dahl, and his grandson, Dick Franz, into two of the greatest pianists of the time. William Peacock gave a fine performance as the professor, while Millar Dixon and

A scene from the G.E.C. Dramatic Society's production of "Give Me Yesterday"

John Smithells did well as Dahl and Franz, respectively. Moira Threlfell showed competence in her character study of Caroline, the housekeeper, and other creditable performances were by Vivianne Richardson, Elsie Walbaucke, Donald Glanfield, Irene Charles and Julie Thomas. The play was produced by Dudley Pearmain, and the proceeds will be handed to the Electrical Industries Benevolent Association as a contribution to the funds.

MR. J. N. CRESSWELL, who, since 1935, has been head of the electrical construction department of the North-Eastern Electric Supply Co., Ltd., will be retiring this month and will live in Surrey. As a token of regard, his colleagues on the staff of the N.E.S. Company have presented



At the B. I. Callender's demonstration. DR. L. G. BRAZIER, SIR ALEXANDER ROGER *and* MR. H. J. STONE *discuss an exhibit*

him with a suitably inscribed silver cigarette case. From his own departmental staff and other friends who have been associated with him in business, he has received an engraved silver salver and a barograph which were presented at a dinner held in his honour on Friday, October 25, and attended by Lt.-Colonel E. H. E. Woodward, the general manager and a director of the company. Mr. Cresswell joined the North-Eastern Electric Supply Co., Ltd. (then known as the Newcastle-upon-Tyne Electric Supply Co., Ltd.) in 1907, and, apart from a short break from 1910 to 1912 when he was engineer-in-charge at Pease and Partners' Thorne Colliery, he has remained with the company ever since. Mr. Cresswell has served as the company's representative on a number of committees in London, including those in connection with the E.R.A. and the B.S.I. and the I.E.E. During the late war he was also a member of Electricity Commissioners' sub-committees dealing with technical matters relating to air raid precautions and the pooling of emergency electrical equipment.

Obituary

MR. STEWART R. THOMSON, founder and managing director of Stewart Thomson and Son (Liverpool), Ltd., electrical engineers, and a director of the Durable Welding Co., and Electric Machinery Co. (Manchester), Ltd., aged 64 years.

Equipment and Appliances

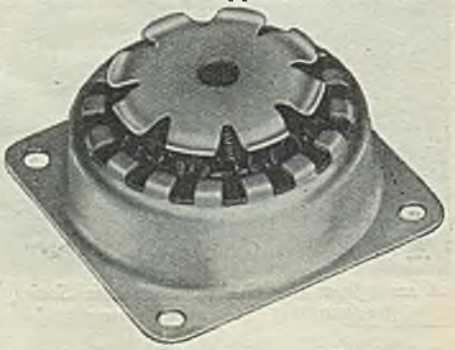
Capacious Washing Machine—Shockless Mountings

THE super-sensitive galvanometer, type 4789, made by H. Tinsley and Co., London, S.E.25, was developed with the object of obtaining the highest possible sensitivity comparable with a low coil resistance, and has a periodic time of 15-20 seconds. By a special design, the usual difficulties which are encountered with low restoring torque galvanometers, such as unwanted magnetic control, shifting zero, etc., have been overcome, it is claimed, and the instrument produced, although classed as a high-grade sensitive laboratory instrument, possesses many of the desirable features of a less sensitive meter, including ease of setting up and operation, repeatable reading and negligible zero creep. The instrument is intended particularly for work connected with iron testing and permeability and magnetic measurements, and also for capacity and high insulation testing. When the galvanometer is mounted on a firm support, the movement is steady and free from vibration. Levelling is effected by adjusting the three levelling screws, and is shown by a level mounted on the base of the instrument. Normally, a lens and mirror combination is fitted to focus at 1 metre, but other focus lenses can be supplied as spares, if required. A clamp is fitted for transport and the instrument is packed into a strong travelling case. With a resistance of 850 ohms, the sensitivity at the metre scale distance is 16 000 mm./μA or 100 mm./μV.

High-sensitivity mirror galvanometer

The Kent electric dish washing machine, supplied by John P. Quinn, 158, Princes Road, Liverpool, 8, is intended primarily for use in hospitals and institutions where considerable quantities of dishes are used. Carriers are loaded with dirty crockery and then placed in the machine. When the lid is closed and the driving motor switched on, hot water from a lower tank is sprayed on to the crockery through high velocity jets, which cause the container to rotate. After spraying, the water returns through a filter to the lower tank and a clean rinse is provided from another tank. The capacity of the machine is 36 plates, or 36 cups and saucers or the equivalent, at each filling. Working continuously, it will wash and rinse 500-600 dinner plates per hour. Approximately 45 complete washing-up operations can be carried out per kWh.

Invented primarily to meet exacting service requirements, such as the shockless mounting of radio gear inside tanks and lorries, the range of "Equiflex" mountings, made by A. Wells and Co., Ltd., of Walthamstow, are now available for general industrial use. The mountings are of two main types, oil spring or rubber suspensions. In construction, the spring type consists of a double array of springs on the surface of two opposed cones. The apex of each cone is connected to a central tubular member and the outer edges are connected to a base plate. The ends of the springs are arranged to form no gap and are positioned on steel rings which are clamped to the base plate and by retainers spaced by the control tube. By virtue of this arrangement, any wear which may occur is between two hardened surfaces. Inside the two opposed cones, a free moving cage surrounding the central tubular member clamps the load springs at resonance and maintains the amplitude of oscillation within safe limits. Under the rated load, the mountings deflect $\frac{1}{16}$ in. whether the load is applied in an axial or



Medium duty pedestal type flexible mounting

radial direction. The rubber types are like the all-metal type described, equiflexible in all directions. The rubber spring members are welded to the metal portions and form a unit complete with safety rebound washers which, in the event of overloads, comes into contact with raised portions of rubber.

INSIDE OF ELECTRICAL MACHINES

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

IN this article, Part XIV of the series,* consideration is commenced of the application of insulation. To understand the problem it is necessary to have a knowledge of the behaviour of various materials. The first part of this article is therefore devoted to information upon the subject, followed by details upon the management of varnishes.

Effect of Thickness upon Electric Strength.—A most important fact to remember is that the electric strength of

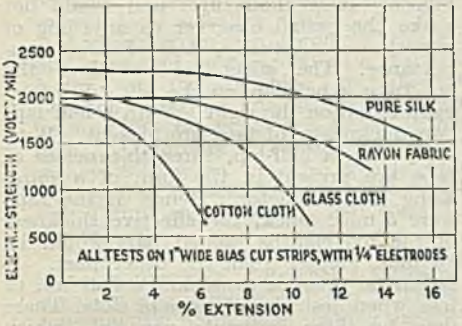


Fig. 1.—Characteristics of various silk substitutes, compared with pure silk; all materials varnished to a thickness of 4 mils in the same varnish and using the same process throughout

insulation does not increase *pro rata* with the thickness. This is shown by the curves of proof voltage given in Fig. 8 of Part XIII, in THE ELECTRICIAN of October 18. It is a feature which is common, in varying degrees, to all solid or built-up insulation. This phenomenon may be described in another way by saying that the thicker the insulation the less volts/mil. it will withstand.

Effect of Tension upon Electric Strength.—The curve in Fig. 1 shows how the electric strength of different varnished fabrics decreases with increasing tension. Since varnished cotton cloth tape is used extensively for machines insulated with Class "A" materials this factor has much to do with the problem, especially as it is mostly applied by hand and the tension cannot be controlled.

Effect of Temperature upon Electric Strength.—In the curve drawn in Fig. 2 is shown the effect of temperature in lowering the electric strength of varnished cotton tape. Other insulations display a similar characteristic.

Effect of Dirt and Moisture.—Dirt and moisture play a prominent part in deciding what creepage distances should be allowed. It is not possible to reproduce in a laboratory all the varied conditions that machines may have to meet. Consequently the creepage distances allowed between various live parts and earth are the result of long experience, not of mathematical calculation.

Flash-over Distances.—Reliable data are available for the voltage required to cause flash-over, or spark-over, for different distances between spheres or between needle points. But windings do not have smooth, rounded surfaces like spheres, neither are they a mass of needle points. Hence experience, rather than mathematical computation, must be our guide. It must be admitted, however, that the data available are sometimes of use.

Effect of Mechanical Pressure.—Mechanical pressure, such as occurs between the vee-rings of commutators, or shrunk-on sliprings and their hubs, reduces the dielectric strength considerably.

Mechanical Strength.—This factor must also be taken into account and one case may be cited. It is probable that a Micanite field coil cheek $\frac{1}{32}$ in. thick is of ample thickness electrically, but it would

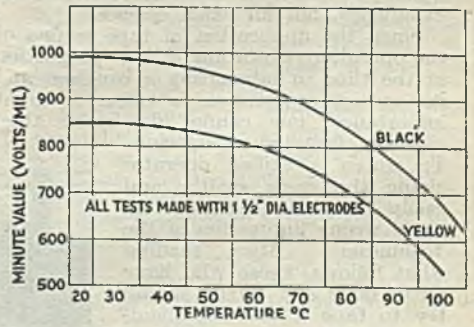


Fig. 2.—Characteristics of 7 mil black and yellow varnished cotton cloths

not stand up to normal handling during assembly. Hence it must be made at least double this thickness.

Designing Insulation.—Seven variables have been summarised, of which only two, temperature and thickness, are under anything approaching complete control. All of them tend to lower the electric strength in some ill-defined manner. It is not surprising, therefore, that the insulating of

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

machines does not follow any strict scientific law.

To make the assemblage still more unscientific, the designer must take expediency into account. This can be illustrated briefly, by reference to a 100 H.P. d.c. motor and a vacuum cleaner, both running on 230 V. In the former the Micanite vee rings will project about an inch from the copper segments, and the slot insulation a like distance from the core. In the latter the vee rings will project $\frac{1}{8}$ in. at the most, and the slot insulation $\frac{1}{16}$ in. It would not be expedient to use the small creepage distances in a large motor, although they seem to work well in a vacuum cleaner. The reason for this is that the motor may run many hours a day in a dirty atmosphere, whereas the cleaner will average only a few minutes a day in a comparatively clean atmosphere. Also, to apply the large creepages to a cleaner would make it unwieldy to use and grotesque in appearance. Furthermore, a breakdown of the motor might close down a large plant and put many people out of work, whereas the failure of a cleaner mostly affects only one person.

It may be said with truth that the designing of insulation is an art born of long experience, not an exact science.

Since the application of tape is one of the operations absorbing a large proportion of the time in fabricating a winding, and its correct application is often of great importance, one cannot do better than give it first considerateion. To watch a skilled operator doing the work swiftly and easily may convey an entirely wrong impression of the technique. After reading what follows, those who have never done any taping should try to tape a coil and maintain a uniform lap.

In Fig. 3 is shown the taping of a conductor $\frac{1}{2}$ in. by $\frac{1}{16}$ in. with $\frac{1}{2}$ in. wide tape. Such a conductor might be used in an armature coil. The inclination of the tape alters gradually as it moves from left to right. If it had been possible to spread this change over three or four times the length, the alteration in inclination would hardly have been noticeable. If it were actual taping it would not be possible to see the edge of the tape—represented by the lines—at a greater distance than about 3 ft., and very close scrutiny would be necessary to detect the alteration in the angle.

The decrease in inclination from one end to the other is shown by the angle at A in Fig. 3. It is about $3\frac{1}{4}°$, and would not strike the casual observer as anything of importance. Actually, it is of serious importance. The effect is to change the lap from a half-lap on the left to a five-eighths lap on the right. With a half lap, two thicknesses of tape are present. With more than a half-lap, three thicknesses of tape are present in the form of a spiral along the conductor. Hence, if the tape were 5 mils. thick, the effective thickness of the five-eighths lapped part would be 10 mils. greater than the other part. It is general practice to assume a half-lap, or less, when designing the size of slots. There may be three segments per slot, which would mean three conductors side by side in the slot. If each were 10 mils. over-size, the coil would be approximately $\frac{1}{32}$ in. too wide for the slot.

In order to produce approximately the same overlap on strips of different dimensions, the tape must lie at a different angle for each change in width or depth of the conductor. The difference in the angle may perhaps only be slight, but it is important to ensure that it is correct.

Fig. 3.—Alteration in lap of taping due to small change in inclination shown at A. The conductor is $\frac{1}{2}$ in. by $\frac{1}{16}$ in.; the tape is $\frac{1}{2}$ in. wide

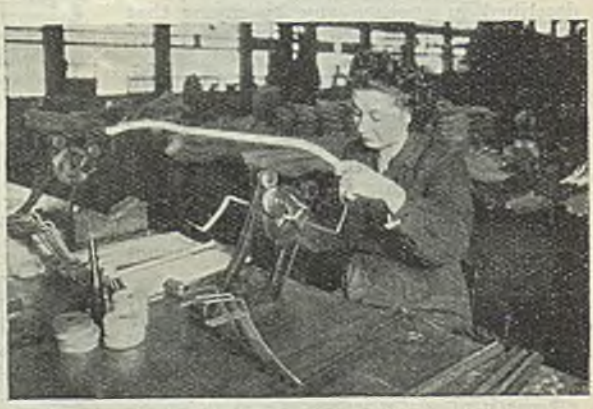


Fig. 4.—A representative machine taping armature coils (The General Electric Co., Ltd.)

Fortunately, by an extremely simple device, it is possible to guard against the tape being lapped more than one-half. The solution is to have a coloured thread woven down the centre of the tape. Fig. 4 shows an armature coil being taped with lined tape. Although the camera was at least 9 ft. from the coils, the line is clearly discernible in the original photograph on all of them. If the line is not visible, the lap exceeds one-half. Since the taping machine runs at something approaching 200 r.p.m. the usefulness of the line to the operator can readily be appreciated.

The line serves another purpose. By having a different coloured thread, say, red for 5 mil. tape, and blue for 7 mil., it is possible to see at a glance whether the correct tape is being used.

It is not known who introduced this idea, but he should be regarded as a real benefactor to the machine manufacturer. Through avoiding the stripping of coils because the taping is too thick, it must save the industry a considerable sum of money each year. It also avoids upsetting production schedules, saves the supervisory staff endless worry, and costs little or nothing.

From an electrical point of view there is no appreciable difference between a slight overlap and a half-lap. There is consequently no point in making the operation unnecessarily tedious by insisting upon a half-lap, or nearly so. It is usual to specify taping to be $\frac{3}{8}$ or $\frac{1}{2}$ lap, and to accept anything from a slight overlap to a half-lap, i.e., to the line being almost covered.

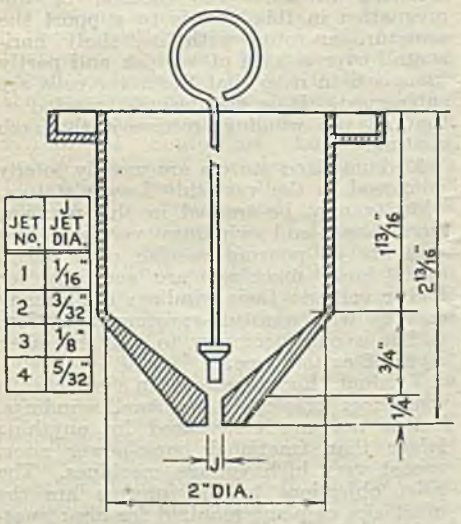


Fig. 5.—Essential dimensions of Ford cap for the determination of the viscosity of varnishes

Large coils, such as are required for stators, are invariably taped by hand, many layers being applied according to the voltage. It may be straight-cut or bias cut varnished cotton tape, or mica tape. Bias cut tape is better than straight cut as it beds better to the varying curves. Both types are obtainable with a coloured line down the centre. This is especially useful in taping coils for, say, 11 kV when

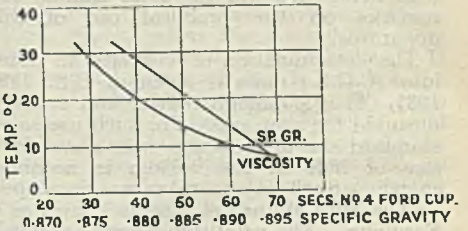


Fig. 6.—Variation in specific gravity and viscosity with temperature of an impregnating varnish

there may be as many as eight layers of tape. If the half-lap is exceeded on every layer, and the author has known such cases, the coil will be almost $\frac{1}{8}$ in. over size. Mica tape, being much more fragile than varnished cotton tape, has to be applied much more slowly and the operator is able to keep to the required overlap with little difficulty.

Management of Varnishes.—It was stressed in the second article of this series, when writing about varnished cotton cloth and tape, that the varnish was the real insulator, the fibrous material merely acting as a carrier. It is therefore essential to use good quality varnishes, and, having gone to the expense of such, they should be properly handled.

Manufacturers of varnishes invariably recommend the specific gravity, or the viscosity, at which they should be used. It may be found necessary, however, to depart a little from their figures, depending upon the work in hand. Having found the most suitable consistency, steps must be taken to maintain the varnish in that condition because when hot windings are dipped in it, solvent is driven off and the varnish thickens.

There are two methods of checking the consistency, by using a hydrometer or a viscometer cup. The use of a hydrometer is so well known that we need not comment upon it. Viscometers give greater accuracy, especially when the specific gravity of the thinner is close to that of the varnish. For example, we know of one varnish which is used at 0.885 s.g. which is thinned with a thinner (or reducer) having a gravity of 0.870. In such a case one could add quite a lot of thinner, without appreciably affecting its specific

gravity. The resulting mixture might, in consequence, have a much lower solids content than was intended. The use of a viscometer cup in such a case would be much more accurate, since the viscosity would fall rapidly as reducer is added. Thus by checking the viscosity within close limits the solids content would be kept within small limits. This subject is rather complex and cannot be fully dealt with here. We will therefore confine our remarks on the practical use of this apparatus.

The determination of viscosity in absolute (C.G.S.) units is given in B.S. 188-1937. It is a difficult matter and entirely unsuited for shop use. For such use some standard size of container with a standard size of hole in the bottom is accurate enough. Such an apparatus was developed by the Ford Motor Co., and is known as a Ford cup. The main dimensions are given in Fig. 5. The cup is filled to the top, the plunger is then removed, and the time taken to empty is checked by a stop watch. The number 4 size of hole, or jet, is the most convenient for impregnating varnishes. The viscosity is spoken of as so many seconds, No. 4 Ford cup. An average varnish will have a viscosity in the region of 60 seconds, and it is not difficult to work to an accuracy of ± two seconds.

Another cup, known as the Lucas cup, was developed by Joseph Lucas Ltd. It is similar in principle but the dimensions are different. The viscosities given by these two can be compared fairly closely by plotting a curve between the points 50 secs. Ford No. 4 = 80 secs. and Lucas 300 secs. Ford No. 4 = 475 Lucas. Both cups are well known in the trade, and it is possible to purchase varnish having a given viscosity when measured with either of them.

Effect of Temperature on Varnishes.—Temperature lowers the gravity and viscosity. For this reason it is advisable to do the thinning at a given temperature or else use a correction curve of the type shown in Fig. 6. The reducer should be kept in a tin near to the varnish so that it is at about the same temperature.

The use of correction curves and stop watches is generally beyond the knowledge of those who do the impregnating. It is therefore customary in works which have laboratories for a junior member to visit all tanks every day, or every other day, and supervise the adjustment of the varnish.

Application of Impregnating Varnishes to Armatures and Stators.—The method of application depends largely upon circumstances, and can only be covered in a sketchy manner.

One requirement, whatever the circumstances, is that all parts or windings must be free from moisture. It is also desirable that they should be impregnated as soon as they are removed from the drying oven, and while in the region of 100° C. (212° F.).

When possible, armature coils and the like should be varnished before winding into slots. This is not practicable in the case of fine wire coils. It is found in such cases, however, that if the dried-out wound parts are held so that their slots are vertical, and slowly lowered into the varnish, thorough penetration is obtained. A soaking of several minutes is given.

Windings of ordinary enamelled wire should not be impregnated. They should be given a quick dip so that the varnish will seal the outer layers of the end windings, but not enter the slots to any appreciable extent. Windings of synthetic enamelled wire may be soaked, if necessary.

Armatures and rotors of more than a few inches in diameter, and which are wound with varnished coils, are often impregnated in a manner to prevent varnish entering pockets in the winding or core. When this occurs it is not always possible to drain it out. It skins over during the subsequent baking, and when the machines are run the skin bursts and the well known phenomenon of varnish throwing occurs. The method of impregnation in this case is to support the armature or rotor, with its shaft horizontal, over a bath of varnish and partly immersed in it so that the lower coils are submerged. It is then slowly rotated so that all the windings receive a thorough coating.

Medium sized stators are usually totally immersed in the varnish. Larger stators, which cannot be treated in this manner, have their end windings varnished by spraying or pouring varnish over them. Since large machines are generally for higher voltages their windings are already covered with moisture-resisting insulation, and it is only necessary to seal the outer layer of cotton tape.

Vacuum impregnation in varnish is sometimes employed for small windings, but is not much favoured for anything larger than fractional horse-power sizes, except very high voltage machines. The chief objections to this process are the great size of plant required for impregnating large numbers of parts, such as industrial motor stators and armatures, and the slowing-up of the production if the plant is not capable of accommodating peak outputs. It is known that the methods just described give quite good results for normal service.

When machines are required for duty in very damp situations they are given a

second varnish treatment. With a normal drying varnish the first coat is thoroughly baked before the second is applied. With synthetic varnishes, which require a pre-baking at about 80° C. for two hours or so, the second impregnation is applied at the end of this period. A second pre-bake is then given, followed by the requisite final bake at high temperature.

(To be continued)

E.A.W. Branch at Erith

AFTER hearing an address by Miss Caroline Haslett, director of the Electrical Association for Women, at the inaugural meeting at the Erith electricity showrooms on October 25, a large gathering of women unanimously resolved to form a branch in that borough. Ald. Mrs. F. M. Ewens, chairman of the Convening Committee, was unable to be present, and Mrs. Rex Reed, a member of the Committee, presided.

Mr. E. A. Logan, borough electrical engineer, who is leaving Erith shortly to take up the appointment of chief electrical engineer under the Government of Burma, said he thought a body such as the E.A.W. was a great asset to anyone in his position, because by personal contact the members of the local branch could acquaint him with the problems of women in the home relating to the use of electricity and domestic appliances. The Electricity Committee would allow the branch to use that hall for lectures and meetings.

Miss Haslett said that under Mr. Logan's leadership electrical progress had gone ahead by leaps and bounds in Erith, and she was sure the new branch would be very energetic and progressive. It was typical of South-East London. The E.A.W. appeared to be forming more branches in that area than in any other part of the country, and certainly more than in any other part of London. The association seemed to be making good headway. That was the ninth new branch whose forming she had attended in the last few months. South-East London was largely connected with electrical development. They had down there large cable works and great electrical engineering firms, and it might be possible to arrange visits to those works. In that connection she had received a message of good wishes from the Hon. Mrs. Leslie Gamage, a member of the Council of the E.A.W., who suggested a visit to the works of Messrs. Fraser and Chalmers. Miss Haslett wished Mr. Logan the best of luck in his new sphere of work in Burma, and then gave an outline of the development and progress of the E.A.W. in the last 21 years, making reference to its educational work and scholarship scheme. They had not only established a wonderful educational work, she said, but they were now in a position to give girls opportunities in scholarship training and travelling exhibitions, which, when she started 21 years ago, seemed impossible to achieve. It was not a bad record, but it was not the limit of what they could do. We were on the eve of great developments and women must take an increasing part in local and national affairs. She had no doubt that an extended use of electricity was going to make possible the living conditions they all desired.

Mrs. C. U. Cole, deputy chairman of the Woolwich branch, wished the new branch every success, and mentioned that it was the seventh to be formed in the South-East London area. Mrs. A. Douglas was the proposer of the motion to form the branch.

The joint hon. secretaries are Mrs. H. Barden, who was first demonstrator in the Erith electricity department and has now retired, and Miss L. Lawrence.

The North-East Coast

Gateshead Town Council has recently discussed with the North-Eastern Electric Supply Co., Ltd., the question of supplying electricity to housing estates. It has been agreed that the company should provide ducts at their own expense to be laid by the Corporation where cables have to cross roads on the understanding that these arrangments will not establish a precedent to be followed when supply conditions became normal. The Corporation will, when practicable, delay as long as possible the paving of foopaths, to give the firm an opportunity of laying their cables. Meanwhile, the company is to lay a 6 kV underground cable from the substation in Newbury Avenue to the High Teams Institution. In a scheme prepared by the North-Eastern Electric Supply Co., Ltd., for the electrification of street lighting, the firm had intended to use steel poles and the existing tram poles for carrying the wiring. The Borough Engineer, however, has suggested that concrete poles should be used, although this will add £10 000 to the cost. The Council has agreed, and has approved in principle the estimate of £94 935 for the scheme, which will now be submitted to the Ministry of Transport for approval. The work will be spread over five years.

NEW BRANCH PREMISES

OPENING ACCOMPANIED BY LIGHTING DEMONSTRATIONS

PRESENTED with a gold key at a luncheon at the Midland Hotel, Manchester, on October 22, Mr. Jules Thorn,

MR. L. M. GLANCY *presenting the gold key to* MR. JULES THORN

chairman and managing director of Thorn Electrical Industries Ltd., performed by what he called a process of remote control, the official opening of the firm's northern branch in Stevenson Square.

The new branch occupies an extensive four-storey building of 20 000 sq. ft. with departments for Atlas lighting equipment, Ferguson radio receivers, domestic appliances, stockrooms, dispatch departments, offices, etc.

Many of the firm's customers, foregathered in the fluorescent lighting showroom to hear addresses on the future of fluorescent lighting with particular reference to its domestic application, by Dr. J. W. Strange, who is in charge of the fluorescent lamp research department, and Dr. H. H. Ballin, manager of the illumination engineering section. An abstract is given opposite.

Mr. L. M. Glancy, manager of the northern branch and a director, who presided at the luncheon, presented the gold key as a gift from the directors, executives and employees to Mr. Jules Thorn, who in reply spoke of the progress made by the electric lamp industry during the war years.

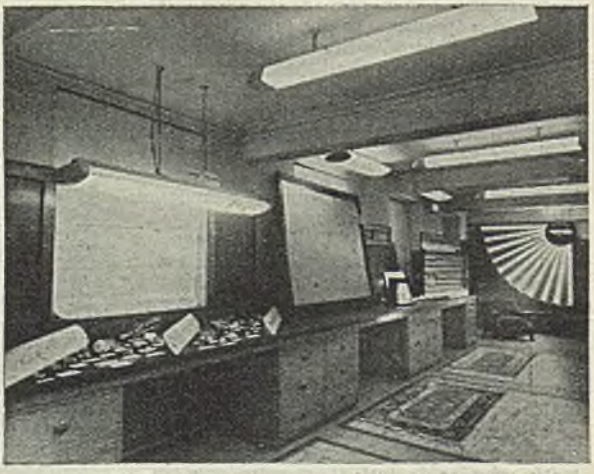
Replying to the toast of the guests proposed by Mr. A. S. Shier, sales director, Mr. R. A. S. Thwaites, chief engineer and manager, Manchester Electricity Department, said municipal engineers avoided politics like the plague, but they were interested in political economy in its widest sense. Some were rather concerned lest the spirit of enterprise should be stifled and thwarted to such an extent that the machine would run down like an unwound clock. Personally he did not think this would happen because common-sense would prevail. Manchester always had a warm feeling for any who come to the city with a spirit of adventure.

Mr. W. B. Fletcher, president of the Hardware Factors' Federation and Mr. F. Graham Maw also replied.

In co-operation with Lewis's, Ltd., a mannequin parade was staged in the Midland Hotel, to show the different effect on dress colours and fabrics of the company's fluorescent lighting and gas-filled incandescent lamps.

Under two sets of lighting six mannequins showed 34 different utility garments in fabrics ranging from rayon, cotton and wool to georgette and plastics. The daylight tube was the nearest approach, at present, to real daylight conditions and the demonstration revealed how the other light sources changed the real colours.

This was the first time there has been in Manchester, a mannequin colour fashions parade before an exclusively electrical audience.



The lighting showrooms at the Northern Branch of Thorn Electrical Industries Ltd.

FLUORESCENT LIGHTING

REVIEW OF ITS POSSIBILITIES IN THE DOMESTIC FIELD

ADDRESSING an audience in the fluorescent lighting showroom at the new northern branch in Stevenage Square, Manchester, on October 22, Dr. J. W. Strange, of Thorn Electrical Industries, Ltd., said that the purpose of his remarks was not to paint a picture of fluorescent lighting in glowing terms but rather to examine the present imperfections and inherent weaknesses, as well as the advantages and future possibilities. The imperfections were often nothing to do with the tube itself, but were concerned with the circuit and control gear which it required. One of the difficulties was that people were used to plugging lamps straight into an electricity supply, and it took time for them to appreciate the essential combination of lamp ballast and starter, which were required by the new type. Its other main disadvantage was high capital cost, though without question the fluorescent tube had many virtues, increased efficiency and total life up to two to three times that of the filament lamp.

DR. J. W. STRANGE

The emphasis placed on the control gear, was, he believed, the right way to approach the design of these lamps, because it was essentially the control gear which determined the conditions under which the tube ran. The tube itself had a negative voltage characteristic. With increasing current the voltage across the tube dropped. There was a wide range of possible tube loadings, which were usually expressed in terms of watts per sq. in. of lighted surface. This loading figure determined the wall temperature of the tube for any given set of conditions and also affected the two main factors which determined the efficiency of the tube. Passage of a discharge through mercury vapour at a fairly low temperature, resulted in the radiation of a high proportion of short-wave u.v. light, mainly the resonance line of Hg. at 2537 AU. With increase of temperature more visible light and long-wave u.v. light, particularly 3650 AU, were produced. This factor was important in the choice of fluorescent material used in the tube. Some materials responded strongly to 2537 AU and weakly to 3650 AU, examples of this were some of the silicates and tungstates. Others such as the sulphides reversed this behaviour. The other factor affected by the loading of the tube was the temperature of the fluorescent screen and this determined the actual efficiency of converting u.v. into visible light, the fluorescent process itself. Some, such as tungstates, fell off very rapidly with temperature. Others, such as the aluminates, stood up far better.

From this point of view of loading present designs varied widely. The first British design, the 5 ft. 80 W tube, had a loading of 0.30 W per sq. in. whereas the 40 W had a figure of only 0.18 W per sq. in. From the point of view of efficiency and of lumen maintenance during life, the latter was a more efficient design. It was important to bear this in mind, when comparing reported British and American figures, because it might mean a difference of up to 5 lumens per W, and a corresponding difference in lumen maintenance.

An interesting recent development in the U.S.A. was the appearance of a 40 W tube, in the size of tube usually used for the 100 W, namely 2½ in. This gave a loading of 0.13 W per sq. in. which was stated as being below the optimum for wall temperature. This was an arguable point.

In considering the future designs to be adopted, the question of lumens per W was not necessarily the only, or even the most important, point. Stress had been laid on increased efficiency, but a different story appeared if the relation of light output to cost of installation and power over a period of years was considered. On this basis, for installations running for a few hours per day only, quite a number of years must elapse before any actual saving of cost was made. This applied even in the U.S.A. where the greater standardisation and the larger market had cut the cost of control gear.

Considerations of this type strengthened the position of the 80 W type, and he thought there was little doubt that it had an assured future for commercial and industrial use. For domestic purposes another factor was introduced; namely, artistic design. Domestic lighting was still in effect tied to the end of a gas pipe, or at least to a central rose fitting with dangling flex'. A clean break was called for with close co-operation between designers and architects. His personal opinion was that for the domestic field, the

3 ft. 30 W tube in single or multiple units, had a very promising future.

Speaking of colour Dr. Strange said that the chief problem was the definition of daylight. Daylight in Manchester at 3 o'clock in November was very different from daylight on Snowden at 9 a.m. on a June morning, but both could be classified as daylight. They were most conveniently described in terms of a temperature of a black body, and 6 500°K. was the most common colour described as daylight. This led British and American manufacturers to adopt this colour for general illumination, but the general reaction to it was that it was too cold and blue. His company had decided to adopt for general use a colour defined as 4 500°K.

DR. H. H. BALLIN

In conclusion the speaker referred to the problem of quick starting. In spite of improvement in starting arrangements since the introduction of these lamps, the standard performance of switches was, he said, still erratic. Cold-cathode tubes had the advantage that they gave instantaneous starting; but from the point of view of future development of fluorescent tubes, particularly in circumstances where they were installed out of the immediate control of experienced operators, they were a doubtful proposition. This point and their long length and other features made them a specialised product, with applications in a limited field.

Dr. H. H. Ballin, manager of the illumination engineering section also spoke, exploring the advantages and disadvantages of fluorescent lighting, compared with the incandescent lamp. It was difficult to guage public reaction to fluorescent lighting in the home so far as this country was concerned, as there had not been much opportunity for the public to formulate any views but it would be of interest to take note of the results of two market researches carried out by the Sylvania Electric Co. of America. The results of their investigations were published in March and May, 1945, and showed some significant facts.

Approximately 10 per cent. of the wired homes in the United States, namely, approximately 2 600 000 had fluorescent lighting and nearly half of the householders intended to have more. Of those who had not any fluorescent lighting at present, a further 13 per cent., or 3 800 000 families intended to have fluorescent lighting, and of these, 73 per cent. intended to have it in the kitchen, 70 per cent. in the bathroom, 52 per cent. in the dining room and 44 per cent. in the bed and living rooms.

As was to be expected, the fluorescent sales were in direct relation to living standards, with the top income group accounting for 26 per cent. of the installations and sales decreasing as income decreased.

The advantage well known from industrial use of fluorescent tubes also applied to many domestic applications. In the home, people were frequently working in their own shadow, such as in the kitchen and bathroom, or in front of the dressing-table. A line source of lighting properly placed could eliminate shadow effects, and thus ease work at home. This consideration weighed in the decision as to the most suitable size of tube. Five feet tubes might be considered to be too long except, perhaps, for very long and narrow kitchens, where cooker, sink and work table were all in one line. 40 W tubes were less unwieldy but had only half the light output of 80 W tubes at more than half their cost. The 30 W three-foot tube would appear to be a handy size, the light output being equivalent to a 75 W incandescent lamp. Two or three tube units were likely to be effective both as regards light output and shape.

The elongated shape of such a fitting had no disadvantage as it was in harmony with the shape of most rooms. 20 W two foot tubes gave only slightly more light than a 40 W incandescent lamp and three at least would be required for a working kitchen and four or more for living rooms. (See Post-War Building Studies No. 12, p. 48 following.) To some extent a 2 ft. tube lost the advantage of a long line source.

A large proportion of incandescent lamps installed in the home were without shades, which gave rise to discomforting glare. The fluorescent tube itself was less glaring, the 80 W and 30 W tubes being 4.5 C's per sq. in. A 40 W fluorescent tube had only 3.5 C's per sq. in. against 4 000 C's per sq. in. for a clear 200 W lamp, and 130 C's per sq. in. of a 200 W pearl lamp.

This meant that a bare fluorescent tube was less objectionable to the eye and indeed it had been thought that there was no need for lighting fittings at all. In industrial installations, it had, however, been found that the impact on the eye of a large number of light sources even of low brightness, was disturbing and shielded lighting was being applied to an increasing extent.

In the domestic field where the number of tubes was restricted this consideration

was not of such importance and the main argument against bare tubes would be from an æsthetic angle.

One of the reasons why many people in this country might be prejudiced against fluorescent lighting for the home was that most fittings on the market were obviously industrial in design. Attempts were now being made to make the industrial fitting even more attractive.

Against the possibilities of fluorescent lighting there must be put a number of factors which might militate against the early wide adoption of this form of illuminant.

Dr. Strange had shown that for the running of the tube, control gear was necessary and a potential cause of trouble and impossible for the layman to instal and maintain. New designs of ballast would be flat and they would in most cases be contained inside the fitting except for architectural application, when space must be provided as part of the architectural design.

The present hot-cathode fluorescent tube required starter switches and the lighting up was delayed by up to 10 secs. after switching on. This was an inconvenience in the home where lights were frequently switched on and off and he felt that fluorescent lighting would not become really popular until this disadvantage was overcome.

One of the disadvantages of fluorescent lighting was the high cost of initial installation, due to the need for ballast gear and the fact that the manufacture of tubes was necessarily more expensive than that of gas-filled lamps. Prices might come down when the stage of really large-scale production was reached, but even in America the relation between the cost of fluorescent and incandescent installations was not substantially different from that in this country. In industrial installations, with long hours of use, the saving in current due to high efficiency of fluorescent tubes, made up for the high initial cost, but this advantage disappeared with lower wattages and only occasional use. He did not think that a case for fluorescent lighting could be made on economical grounds for normal domestic applications.

If the above investigation was correct the advantages of fluorescent lighting were in the possibility of raising the standard of lighting and adding to the comforts of living and ease of working. For these reasons it was likely to enter the home through the kitchen, which was the domestic workshop and might be restricted to the kitchen in the lower rent house and flats for some years to come. On the other hand, the possibilities might make this light source increasingly popular in the better type of homes and should find widespread application.

E.D.A. North-West Area Conference

INTRODUCTION of the dual-heat principle has brought about the lowest possible consumption of current for electric water-heating, said Mr. J. I. Bernard, chief technical officer of the E.D.A., on Tuesday, when speaking at the conference of the association's North-West Area at Preston, on the subject of " Electricity in New Houses."

Mr. Bernard also drew attention to the wide variety of electric fires, both portable and for wall-mounting, which was now available, and to the fact that the need for a wringer was avoided in the latest idea in home laundry equipment—the tub was run at high speed to remove most of the water by centrifugal force. Other items referred to in respect of new housing were that post-war electric cookers had been improved by incorporating quicker oven-heating (thermostatically-controlled), facilities for simmering, and increased grilling and warming space. Illumination of corners and ridges had made cleaning easier, while standard sizes had assisted the architect to utilise kitchen space to the full.

Referring to the wiring of new houses, Mr. Bernard said that the problem of providing cheaply an adequate number of plug points to ensure the convenient and safe use of electricity—which must be expected to increase very considerably during the life of houses now being built, —had been largely solved by the introduction of an all-purpose plug.

Mr. Bernard detailed the different types of permanent prefabricated houses which had been approved, and urged that local housing authorities should insist on adequate electric wiring and equipment in all new houses.

At the morning session Mr. R. H. Harral spoke of the work done to bring about the electrification of cotton mills and factories by the E.D.A. Textile Sub-Committee, of which he is chairman.

British National Electrics, Ltd., have formed a recreation and welfare club at Wishaw, with Mr. Thomson, production manager as vice-president and Mr. M. Bradley, works manager, as hon. vice-president. Some 400 employees have co-operated with the management.

GOODWILL AND ILLWILL

DANGERS OF THE PRESENT GOVERNMENT POLICY

IN most business balance sheets an entry will be found on the asset side called Goodwill. The real value is always the subject of doubt and discussion, but, observes Sir Ernest Benn in an article in "Truth," the fact that seldom can a precise value be placed upon the goodwill of a business serves to differentiate goodwill from every other type of asset and to emphasise its importance.

Goodwill, continues Sir Ernest, may be defined as the prospect of continuity, it consists of the expectation that the business of the past and present will continue into the future, it is the measure of the satisfaction that may be expected to bring the customers back for more.

The preservation of his goodwill is then the overriding anxiety with every good business man, who always thinks less of the profit and benefit of the orders in hand than of the continuing profit to be expected if those orders are filled in such a way as to give the maximum of satisfaction to the customer. It is far better to have a small profit on a constantly recurring transaction than a larger profit on business which must always be sought afresh. A firm with a well-established goodwill can be reasonably sure that next week, next month and next year there will be a steady flow of repeat orders from old customers. Goodwill is thus an assurance to capital, labour and consumer of the security of continuity.

But to-day some thousands of millions of trade is done by the Government, and not a pennyworth of goodwill attaches to a single sovereign's worth of it. On the contrary, most of it produces a great deal of ill-will in the minds of all the parties concerned.

BULK PURCHASING

Bulk purchasing, like the black-out, was imposed upon us by Hitler, but while we have been able to shake off the horrors of the latter, the blacking or blotting out of the natural commercial structure by bulk official sale and purchase has been continued, and indeed intensified. Expressed in another way, it is the melancholy fact that the willing buyer and the willing seller, in the sense in which those terms were previously used, are now almost non-existent; nobody, whether in trade or in any other way, deals willingly with any government, for government in its nature is force. Although many a good worker is doing his best in view of the admitted difficulties of the times, it is the case that thousands of millions worth of trade is now performed under the handicap explained by the proverb—"the horse thinks one thing and he that rides him another." There is not a sovereign's worth of all this government business to which the people who are forced to do it, do not attach the hope that it will never again be done this way.

Bulk purchases by governments abolish the willing buyer and the willing seller, destroy the goodwill of good trade and offer no prospect of the security of continuity, if only for the reason that before the next order is due one or other of the contracting governments is almost certain to have gone out of office.

When one government buys from another government, force is applied at both ends of the transaction; the seller government enforces its own terms upon its own producer and the buyer government imposes its own terms upon its own consumers.

SYNTHETIC TRANSACTIONS

All the elements of prosperity and progress are absent from these synthetic transactions. Price is a political calculation having little, if anything, to do with reality.

Quality has ceased to be of the importance once attaching to it, and here is perhaps the most serious count in the indictment of government trading. Nothing is a good as it was.

Instead of Freedom from Fear as promised by the Atlantic Charter, deep-rooted fear is now the prevailing sentiment in the breasts of all those on whom the economic well-being of mankind has hitherto depended. And that fear is best defined in the language of commerce as the absence of goodwill. No single one of these government transactions, whether good or bad, carries with it any assurance of continuity or repetition, and continuity and repetition are the very life of trade.

Goodwill is a thing of the past and we only manage to live from hand to mouth because honest workers, buyers, sellers, consumers, everywhere, are struggling to mitigate the ill-will inherent in economic illegitimacy.

Government trading, a war-time evil, cannot be closed entirely by a stroke of the pen, but to-day the aim is to establish this abuse on a permanent basis. That way, lies disaster; recovery will only occur in so far as this policy is reversed and genuine markets opened.

Radio Direction-Finding

Papers Read at the I.E.E. Symposium this Week

AT the meeting of the I.E.E. Radio Section, on October 30, a symposium of papers was delivered on the technique of radio direction-finding.

Use of Earth Mats.—Dr. R. L. Smith-Rose and Mr. W. Ross began with a paper on "The use of earth mats to reduce the polarisation error of U-type Adcock direction-finders," in which they reviewed work carried out in 1943-44.

The direction of arrival of electric waves in azimuth as observed with radio direction-finding equipment was sometimes subject to what were termed "polarization errors," due to the effects of the waves arriving at an angle to the vertical, and polarized with a component of the electric force horizontal. In using the U-type Adcock or spaced-aerial system, it had been established that such polarization errors were due to the excitation of the horizontal portion of the aerial or feeder by the horizontal electric force in the arriving wave. Any method which reduced the intensity of this force, without introducing other undesirable effects, would reduce the polarization error of the system.

It had been shown that it was not practicable to overcome this difficulty by placing a horizontal conductor in a concentric screen, because the vertical components of the secondary electric field, resulting from the charges on the screen itself, induced electromotive forces in the vertical portions of the aerial system. A more effective device, which had been used on an extensive scale in Adcock direction-finders for short wavelengths (10-200 m.) was to bury the horizontal portions of the aerial system to a depth of a few metres. Where the soil conductivity was low, however, the attenuation of the horizontally polarized component was very slight, and the error of the direction-finder could be as high as that of the unscreened U-type.

It was decided to examine experimentally the properties of some earth mats having dimensions several times those of the aerial spacing and yet small compared with the wavelength. The polarization error of a standard form of direction-finder, erected in the normal manner on highly conductive ground (3×10^8 e.s.u., or about 3×10^3 ohm-cm resistivity) at the Radio Research Station, Slough, was measured over the frequency range 3 — 10 mc/s, with the aid of a local transmitter which radiated at controllable angles of incidence and polarization. An earth mat, about 31 m. in diameter and of a square mesh between 0.3 and 1 m. was then installed at the direction finder, and the measurements were repeated for various experimental arrangements of the installation.

When the mat was raised above and insulated from the ground, the polarization error of the direction-finder was seriously increased, but when it was effectively earthed (both around its perimeter and at an intermediate radius) the error was slightly reduced. In place of the direct earth connection, a similar result was obtained by attaching radial wires to the perimeter of the mat, the length of the wires being selected to resonate at the frequency in use. By using a combination of 108 wires of 11, 15 and 25 m. lengths, arranged so that there were 36 of each length, the desired reduction in the polarization error was obtained, more or less uniformly over the whole of the 3 — 10 mc/s range.

Additional experiments were carried out where the ground was of such poor conductivity that the direct earth connection to the mat was ineffective. The results confirmed previous deductions that the attachment of radial wires made the earth mat effective. It was shown, furthermore, that the aerial feeders themselves could be laid on the ground just under the mat, or along the surface of the mat, if the feeder screen were well bonded to the mat itself.

A series of observations of bearings taken on signals from various transmitting stations showed that at ranges up to 250 km. the installation was capable of giving moderately accurate bearings at all times when ionospheric conditions did not limit the accuracy obtainable. The instrument without the earth mat was practically useless at this range. At a range of 400 km., the mat effected a great improvement and even at ranges of 800 km., it produced appreciable and significant improvements in bearing and quality. The improvement at very long distances would probably have been less marked, but it was deduced that it would still have been sensible.

Spaced-Loop H.F. Direction-Finder.—The next paper was presented by Mr. Ross alone, who dealt with "The development and study of a practical loop-spaced radio direction-finder for high frequencies." Most practical Adcock type direction-finders, employing spaced vertical aerials, had a standard-wave error of the order of 5° or more, and in order to over-

come this difficulty, another type of spaced-aerial direction-finder had been developed and employed. This was the space-loop type, which, being much more free from polarization error than the Adcock, could be used to take accurate bearings under difficult conditions, e.g., when the angle of incidence was small.

A practical instrument was then described which embodied these principles. The dimensions of the model were: Size of loops, 1 m. square; spacing between loops, 3 m. It was designed for the frequency range within which the spaced-loop direction finder could have most useful applications, namely, 3-15 mc/s. Since it gave, theoretically, the maximum intrinsic signal/noise ratio, the simplest possible aerial circuit was adopted, with the aerials connected in parallel and tuned by a parallel variable condenser. The tuned circuit so formed was connected direct to the grid and cathode of the input valve of the receiver. The parallel connection of the aerials was through a reversing switch, which served to distinguish the spaced-loop minima from the minima of the loops themselves and also provided a useful standby position for searching, since the conjunction connection of the loops gave a substantial increase in pick-up over the opposition connection.

A novel means of resolving the 180° ambiguity in the differential minima was employed in the instrument described. It was found that by connecting a resistance across the gap in the screen of one loop aerial, the direct and reciprocal nulls were displaced in opposite senses with practically no additional blurring. A subsidiary advantage of this sense device was that it served to distinguish the loop minima from the spaced-loop minima; only the latter minima could suffer any shift when the resistor was brought into circuit.

The sensitivity of the instrument was such that for an arc of silence not exceeding ± 5°, the required field strength, for a ground wave, varied from 1.5 to 4 V/m. throughout the range.

To obtain the high accuracy of which the instrument was capable, care had to be taken that the local surroundings of the aerials did not contain features capable of introducing errors of various types. In particular, attention had to be paid to the proper disposition of power or telephone cables. The most satisfactory method of avoiding trouble due to the presence of cables was to render the innermost 15 m. or so of cable of relatively high impedance, to r.f. currents by the insertion of suitable chokes at intervals. The proximity of large metal surfaces had also to be avoided.

In the Appendices, the effects of the essentially non-uniform character of the current distribution in loop aerials were considered, and it was shown that certain arrangements of spaced-loop aerials could be very inaccurate, on account of a type of polarization error thus introduced.

Site and Path Errors.—In his second paper, Mr. Ross discussed the results of a series of errors observed in short-wave direction-finding on wavelengths of 20-50 m. It was shown that the errors observed on a transmitter at a distance of several miles might vary rapidly and erratically with azimuth, wavelength and distance. In some cases, a change in bearing of 2-3° had accompanied a change in azimuth of 0.5° or a change in wavelength of only 1 per cent.

It had also been found that for two different sites, the average numerical error and the (statistical) probable error were roughly proportional to the wavelength. For one site, the probable error on a wavelength of 50 m. was 1.7° and on 30 m. 0.8°. A hypothesis was put forward to explain these results on the basis of an assumption that the errors were due to re-radiation from a large number of reflectors scattered at random over a considerable area around the direction-finder. The implications of such a theory were discussed, and it was deduced that for average sites the probable error would have a maximum value on a wavelength of about 100-150 m.

Earth Screens at V.H.F.—"Some experiments on conducting screens for a U-type spaced-aerial radio direction finder, in the frequency range 600-1 200 mc/s." was the title of the paper delivered by Dr. R. R. Pearce. The performance of these aerials, working on short wavelengths in the presence of down-coming radiation with a component of horizontal polarization, was affected by the electrical properties of the site on which they were erected. A large wire-mesh screen placed on the ground around the aerials was known, as shown in the first paper, to improve the performance, and it was desired to determine the minimum dimensions of a screen which would reduce the polarization errors to a satisfactorily small value ($\simeq$ 1°). Although this was difficult and laborious at short wavelengths (10 to 100 m.), at decimetre wavelengths, screens several wavelengths in diameter could easily be constructed and handled.

A simple rotatable U-type spaced-aerial system was accordingly built to work at wavelengths of 25-30 cm. and arranged so that screens of different sizes, both of sheet metal and with various types of mesh, could be used to determine the minimum screen-size/wavelength ratio for which the polarization errors were reduced to about 1°. This could be attained, it was found, provided that a metal sheet was not less than 4 λ in diameter. For wire-netting screens of the

same diameter, a mesh size not greater than $1/12\lambda$ was required for the same performance.

Thunderstorm Location.—The concluding paper dealt with the location of thunderstorms by radio direction-finding, and was presented by Dr. F. Adcock and Mr. C. Clarke. A lightning flash could be divided into four sections: (a) an initial pilot streamer, (b) a series of "stepped" leader strokes, (c) a main return stroke, and (d) subsequent "dart" leaders and return stroke. Owing to its high velocity and the heavy current involved, the return stroke was the main source of radiated energy, and the maximum energy per unit frequency-band radiated by the return stroke occurred at about 10 kc/s. Hence, frequencies of this order were normally used for the location of atmospherics.

The signal as received at the direction-finder usually consisted of a ground wave followed by a series of ionospheric reflections, particularly at night when ionospheric conditions were most favourable for the propagation of the sky waves. Although the initial radiation might be elliptically polarized, the ground wave rapidly became predominantly vertically polarized, owing to the low frequency involved.

Since frequencies of the order of 10 kc/s had normally to be used, the most convenient receiving-aerial system was some form of loop. Crossed-loop direction-finders on these frequencies, however, were subject to large polarization errors, the reduction of which was the main objective in the development of more accurate methods of location.

After discussing the various methods which might be used for reducing polarization errors, the paper went on to describe an improved atmospherics direction-finder which had been developed as an experimental tool for providing an accurate 24-hour thunderstorm location service. It had been constructed for use with ordinary crossed-loop aerials, but could be adapted along other lines.

A twin-channel cathode-ray direction-finder was employed, using fixed-loop aerials at right-angles. A superheterodyne receiver covered a signal frequency range of 10-30 kc/s, in three bands, with an intermediate frequency of 50 kc/s. Each aerial was connected to a separate channel, and the output of the intermediate frequency energised one pair of plates of a c.r.t. The c.r.t. had a persistent screen, and the bearings were taken by visual observations. A brilliance-modulation system was employed, in which the tube was normally blacked-out until a signal was received, whereupon the brilliance was brought above its normal level for a duration of about 200 μsecs. This made the reading of bearings easier, and prevented errors in bearing being caused by the receiver becoming overloaded.

Faraday House Dinner

THE thirty-first annual dinner of the Faraday House Old Students' Association took place at the Savoy Hotel on October 25. Under the chairmanship of Mr. F. Smith, a gathering of some 220 guests met for the first time since 1938—the jubilee dinner planned for 1939 having been prevented by the outbreak of war.

The first toast, to Faraday House, was proposed by Dr. P. Dunsheath, immediate past-President of the I.E.E., who in the course of a witty speech, explained that he had an old-fashioned regard for anything in the nature of private enterprise, of which Faraday House was a good example in a world of nationalised education. It was carrying on a tradition which could give many lessons to other forms of educational bodies in this country. He appreciated, too, the types of engineer in which Faraday House specialised; they were practical-minded and had what he called "a capacity for horse-sense."

Referring to the presence, for the first time, of lady students among the guests, Dr. Dunsheath said this showed that the monastic nature of the college was changing, and he felt sure that they would in future include as many women as possible among their students.

After saying that he believed Faraday House would be of service in the future, not only to the electrical industry of this country, but to the whole world, Dr. Dunsheath concluded with a warning that the present sellers' market would not last for many more years. The electrical industry in the future depended on the leaders being trained to-day. Faraday House was training them.

Replying to the toast, Dr. W. R. C. Coode-Adams, the Principal, recalled the last annual dinner in 1938, and said that there was one sad difference to-day; Dr. Russell was no longer with them.

The evacuation into Devon during the war remained one of the strangest experiences in his life, when everything had to be extemporised. Although they had now returned to London, they had found squatters—the Customs and Excise Department—in their new building, and

had not yet succeeded in evicting them. The number of students now enrolled was, he thought, phenomenal. They were booked up for the year and by summer should pass the 1930 peak. Accommodation and equipment were still, however, causing difficulties, but steps were being taken towards the installation of new apparatus, including new prime movers and more machine tools. The laboratories would be revised when they were able to move into their new building.

Reviewing the war record of old students, he said that 27—including one George Medal—had been decorated for war service, and 36 had, unfortunately, been placed on the Roll of Honour.

The toast to The Guests was proposed by Mr. C. P. H. Ewbank, chief engineer, Edmundson's Electricity Corporation, Ltd., who said that there was to-day a great need for technical education, and there was a dearth of skilled station operators and also, on the light current side, of technicians trained in electronics. Faraday House would play a big part in filling these gaps.

Sir Noel Ashbridge, B.B.C., replying, said that Brig.-General Wade Hayes, who was to have responded to the toast, was unavoidably absent because of a slight but painful illness, and he would, therefore, try to deal with both the light- and heavy-current sides of electrical engineering. During the war, he had seen most aspects of radio engineering and he thought that the concentration of scientists on radio work had led—although he was sure that some people would disagree with him—to too many inventions. War-time developments, which were often brilliantly successful, were made regardless of expense, and it was now the task to sort out those capable of economic working. An example of this, was provided by the countless number of ways in which radio could help in the navigation of aircraft; they were not all necessarily practicable for commercial flying. Engineers should now turn to the job of examining the work of the scientists, and should then concentrate on sorting out the useful ideas.

TOO MANY ADMINISTRATORS

After recalling the difficulties which had been encountered in arriving at a satisfactory standard for post-war television, Sir Noel turned to what he described as the excessive amount of administration which one encountered to-day. The overheads in every operation were appalling, and far too many people wanted to take office jobs instead of worrying about craftsmanship. Nowadays, two or three people were doing the administrative jobs carried out by one—or none at all—before the war. We were, unfortunately, getting away from the old ideas about the importance of the craftsman.

The final toast, to the Chairman, was proposed by Mr. G. Chelioti, a director of the Osram — G.E.C. Lamp Works. Although he was not, he said an Old Faradian himself, he always seemed to have one or more of them at his elbow to prompt him.

TRAINING FOR INDUSTRY

After reviewing his early career, Mr. Chelioti recalled that during the war Mr. Smith, had "drifted into" electronics and had taken a considerable share in the Services' electronics programme. Now, he was faced with all the difficulties of the post-war world—and the problems of management were very considerable. Factories of the kind over which the Chairman presided were, he concluded, a university extension course, and many young engineers had been inspired and guided by him.

Mr. Smith, replying, said that at the dinner planned for 1939, at which the 50th anniversary of Faraday House would have been celebrated, a presentation had been planned for the late Dr. Alexander Russell. He paid tribute to his ability and personality, which, he said, had given Faraday House a name of the highest order. Dr. Coode-Adams had, however, been ready to take over his duties, and would add more lustre to the good name of the college. After welcoming Mr. P. V. Hunter as the new treasurer, Mr. Smith spoke on behalf of the young engineers who had just been released from the Services. Many of those present would remember the situation after the last war, when men who had had their training interrupted by Service were led to believe that the electrical world was waiting for them with open arms. There were sad shocks; perhaps they had expected too much, but they were cruelly deceived and often told that there was no hope for them unless they started at the bottom.

It was hoped that this time those with power to employ would extend more sympathy and a helping hand. The men in the Services had done a grand job and had shown themselves to be capable of bearing heavy responsibilities. They represented good material which was not to be wasted

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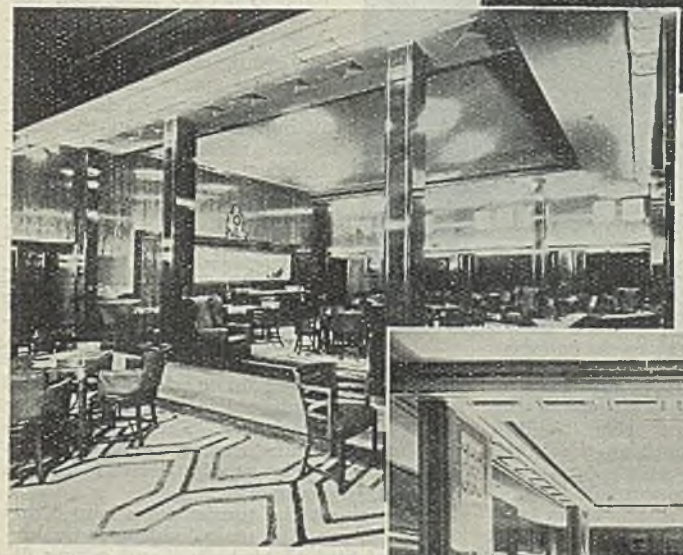
In response to a letter from the Sunderland Town Council, the L.N.E.R. has stated that when circumstances permit, consideration will be given to electrification of the railway between Sunderland and Newcastle and Sunderland and South Shields.

Decorative Lighting Afloat

We give below and on the next page a brief description, together with illustrations, of some of the decorative lighting arrangements which have been carried out in the "Queen Elizabeth." The right-hand top picture shows the exterior floodlighting, with the First-Class Smoking Room on the left. The other picture is of the Restaurant.



A FEATURE of the many public saloons on the R.M.S. "Queen Elizabeth" is the integration of the lighting scheme with the general decorative architecture, much of which has been the work of B.T-H. engineers working with Mazdalux fittings.

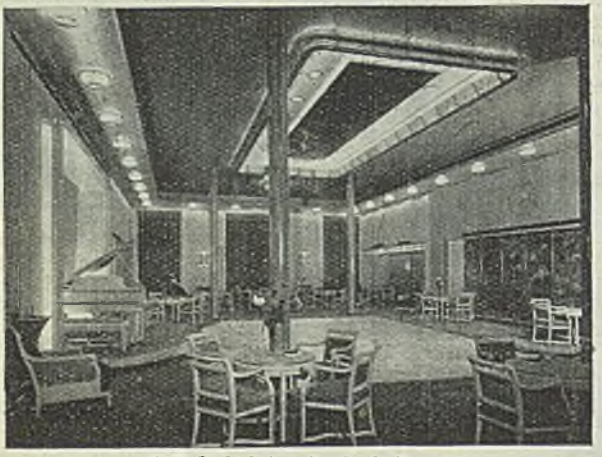
The first-class restaurant, with seating space for 720 passengers, is divided, for lighting purposes, into three areas. The centre of the room is indirectly lighted by floodlights concealed in the luminous capitals of six dumb waiters; this lighting is supplemented at the forward and aft ends by indirect floods in decorative metal and glass bowls fixed high on the bulkheads. Two luminous soffits running fore and aft light each of the low outboard areas, and the tables are lighted by special Mazdalux two lamp and single lamp bracket fittings with translucent, fluted plastic shades. The break in ceiling level between centre and outboard areas is marked by a glass semi-direct trough which is mainly decorative in function.

The portholes are constructed to give a warm sunny effect at night when the ports are closed. This is achieved by concealed lamps flooding on to an angled matt reflector behind the inner false windows. The total loading for this space is approximately 70 kW, giving an average intensity of 7 ft.-candles.

In the private dining rooms and cocktail bar, which lead off from the four corners of the restaurant, the main illumination comes from a number of recessed ceiling panels of sandblasted glass, supplemented by bracket fittings mounted on the bulkheads and designed to illuminate both the tables and the ceiling. The outboard windows are treated in the same way as those in the main restaurant.

Two large luminous beams, running fore and aft, divide the first-class smoking room ceiling into three parts. Over the centre of the room are mounted six circular fittings

projecting about six inches below the ceiling, and on either side of these are three smaller fittings, similar in design, mounted flush with the ceiling. Architectural tubular lamps in glass troughs light up the outboard areas. On the forward bulkhead,



G.E.C. lighting in the ballroom

lighted from overhead panels, is a map on which will be shown the positions of the "Queen Elizabeth" and the "Queen Mary" when they are both on the North Atlantic run.

The lighting is used to provide an impression of spaciousness in the cabin class restaurant. Recesses in the bulkheads contain a 12 in. architectural lamp in each fitting, while five large circular fittings, spaced at intervals down the centre line, illuminate the centre of the room and give a halo effect on the ceiling; four smaller circular fittings increase the general illumination. In each corner of the room six lamps are concealed in half cylinders of fluted frosted glass.

The main lighting in the cabin class lounge comes from bracket fittings on the pillars and bulkheads, each consisting of an inner diffusing glass bowl containing a 100 W lamp. A large ornate circular fitting, mounted flush with the ceiling, marks the centre of the room and is surrounded by rectangular dished fittings with louvred silver bronze corner-pieces. On the port and starboard bulkheads glass contoured maps of the northern and southern hemispheres are floodlit from luminous soffits.

The floodlighting arrangements for the exterior of the ship include three Mazdalux floodlights playing on the bridge, and four 1 000 W floodlights illuminating each of the funnels. Four additional floodlights, two on each side, can be switched on to facilitate night embarkation.

The G.E.C's. main contribution to the internal lighting of the "Queen Elizabeth" included the manufacture of fittings for the first class salon, lounge and wing staircases, the cabin class cocktail bar, the tourist class lounge, dining saloon, smoke room and their respective entrances. In addition, the company made lighting fittings for some special cabins. In the first class salon, the central lighting feature is a large silver-bronze fitting 27 ft. 6 in. long by 12 ft. wide, and employs architectural and standard lamps. The outer margin ceiling lights are of special pressed glass and employ standard lamps, as do the wall fittings and those at the back of the dais, whilst the outboard "soffit" lighting is by architectural lamps. Engraved "glamour" glass with a rich sand-blast finish is used throughout.

In the cabin class cocktail bar, fluorescent tubes of the cold-cathode type are employed. Approximately 64 ft. of tubing of the "warm-white" type is arranged in a double-line, and semi-recessed into the ceiling immediately above the bar counter. The tubes operate through two transformers, connected to a 230 V, 50 cycle supply derived from a small rotary converter.

Throughout the tourist class lounge and dining saloon, the main lighting is by laylights of flushed opal glass and ceiling fittings in silver-bronze employing standard lamps in Superlux glass bowls.

The G.E.C. manufactured the fittings to the design and specification of Mr. Grey Wornum, the architect responsible for the interior decoration of the ship and Mr. Waldo Maitland, the lighting consultant of the Cunard-White Star Line.

The annual private exhibition of British radio and communications components and accessories will be held at the new Royal Horticultural Hall, Greycoat and Elverton Streets, Westminster, S.W.1, from March 10 to 13, 1947. The display is organised by the Radio Component Manufacturers' Federation and is intended to acquaint radio manufacturers and engineers with the most recent advances in the design and development of British radio components, accessories and materials. The exhibition will be open to visitors, by invitation only, from 10 a.m. to 6 p.m. daily during the four days, and it is hoped to attract a record attendance of overseas visitors.

Industrial Information

New Zealand Imports

The Board of Trade has been notified of an amendment to the New Zealand Import Licensing Schedule for the 1947 period. Applications for licences to import indoor or switchboard type fuses must bear an indication of the voltage for which they are to be used, and whether or not they are high rupture capacity fuses.

Three Day Conference

This week 150 electrical housecraft advisers and senior saleswomen, drawn from every part of Britain, attended the three-day conference, organised jointly by the E.D.A. and the E.A.W., which opened on Wednesday, October 30, at the Connaught Rooms, Great Queen's Street, W.C.2, and will conclude to-day. The programme included an opening speech by Mr. L. Silkin, Minister of Town and Country Planning, and addresses by Miss Caroline Haslett, director, E.A.W., on "Growth and Spread of Electrical Housecraft Advisers' Work in the Industry"; Mr. V. W. Dale, general manager and secretary of the E.D.A., on "Domestic Fuel Policy"; and Mr. T. L. Freeth, of the E.L.M.A., on "Light and Interior Decoration." Other speakers dealt with the work and functions of the electrical housecraft adviser, electric kitchen planning, basic kitchen equipment, servicing, and so on.

75 Years in Electrical Industry

This year marks the seventy-fifth anniversary of the establishment of William Geipel, Ltd. Founded at Covent Garden in 1871 the firm supplied the main electrical demand of the day, viz., electric bells, batteries and indicators, later making Wheatstone bridges and other instruments. In the 'eighties, when electric lighting began to come into practice, contracts were undertaken for the complete lighting of industrial, public and other premises, among them Covent Garden Theatre and the Queen's Hall. Contracting, both for lighting and power installations, remained the chief business, until in the early part of the present century, the firm moved to Bermondsey and commenced to manufacture motor starters and control gear, later erecting its own electric cable factory at Alperton, near Wembley. In both world wars the factories were fully engaged on Government contracts, and in the recent war valuable work was done in developing and making special gear to Admiralty instructions for use at sea in connection with radar, anti-submarine and other devices. The reconversion to peace-time production is now complete.

Large Transformer in Transit

The photograph reproduced on this page shows a 45 000 kVA, 3-phase, 132/33 kV transformer for the Central Electricity Board, leaving the Stafford works of the English Electric Co., Ltd., by road for Nottingham. The complete transformer weighs 125 tons and its weight as shown on the transport vehicle is 92 tons. On its journey this load had to descend the 500 yds.-long Weston Bank near Stafford, with an average gradient of 1 in 9 and a maximum of 1 in 7. This was negotiated with one tractor at the front end of the vehicle and a second tractor coupled to the rear.

Ekco Television School

Television courses for dealers, arranged by E. K. Cole, Ltd., are now well under way with a mounting waiting list. The

A 45 000 kVA 132/33 kV transformer for the C.E.B. leaving the Stafford works of the English Electric Co., by road for Nottingham

school is part of the service organisation under E. W. Shepherd, and takes place at the service headquarters, Somerton Works, Southend-on-Sea. Each course runs for one week—Monday to Friday—with a maximum of 12 students. The latest test gear, including the Ekco television pattern generator, has been installed, and a feature is a permanent display of various types of aerials. Mr. A. W. Stephen, the instructor, has been with the company for 15 years, and has recently returned from radio and signal work in the Royal Navy.

Works Transfer

De La Rue Plastics, Ltd., announce that Scottish Plastics, Ltd., are transferring as from November 3, all manufacture of plastic mouldings to Avenue Works, Walthamstow Avenue, London, E.4. The Strathendry works are being taken over by De La Rue Stationers, Ltd.

Henley Students' Conversazione

The fourth students' conversazione since the inauguration of the Henley Education Scheme, will be held at the Gravesend Technical Institute, tomorrow, Saturday, when the presentation of prizes and awards to students will be made by Sir Montague Hughman. In addition, there will be an exhibition of students' handicrafts and demonstrations of scientific and technical apparatus.

H.F. Induction Heating of Metals

A well-produced quarto brochure of 20 pages, entitled "The ABC of High Frequency Heating of Metals," has been issued by the electronic heating department of Philips Lamps, Ltd., Aboyne Works, Aboyne Road, London, S.W.17. It is intended to explain the elementary principles and applications of the high frequency induction heating process for the guidance of work's executives and operators, as distinct from technicians.

Electrical Code for Petroleum Industry

A provisional code of electrical practice applicable to conditions in the petroleum industry has been issued by the Institute of Petroleum recently. The scope of the code embraces conditions and operations throughout the industry from the oil well to the delivery of the finished products. It is not confined to offering guidance, in regard to the use of electricity for lighting, power and instruments; it takes account also of the problems arising from accumulations of static electricity and of protective measures that may be adopted against the effects of lighting.

Export Drive Display

One of the efforts of the Metropolitan-Vickers Electrical Co., Ltd., in the national export drive has resulted in a display in the windows of the company's agents in Lisbon of a series of 6 ft.-high show-cards in two colour schemes—red and

One of the export drive display cards exhibited in the window of the agents of the Metropolitan-Vickers Electrical Co., at Lisbon

black and yellow and blue—drawing attention to various schemes carried out by the company in different parts of the world. The exhibition is in a popular square, and forms part of the drive for business in Portugal. We have received a composite photograph of the show-cards displayed, but owing to restrictions on space, are able to reproduce only one example.

Radio Set Presented to Town

The first Philco radio set produced in the new factory of Airmec, Ltd., at Ossett, Yorks, was officially presented to the borough at a ball at the Town Hall on October 18. Attended by nearly 700 people, the ball was organised jointly by Airmec, Ltd., and Philco Radio to celebrate the establishment of the factory, which was opened in March of this year. The set, an "A 535 B" all-wave table model, bearing a suitably inscribed silver plaque, was presented to the Mayor of Ossett, Alderman J. Gill, by Mr. L. D. Bennett, chairman of the RadioTel group of companies. The presentation was preceded by a contest for "Miss Airmec, Ossett, 1947." This was won by 19-years-old Miss Audrey Field Willans, employed in the coil room at the factory. After investing Miss Field Willans with a white nylon sash of office, autographed by all the important people present, Mr. L. D.

Bennett presented her with an inscribed silver cup and a silver powder compact. The contest judges were Mr. L. D. Bennett, Air Vice Marshall R. S. Aitken, a director of Radio and Television Trust, Ltd., and Mr. E. M. Benjamin, a director of Radio and Television Trust, Ltd., and joint managing director of Airmec, Ltd. The host of the evening was Mr. J. W. Tofts, manager of the Ossett factory, who was assisted by Mr. S. S. Barratt, office manager.

Russians See British Factories

During a stay of several weeks in Liverpool, over 200 Russian seamen have visited various works, including those of British Insulated Callender's Cables, Ltd., at Prescot, where electric cable has been made for use at Stalingrad.

Token Imports

The Board of Trade have already announced two lists of specified goods, which may be imported from Canada, U.S.A., Belgium and Switzerland under the token imports scheme. The range has been extended to include the goods set out below. Until the end of 1946 the individual overseas manufacturer will be able to ship the goods in this list to this country to the extent of one-half of the quota of 20 per cent. for the calendar year, i.e., 10 per cent. by value of his average annual pre-war trade in these goods with the United Kingdom. The list includes varnished cambric insulating material, electric refrigerators for domestic purposes, electric meters, electric light fixtures, electrical equipment for cycles and motor cycles.

Transporting a 130-ton Stator

On Sunday, October 27, a special train carrying an alternator stator weighing 130 tons left the Heaton works of C. A. Parsons and Co., Ltd., on the first stage of its journey to the Hams Hall "B" power station of the Birmingham electric supply department. The plant, which Messrs. Parsons are supplying to this power station consists of six turbo-alternators complete with surface condensing plant giving a total output of 321 000 kW. Each set comprises a two-cylinder tandem turbine with a single-flow low pressure cylinder driving a 50 000 kW main alternator and a 3 500 kW auxiliary alternator on one shaft line. Three complete machines have already been installed and the parts of the fourth machine are now being delivered to the site. The stator for the main alternator was the load which was being moved on Sunday. The unit was suspended between two railway wagons to keep the base of the stator as near the top of the rail as possible and so obtain additional clearance to enable the load to pass under bridges and through tunnels. The width was such that, to pass a number of fixed structures, arrangements had been made to move the stator laterally in transit. The maximum speed of the train, when the load was central had not to exceed 15 miles an hour, and when the load was 12 in. out of centre the maximum speed was brought down to 6 miles an hour. The length of the train, engine to van, was approximately 123 yds. Owing to its large dimensions the load can only be moved on a Sunday, and the train is scheduled to take six Sundays to reach its destination.

Drop Stamp Forming

As the result of recent improvements in drop stamp equipment and technique, it is now possible to produce small quantities of deep drawn shapes in aluminium and aluminium alloy sheet which formerly could be produced only by hand methods. The Aluminium Development Association have issued an information bulletin (No. 12) entitled "Forming of Aluminium and its Alloys by the Drop Stamp," which describes and illustrates the rope and air operated drop stamps and gives much information concerning the design of tools for the drop stamp and the materials available for such tools.

Radar for Marine Navigation

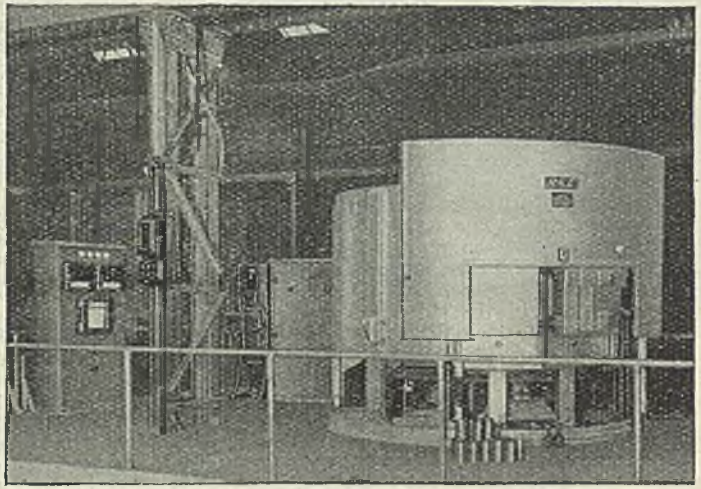
The current Engineering Bulletin, published by Siemens Brothers and Co., Ltd., Woolwich, contains a description of the radar equipment for merchant shipping

Special train carrying a 130-ton stator, leaving the Heaton Works of C. A. Parsons and Co. Ltd,. on its journey to Hams Hall "B" power station, Birmingham

now being produced by the company in association with the Metropolitan-Vickers Electrical Co., Ltd. It mentions also that at the Woolwich works a MV/SB marine radar school has been established for training navigation and radio personnel in the use and maintenance of the Metrovick radar set, and that a world-wide maintenance service has been built up by the company.

Rotary Hearth Furnace

With the recent installation of a hydraulic extrusion press for the production, among other things, of high tin content bronzes, Earle Bourne and Co., Ltd., of Birmingham, found that no other form of heating could give the close range of temperature control achieved by an electric furnace. In consequence, the General Electric Co., Ltd., installed a rotary hearth furnace rated at 175 kW, and giving an output of approximately 2 000 lb. of alloy billets per hour at a predetermined temperature of between 800° and 900° C. Each billet is extruded into tubes immediately it reaches the required temperature. The heating chamber has a cross section 1 ft. 4 in. wide by 1 ft. 6 in. high, the hearth being annular and having a mean diameter of 5 ft. 9 in. The elements are arranged in three zones, each having individual thermostatic control. An Osram photo-electric cell gives visible warning by means of a lamp when billets are ready for unloading. This "electric eye" also acts as a safety device, for once the beam is cut the motor driving the hearth is stopped. If a number of billets are ready for unloading at the same time the broken beam from the photo-cell prevents the hearth from rotating until the last billet has been removed. The hearth drive is worked through a P.I.V. gear and the furnace can thus cater for a diversity of heat treatments and types of charge.



Electrically heated rotary hearth furnace, installed at theBirmingham Works of Earle Bourne and Co., Ltd.

Testing Memorandum

The Ministry of Fuel and Power has issued a new Testing Memorandum, No. 10, dealing comprehensively with the testing and certification of all the various kinds of electrical apparatus to which the principle of intrinsic safety has been applied. It explains the scope and limitations of intrinsic safety, describes the procedure to be followed in submitting apparatus for test and the tests to which it would be subjected, and gives much other technical information on the subject generally. The memorandum is published by the Stationery Office, price 6d.

Lectures in Electrical Engineering

Details of post-advanced lectures in electrical and mechanical engineering to be delivered at the Manchester College of Technology during the 1946-47 session are given in a pamphlet published by the Regional Advisory Council for Technical and Other Forms of Further Education for Manchester and District. Particulars may be obtained from the Secretary to the Regional Advisory Council Education Offices, Deansgate, Manchester.

E.I.B.A. Ball

We are asked by the secretary of the E.I.B.A. to state that no further tickets are available for the Electrical Industries Ball, in London, on November 8.

Trade Publications Received

A pamphlet issued by the Visco Engineering Co., Ltd., Stafford Road, Croydon, describing their Viscozone generators for deodorising and revitalising polluted air, preventing taint and mould growth, sterilising water supplies, and so on.

The Sunco catalogue of electrical installation supplies, together with a schedule of price advances and alterations, issued by the Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.2.

B.E.T. JUBILEE DINNER

FIFTY YEARS' ASSOCIATION WITH SUPPLY AND TRANSPORT

A DINNER in celebration of the Jubilee year of the British Electric Traction Co., Ltd., was given by the chairman and directors of the company at the Savoy Hotel, London, on Tuesday, and each of the guests, who numbered upwards of 160, received a souvenir copy of an admirably produced book, entitled "Five Decades of B.E.T.," by Roger Fulford, telling the story of the company since its foundation in 1896 and indicating the scope of the present operations of the group of associated companies. In the absence on business overseas of the chairman, Mr. H. C. Drayton, Mr. R. J. Howley, the late chairman of the B.E.T., presided.

GIANTS OF THE PAST

Sir Robert Renwick, chairman of the County of London Electric Supply Co., Ltd., in proposing the toast of "The B.E.T." said the occasion gave them a unique opportunity to pay homage to the great men of the past, great industrialists and great men of the City who left such a great heritage to his generation. They remembered not only the great men who built up the B.E.T., but those giants of the past who gave us our industrial system, our banking system, our insurance system and our trust system—pioneers like Emile Garcke, J. B. Braithwaite, Sydney Morse, and others, whose transport system and electricity supply industry built up over 50 years, despite legislative prejudice, was to-day second to none in the world. The Government had declared their intention to nationalise road transport, electricity and gas. The business men of the past, who were sincere and knew what they wanted, did not include the words compromise and appeasement in their vocabulary. He was afraid their successors of to-day were not of the same calibre. Our industrial leaders of to-day seemed to take the path of least resistance when all that they stood for was being undermined by doctrine, theory and inexperience. The fight against the policy of nationalisation which in one short year might well take away 95 or 97 per cent. of what the B.E.T. had built up over 50 years, was one of principle, and if they believed in a principle there could be no compromise. Were they, who believed in private enterprise, prepared to sell their heritage for a mess of Civil Service pottage? Unless the leaders of all the great industries, the banks and the insurance companies got together quickly their time would surely come. Now was the time for industry to speak with the voice of experience and tell the people frankly how rapidly this country was drifting to economic chaos.

The Chairman, in reply, said the B.E.T. had never lacked fighting spirit and he thought they would find, as time went on, that, as it always had, the company would produce men who were quite capable of holding their own. The company was formed to establish public service undertakings. It came into a world taped up with Acts of Parliament and Statutory Rules and Regulations—not perhaps quite as many as to-day, but still sufficient to provide material for many a fight.

The man who was chiefly responsible for creating the company was Mr. Emile Garcke, but it was he who guided its policy for many years as managing director, and, later, as chairman. Before he founded the B.E.T. Mr. Garcke was connected with the Brush Company and he learned to appreciate earlier than most people the great changes which the use of electrical energy would make in our everyday life. He foresaw its general use as a source of light, heat and power, and that caused him in 1896 to form the British Electric Traction Company to finance companies to generate and supply electricity for use in homes and factories, for street lighting and for traction purposes.

MUNICIPAL OPPOSITION

Mr. Garcke, a man of boundless energy and vitality, was assisted in those early days by Mr. J. S. Raworth as electrical engineer of experience and vision; Mr. Stephen Sellon, a consulting civil engineer; Mr. Sydney Morse, their able solicitor for many years; and, later, by Mr. W. L. Madgen. On the financial side Mr. Geo. Herring and Mr. J. B. Braithwaite backed Mr. Garcke in finding the necessary capital. The company, usually through subsidiary companies, applied for statutory powers to generate and distribute electricity and to lay down electric tramways in many parts of the country. At that time municipal trading was beginning to be a feature of local government, and Mr. Garcke's efforts to obtain operating powers in a number of boroughs was strongly opposed. To meet that opposition he formed the Industrial Freedom League which received a lot of publicity in the Press. It was supported by "The Times" and condemned by the "Daily News."

During the first 10 or 15 years of the company's existence some 16 power supply

undertakings were established and over 400 miles of electric tramways were put into operation. Several of those electricity undertakings laid the foundations of what were now great power companies. They were the Northmet Power Co., the Shropshire, Worcestershire and Staffordshire Electric Power Co., the County of Durham Electric Power Supply Co., the County of Northampton Electric Power Supply Co., and the Leamington and Warwick Electricity Supply Co. He thought he was justified in claiming that that company was truly a pioneer in the field of electricity supply and traction in this country.

OVERSEAS VENTURES

The company also went into business overseas and became interested in its early days in the Auckland (New Zealand) tramways, which were reconstructed and electrified. The undertaking proved successful, and was sold to the Corporation in 1919. Later another large scheme was carried through when, with their partners in India, the old Bombay tramways were purchased and an agreement was entered into with the Corporation to lay down electric tramways, to build a new power station, and to supply electricity in that city. The business turned out very well, and the shares were actively bid for in Bombay. Later the registered office of that company was transferred from London to India.

The electric tramcar was a great improvement on the old horse and steam cars. It had plenty of power; it was well lighted, and warmed, and except under deep snow conditions, could be counted on to provide the road transport the public needed. A tramway was, however, very costly to lay down; the supply of electricity to the cars necessitated an underground cable system and the erection of poles along the road. But the electric tramcar was soon to be superseded by the more flexible motor omnibus, running at first on solid tyres and later on pneumatic tyres, and the directors of the B.E.T. Company had to face up to a serious decision. They decided that no more electric tramways should be constructed and that motor omnibus services should be substituted for tramway services as quickly as possible.

What would be the form of passenger transport 20 years hence? It was within the range of modern developments in the air that for express carriage journeys a helicopter 'bus might be used to transport passengers quickly to the seaside and other holiday resorts. The use of airborne transport would help to solve the question of road congestion which would soon become a major difficulty of travel. The company was interested in aviation before the war.

Mr. Howley mentioned that when war broke out in 1939, the B.E.T. interests were operating over 9 000 omnibuses, and referred to their happy association with the railway companies.

He also alluded to the fact that during its 50 years' existence the B.E.T. Company had had five chairman—Sir Charles Rivers Wilson, Mr. Emile Garcke, Mr. J. S. Austen, himself, and then Mr. H. C. Drayton.

The chairman recalled that the office of the company at 88, Kingsway, was severely damaged by enemy action during the late war.

Referring to the uncertainty regarding the intentions of the Government, Mr. Howley said they who were connected with the company were naturally disappointed that the public services which they had built up should be transferred to public ownership. Those with which they were connected had long, fine records and they considered that no form of Government controlled operation would be as efficient or as economical as they were able to provide.

The toast of "Our Guests" was proposed in humorous vein by Mr. J. S. Wills managing director of the company and acknowledged, with characteristic wit, by Sir Frederick Handley Page, who also made a spirited attack on the policy of nationalisation.

Col. Sir Joseph Nall, chairman of the British Omnibus Companies' Public Relations Committee, submitted the toast of the Chairman, who was accorded musical honours.

Mr. Howley suitably acknowledged the compliment.

Edinburgh Electrical Society

At the meeting of the Edinburgh Electrical Society on October 23, Mr. H. E. Partridge, consulting engineer, read a paper on "Heat Transmission in Steam Boilers." Mr. Partridge referred to the improvements in boiler design which had reduced the weight of a plant to one ton for each ton of steam per hour produced. Exposure of as much as possible of the boiler surface to the radiant heat from the furnace and the maintenance of as high a furnace temperature as possible were essential features. Pulverised firing was not considered to have any advantages whatever for high-efficiency boilers. The use of oxygen instead of air for promoting combustion was suggested and it was claimed that such a scheme would result in an enormous increase in steaming capacity for a given size of plant.

Trends in Meter Design

Advances in Jewelled Bearings and Magnets

SPEAKING as a manufacturer whose principal interest for nearly 40 years had been in the making of meters and instruments, Mr. L. J. Matthews reviewed the immediate post-war position of the measurements branch of the electrical industry, in his Chairman's Address before the I.E.E. Measurements Section, on October 25.

Beginning with a survey of present-day house service meters of which, he said, the d.c. meter was in a dwindling minority, Mr. Matthews said that during the war, production was reduced to something like 5 per cent. of normal, and meter manufacturers, almost without exception, were engaged in making quite different types of instruments and equipment for war purposes. A considerable amount of research and discussion continued, however, and it was evident that meter practice was entering upon a period of important change. Developments which were foreshadowed included not only questions of design, construction and standardisation, but also, a much more enlightened treatment of meters in service.

After referring to the arduous conditions in which house-service meters were often required to operate, Mr. Matthews said that the now almost universal use of moulded plastic for cases, terminal insulation and other parts was saving large sums previously spent in re-finishing corroded meters. The use of electroplating for internal parts eliminated much trouble due in the past to the flaking of paint on to the rotor.

NEW MAGNETIC ALLOYS

A major factor in the attainment of stable accuracy was the brake magnet, and the employment of modern magnetic steels—the cobalt steels and especially the aluminium-nickel-cobalt alloys first used in meters a year or two before the war—had effected a very great improvement. The new magnet alloys, however, were very difficult to machine and had to be cast to shape and finished by grinding. At the present time, there was room for a considerable improvement in both those processes.

Low-load accuracy depended more on the performance of jewelled rotor bearings than on any other factor. As a result of the findings of the research into the orientation of the sapphire cup and the best type of oil, it was now possible to rely on a period of at least seven years and perhaps longer before the error of a single-phase meter at 1/20th load increased by 2½ per cent. There was also some evidence that the precise nature and thickness of the surface layer formed in the polishing process had considerable effect on the life of the cup.

There had been a steady improvement in meter performance, and all new single-phase meters up to 50 A rating were of the long-range type for which close limits of error were specified from twice full-load down to 1/20 load; that was, over a range of loading of 40 to 1. Was there, he asked, any other piece of commercial electrical equipment for which a comparable performance was specified?

VARIETY OF REPAYMENT METERS

In the past 15 years, development had been particularly noticeable in the prepayment class of meter. There were flat rate, step rate, load rate, dual-circuit and finally two-part tariff slot meters, with many additional complications such as dual and triple coin operation, universal rate-changing mechanisms and—strange anomaly in a prepayment meter—devices which allowed the consumer to run into debt while still drawing supplies. The principal problems were mechanical, but designers had had to take care that the electrical performance was not adversely affected by the complication of mechanism and at the same time to keep pace with the rapid increase in loads which this type of meter had to carry. The type most in demand to-day was rated at 25/30 A. The design of switches to meet this condition of service had needed much attention.

The two-part tariff meter employing a small continuously running synchronous motor was among the most recent developments of this type. Its chief causes of failure were weakening of the permanent magnet rotor and excessive wear in the rotor bearings. In a recent design, the rotor was made from one of the more modern materials to withstand the demagnetising effect of the stator, and the rotor bearing had a high ratio of length to diameter, while provision was made for retaining a reserve of oil supplemented by an oil-impregnated fabric packing feeding through the sleeve. When running, the rotor floated in the field, avoiding the use of a footstep bearing.

In recent years, there had been no notable advance in polyphase meters,

which, in this country, had become standardised as 2- or 3-element meters for 3- and 4-wire circuits, respectively. The problem of the lower bearing was accentuated in the case of the polyphase meter owing to the heavier rotor, and in the light of present knowledge, the diamond cup offered the best solution. They were at present used largely in industrial installations, but was it outside the bounds of possibility, he asked, that domestic loads might increase to a level at which three-phase services would be used?

UNSATISFACTORY STANDARDS

A review dealing with electricity meters would be incomplete, Mr. Matthews continued, without a reference to the Electricity Supply (Meters) Act, 1936. Its immediate effect upon the supply undertakings had been a total expenditure on testing equipment of the order of £1 million and there was a consequential improvement in the equipping and staffing of meter departments. It seemed to him that the meter engineer had not yet shared to the extent warranted in the improved status of his department. After remarking that the benefit of the Act to the consumer had so far been slight, Mr. Matthews said that there were two practical points of interest arising from it. The first related to the statutory limits of error, which were stated to be "2½ per cent. plus and 3½ per cent. minus at any load at which the meter may be operating." No manufacturer could give a guarantee covering an unspecified range of loading. The second point was that the final testing and certification of meters ought to be carried out in the area in which the meter was to be used, and not, as was often the case, in the manufacturer's works prior to a journey of perhaps 200 or 300 miles.

Definite progress had been made towards the standardisation of meters, and it had been found possible, in the case of whole-current single-phase credit meters, to fix the maximum overall dimensions, the actual dimensions of fixing points and the disposition of terminals, thus ensuring interchangeability. These dimensions had been issued in the form of an addendum to B.S. 37 and would become mandatory in new designs on January 1, 1949. Similar consideration was being given to prepayment meters, in which the difficulties were much greater and the cost of redesigning extremely heavy. The Government's intention to nationalise the supply of electricity might result in meters being manufactured to one detailed specification.

After reviewing current proposals for rating meters, Mr. Matthews said that a suggestion which had much support was the reduction of ratings to three—10, 40 and 80 A c.m.r. Whether these were the correct sizes only the electricity supply industry could determine, but if any advantage were to be gained all users would have to agree to their adoption, to the total exclusion of other sizes.

In the second part of his address, Mr. Matthews turned to other types of instrument for measurement and control purposes. It was in this sphere, he said, that the most remarkable expansion had occurred in recent years, aided particularly by electronic devices. Radical improvements in the performance of thermionic valves associated with instruments of high sensitivity had permitted the accurate measurement of extremely small currents and voltages, one important result of which was the increasing use now being made in medical diagnosis and treatment of delicate electrical measurements. Continued progress in the design and manufacture of the cathode-ray oscillograph had led to its extended use for many purposes —for example, an equipment had been designed for the continuous testing of magnetic recording wire in which the hysteresis loop was reproduced on the screen.

Another innovation was the electric strain gauge for the measurement of the stresses in material under load, while a most important development was now taking place in the design of fully automatic control systems, or servo mechanisms. The basic principles of these instruments was the measurement of a small variation in a predetermined condition and the amplification of that variation for the release of energy to operate a correcting control, which restored the conditions to normal.

SUBSTITUTES FOR JEWELS

During the war, there was a demand for very large quantities of moving-coil ammeters, voltmeters and milliameters, mainly of 2 in. or 2½ in. sizes in moulded plastic cases, and the conditions of service to which they were subjected were often severe. Among the difficulties which had to be met in their manufacture was the extreme shortage of sapphire for instrument bearings. Various substitute materials were employed, including phosphor-bronze, nitrided steel and glass. Moulded glass became the most generally employed material and proved to be an excellent substitute on account of its ease of manufacture and low coefficient of friction when used with standard pivots and a film of suitable oil. Other obstacles to mass production had included difficulty in manufacturing large quantities of fine-gauge control springs to a specified torque, owing to non-uniformity in quality and dimensions of material and lack of silk for insulating fine wires.

Electricity Supply

South Shields.—It is expected that the Town Council will decide in the near future to increase electricity charges by at least 5 per cent. The last increase (10 per cent.) was made in 1940.

Bedford.—The Electricity Department's existing 10 per cent. increase in electricity charges, the only increase made since the outbreak of war, is to be increased by a further 5 per cent. in respect of non-industrial tariff charges. The increase will affect fourteen tariffs.

Manchester.—Because of the load development in the south of the city, the Electricity Committee has made application to the Commissioners for sanction to borrow £14 800 to cover the cost of installing a 10 000 kVA transformer, modifications to switchgear, and purchase of batteries and supervisory gear to enable the station to be remote-controlled from the central control room.

North Wales.—Regarding the lack of materials, at a meeting of the North Wales and South Cheshire Joint Electricity Authority, it was stated that only 10 per cent. of the company's normal requirements of poles were being allocated. For the schemes in hand they required 6 000 poles. Electric cable could not be delivered by manufacturers under many weeks of the order being placed. The company's immediate £450 000 programme of electrical development in the area was being held up. The only work they had been able to do amounted to £130 000, so that work involving £320 000 was lying idle.

Glasgow.—The annual statement of accounts of the City Electricity Department, for the financial year ended May 31, 1946, shows a deficit of £98 924, compared with a surplus of £62 158 in the previous year. The gross revenue for the year was £2 171 103, and the working expenditure £1 903 696, leaving a net revenue of £267 407. The total expenditure per unit sold was 0.8274d., and the total revenue 0.7913d., resulting in a deficit of 0.0361d. per unit. Units generated amounted to 665 860 600, while 81 675 977 units were imported from the grid. Units sold included 652 084 487 to private consumers and 6 334 842 for public lighting. The total connections to the system were 612 251 kW, against 592 430 kW at the end of the year ending May 31, 1945.

Cyprus.—Plans for economic development and social welfare schemes costing over £9 000 000 have been announced by the Governor. This sum will include £3 350 000 for an island-wide scheme of electricity generation and distribution. Details of the electricity project have not yet been worked out, but the plant will, it is understood, be oil burning.

Hackney.—Recording a surplus for the year of £15 281, against £30 549, the report of the Electricity Committee explains the drop as being due to the increased cost of energy purchased, an all-round increase in prices and wages and a decreasing revenue per unit, due largely to a large expansion in total units sold on Scale 5 (domestic) as compared with other scales. The gross revenue from sale of energy amounted to £531 659, an increase of 10.7 per cent., and the number of units sold increased 14.1 per cent., to 83 825 463. The gross revenue per unit on all scales was 1.522d., an increase of 0.047d. The cost of energy purchased from the C.E.B. rose from £288 915 in 1944-45, to £367 800 in the current year, an increase of 27.3 per cent. A contributory cause of the increased cost of energy was the accelerated depreciation of the generating plant, due to poor quality coal and onerous conditions of working. Total units generated during the year were 168 683 300, of which 159 157 277 was sent out. Energy exported out of the area of the undertaking included 41 819 377 units to the C.E.B. and 20 520 100 units purchased by the Stoke Newington Borough Council.

London.—Opening the "Electricity Meets the Challenge" Exhibition in London, on October 25, Mr. Geoffrey Lloyd, a former Minister of Fuel and Power, said that he admired very much the courage with which the industry was making its fight against nationalisation. "This industry," he said, "has a wonderful record of development. Why should the Government want to upset an industry which is doing such a good job for the country." The Government's policy, he felt, was the Hitlerian one of "divide and conquer," whereas the motto should be "unity is strength." Sir Robert Renwick, chairman of the Electricity Public Relations Committee, said: "We are proposing to use every single weapon we can to fight the nationalisation of our industry, and other industries. Even if we hear in the King's Speech that we are the first on the list, we shall continue fighting to the gallows and after." The exhibition, which has been organised by the supply companies to demonstrate the development of the industry under private enterprise, will tour the provinces after closing in London.

In Parliament

Some Electrical Questions Asked and Answered

Retail Equipment.—In reply to Mr. R. Adams, who asked the Minister of Works if satisfactory arrangements had now been made for retail stockists to receive supplies of electrical equipment surplus to W.B.A. requirements, Mr. Tomlinson said that present production did not permit the accumulation of stocks, and he was not aware of any need for special steps to divert additional supplies to the retail trade.

Telephones (Malaya).—Replying to Mr. W. Fletcher, the Secretary of State for the Colonies (Mr. Creech Jones) stated that all Malayan orders for telephone equipment, including switchboards, were treated as of high priority. In spite of difficulties due to shortage of labour and materials, it had already been possible to deliver more than half the orders placed, and the remainder were expected to arrive in Malaya between now and next June.

Rural Electrification. — Mr. Shinwell (Minister of Fuel and Power) said, in a reply to Col. Clarke, that an average figure for the completion date now being quoted for new applications for a supply of electricity in rural areas could only be struck after detailed returns had been obtained from 570 undertakings. He did not think that he would be justified in asking for these forms to be filled up in existing circumstances.

Gas Coal.—Col. Clarke asked the Minister of Fuel and Power what proportion of the coal now used in generating stations could be utilised for the production of gas and by-products. Mr. Shinwell replied that the matter had been fully investigated and, apart from Scotland, where there was a greater degree of interchangeability than elsewhere, there was at present no coal supplied to generating stations which could thus be used.

Electricity Nationalisation.—Mr. Shinwell told Col. Clarke that the I.M.E.A., the Conference of J.E.A's. and Joint Boards, the Electrical Trade Union and the Electrical Power Engineers' Association had indicated their willingness to co-operate in carrying out the Government's policy of nationalisation. In reply to Mr. Palmer, Mr. Shinwell said that it was not quite clear that the electricity companies had refused to co-operate. They had said something about it and it had got to be analysed.

Improved Branch Exchanges.—Asked by Mr. Digby what progress had been made with the testing of the new and improved design of automatic branch exchange which his Department intended to provide in the future, Mr. Burke (Assistant Postmaster-General), said that the testing of prototypes of the smaller sizes was expected to be completed within a few weeks. If these tests proved satisfactory, arrangements would be made for the manufacture of bulk supplies. The equipment manufacturers, however, were already faced with a very heavy programme of work and it was accordingly impossible at present to say how soon the new system would be available to business firms.

Nigerian Power Supplies.—The Colonial Secretary (Mr. Creech Jones), replying to Col. Wigg, stated that under the Nigeria ten-year development plan, comprehensive schemes had been prepared for the extension of electricity supplies and arrangements had been made for investigating the possibilities of hydro-electric power. A proposal to establish a Government-owned electricity Corporation in which all existing Government - owned electric enterprises would be vested, together with future extensions and new installations, had been approved in principle and was now being examined by the Nigerian authorities.

Naval Electrical Branch.—In the course of an oral answer, Mr. Dugdale (Parliamentary Secretary to the Admiralty) announced that the growth of electrical equipment in H.M. Ships had necessitated the formation of a new Electrical Branch in the Royal Navy, which would be known as the "L" branch. The new branch would be responsible for all aspects of naval electrical and radio engineering, including maintenance, research, development and design of new equipment. The immediate requirements for officers had been met by transfers from other branches and from qualified temporary officers. Future recruitment of officers would in the main be from young men between the ages of 17 and 19 on September 1, each year, who had obtained a higher school certificate of one of the recognised university examination boards, with mathematics and physics as main subjects. Selected condidates would undergo a year's training as naval cadets (L), followed by three years advanced technical training to honours degree standard. This would be followed by a further two years naval training, and training at commercial electrical engineering works. Ratings would join the Navy through the recruiting offices and would then be selected for the new branch and trained in the Service. Opportunities would be provided for ratings to attain commissioned rank

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:—

Plymouth, November 2.—Supply of meters, time switches, underground joint boxes, underground disconnecting boxes and two 5 mVA 33/6.6 kV outdoor transformers. Particulars from City Electrical Engineer, Armada Street, Plymouth.

Redcar, November 2.—Supply, laying and jointing of e.h.t. and associated pilot cables. Forms of tender, etc., from Borough Electrical Engineer, Electricity Offices, High Street, Redcar.

Heanor, November 4.—Supply of two two-stage horizontal electrically operated centrifugal pumps (or alternatively vertical spindle pumps) with the necessary motors, starting gear, valves and other incidental fittings. Particulars from Engineer and Surveyor, Council Offices, Heanor, Nottingham. Deposit, £2 2s.

Manchester, November 4.—Supply of steel line poles for twelve months. Particulars from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester.

Weymouth and Melcombe Regis.—Supply, erection and connecting up of 11 kV and l.t. overhead lines, to supply villages of Bincombe, West Knighton and West Stafford; which will be placed as one contract. Particulars from Borough Electrical Engineer, Electric House, Westham Road, Weymouth.

Manchester, November 5.—Supply and delivery of control cables, 33 kV single, 660 V, single and multi-core. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2; deposit, £1 1s.

Southport, November 7.—Supply and delivery of 80 cast-iron short street lighting standards. Specification from Borough Electrical Engineer, 188, Lord Street, Southport.

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

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

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

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

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

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

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

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

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

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

Dublin, November 18.—Supply of street lighting control equipment for the sending of control signals by means of audio frequency impulses superimposed on normal supply over Dublin supply network. Area of control will comprise three 10 kV substation areas of the Board's networks, and will require approximately 445 relays. Particulars from City Engineer's Department, 28, Castle Street, Dublin.

Gairloch, November 25.—Supply, delivery and erection of h.t. and l.t. distribution lines for North of Scotland Hydro-Electric Board. Tender documents from the Engineers, Messrs. Strain and Robertson, 154, West George Street, Glasgow, C.2. Deposit, £1 1s.

Company News

BABCOCK AND WILCOX, LTD. — The interim dividend on the £4 299 656 ordinary capital is to be raised from 4 per cent. to 5 per cent. The dividend will be payable on November 14. The total distribution for the year 1945 was 12½ per cent.

J. AND F. STONE (LIGHTING AND RADIO), LTD.—Accounts for yr. to June 30 show trading prft. and sundry receipts £186 949 (£113 850), div. from subsid. co. (gross) £90 000 (£30 000), mkg. £276 949 (£143 850), deduct prov. for amort. of leases and deprecn. £10 530 (£10 408), dirs.' fees £750 (same), taxn. prov. £126 380 (£88 000), leavg. net profit £139 289 (£44 692). To pref. sh. rdmptn. £7 694 (£7 524), prov. for future repairs and renewals £40 000 (nil), war damage contributions nil (£93), pref. div. £4 539 (£4 586), ord. div. (already announced) 40% (15), £88 000 (£30 000), fwd. £12 853 (£13 797). Consolidated balance-sheet shows current assets £1 029 823 (£819 425) and current liabilities £358 562 (£212 043).

MUREX, LTD.—Profit to June 30, £14 392 (£232 535). Add div. from sub. co. free of tax £30 000 (same), gross income from invts. incldg. prft. on sale of War Bonds and arrears of hldgs. in former enemy-occupied territory £13 346 (£1 529), trfr. fees £129 (£110), and taxn. recoverable (E.P.T. refund, less inc.-tax and N.D.C.) £125 000 (£55 000), mkg. £310 867 (£319 174). To deprecn. fixed assets £106 661 (£102 892), dirs.' fees £2 716 (£3 250), lvg. net blce. £201 490 (£213 032). Add prft. on sale of shs. in assoc. co. £34 246 (nil), recovery of amt. written off invt. in former en.-occ. territory £35 754 (nil), and £126 680 (£125 398) brought in, giving avail. sum £398 170 (£338 430). To gen. res. £110 000 (£90 000), obsoles. £50 000 (nil), pension conting. nil (£20 000). Pref. div. £1 838 (£1 750), intm. on ord. 7½% £41 250 (£37 500), and fin. div. 10% and cash bonus 2½% £68 750 (£62 500), both same, mkg. 20%, less tax (same), fwd. £126 332.

CABLES INVESTMENT TRUST, LTD.—Sir Edward Wilshaw, the chairman, said, at the ordinary general meeting, that the revenue had shown a further increase of £17 789 to £359 772, a total that had been exceeded on one occasion only since the Trust was formed in 1935. After payment of debenture interest, administration expenses, directors' fees and taxation, amounting to £133 099, there was a balance available of £226 673, out of which the preference dividend and an interim dividend on the ordinary stock of 2 per cent. had already been paid. Those dividends and the proposed final dividend of 3 per cent. on the ordinary stock would absorb £190 000, leaving a balance of £36 673. Further improvement was shown in the balance-sheet position, the Chairman added, where the capital reserve had been increased to £635 069, while their investments were valued at £8 471 322 and showed at the date of the balance sheet an appreciation of £1 235 148 or 17 per cent.

ATLAS ELECTRIC AND GENERAL TRUST, LTD.—Revenue for yr. to March 31, £331 964 (£308 365). To United Kingdom tax and N.D.C., less tax recoverable on man. exes., £149 596 (£137 437), leaving blce. £182 368 (£170 928). Deb. int. absorbs £19 531 (£18 750), admin. and dirs.' fees £17 642 (£18 134), exes. of the Trust's spec. representative in Uruguay £1 800 (same), leaving net profit £143 395 (£132 244). To pref. div., less tax, £110 250 (£111 563), ord. div. nil (same), gen. res. £3 359 (nil), fwd. £216 656 (£188 870). Gross receipts of Uruguayan subsid. co. $6 871 938 ($6 593 497) and blce. of rev. over operating costs $278 701 ($211 109), reducing debit blce. brot. in from $760 364 to $481 663. Invests. appear in blce-sheet £5 804 840 (£5 756 223), valuation based on quotations at date of accts., where available, and on est. regarding remainder indicated apprecn. of £1 547 856 (£1 018 554), or about 26½% (17½). Val. of interest in subsid. co. shown at £4 420 547 unascertainable. Res. accts. and blce. unappropriated rev. amt. to £2 413 662 (£2 419 827).

BRUSH ELECTRICAL ENGINEERING CO., LTD.—Some of the war-time activities of the company were reviewed by Sir Ronald W. Matthews (chairman) at the annual meeting, held at Falcon Works, Loughborough. Apart from a large number of generators built to meet the electricity supply requirements of this country, the Dominions and the U.S.S.R., special generating plant was built for the Mulberry Harbour. All new recruits to engineering, 200 women alone produced over 50 000 generators for aircraft, while a wiring assembly department produced approximately 1 000 sets of wiring installations and 100 000 radio connectors for incorporation in Bomber Command aircraft. The traction section, subsequent to the carrying out of development work on auxiliary gear for radiolocation vehicles, produced 2 000 turntables, 2 000 slip-ring collector units, and 2 100 sets of manually

operated gears. Among peace-time developments, the production of the latest type of battery electric vehicles was now rapidly increasing, and he believed that it was generally acknowledged that the company was the largest producer of battery electric vehicles in the Empire. The chairman referred to difficulties which had been experienced with certain of the large steam-turbines manufactured under licence from the S.T.A.L. of Sweden. Serious blading trouble had been experienced with most of the new large-size machines with the exception of the 30 000 kW, 3 000 r.p.m. turbines, which had given satisfactory service. The troubles could be attributed to a combination of war-time conditions, unsatisfactory material and unsatisfactory technique in manufacture. The technical staff had spared no effort in diagnosing the causes, and the directors were determined to stand by the machines. The turbine order book was now improving, and he believed that before long all the lost ground would be recovered. In order to expand the company's range of electric motors, the goodwill of Messrs. Flather and Co., Ltd., of Leeds, had been acquired, and this firm was now producing the whole output of small electric motors.

LONDON ELECTRICAL AND GENERAL TRUST, LTD.—Speaking at the ordinary general meeting, the chairman (Mr. A. R. Guinness) announced that the gross revenue had increased to £61 117, as against £55 599 last year. An interim dividend was paid last January, and the directors now recommend a payment of a final dividend of 4 per cent. on the ordinary stock, making a total distribution of 6 per cent., compared with 5 per cent. last year. In common with most other investment trusts, they had benefited from the resumption of dividend and interest payments from investments which were not previously paying, and from increased distributions. These favourable factors offset the continued loss of income caused by the conversion of high yielding prior charges into ones yielding a lower income.

Coming Events

Friday, November 1 (To-day)

I.E.E., N.E. CENTRE, STUDENTS' SECTION.—Newcastle-on-Tyne. Informal meeting. *6.30 p.m.*

I.E.E., N.W. CENTRE, STUDENTS' SECTION.—Manchester. "The Electrical Characteristics of Resistance Welding Machines," F. P. Hahn. *6.45 p.m.*

JUNIOR INSTITUTION OF ENGINEERS.—London. Discussion Group. "High Temperature Insulation," R. L. Ballard. *6.30 p.m.*

ROYAL INSTITUTION OF GREAT BRITAIN.—London. "New Problems in Electrical Engineering," Dr. D. P. Dunsheath. *9 p.m.*

Saturday, November 2

I.E.E., LONDON STUDENTS' SECTION.—Informal Dancé at the Royal Hotel. *7 p.m.*

I.E.E., S. MIDLANDS STUDENTS' SECTION.—Birmingham. Dance at the Botanical Gardens, Edgbaston. *7 p.m.*

THE ASSOCIATION OF MINING ELECTRICAL AND MECHANICAL ENGINEERS, S. WALES BRANCH.—Cinderford. Third Annual General Meeting, including Brains Trust. *5.30 p.m.*

THE ASSOCIATION OF ELECTRICAL HOUSECRAFT ADVISORS.—London. Annual General Meeting at the Kingsway Hall. *2.30 p.m.*

Monday, November 4

I.E.E., S. MID. CENTRE.—Birmingham. Informal Lecture. "Rehabilitation of Electricity Supplies—Italy," W. M. Lapper. *6 p.m.*

Tuesday, November 5

I.E.E., N. MIDLANDS CENTRE.—Leeds. "Rural Electrification: the Use of the Singe-phase System of Supply," J. S. Pickles and H. W. Wills. *6 p.m.*

I.E.E., LONDON STUDENTS' SECTION.—Brains Trust. *7 p.m.*

Wednesday, November 6

I.E.E., N.E. CENTRE.—Newcastle-on-Tyne. Radio and Measurements Group. Discussion: "Standardisation of Energy Meters," opened by E. Fawsset. *6.15 p.m.*

I.E.E., N.E. CENTRE, TEES-SIDE SUB-CENTRE.—Middlesbrough. Committee Meeting, *5.15 p.m.*, and Chairman's Address (repetition), T. M. Ayres, *6 p.m.*

I.E.E., LONDON STUDENTS' SECTION.—Visit to Metal Box Co., Ltd., Palmers Green, N.13. *2.30 p.m.*

I.E.E.—London. Radio Section. "The Pulse Testing of Wide-Band Networks," E. C. Cherry and M. M. Levy. *5.30 p.m.*

JUNIOR INSTITUTION OF ENGINEERS, MIDLANDS SECTION.—Birmingham. Chairman's Address, A. Russell. *6.30 p.m.*

Thursday, November 7

I.E.E.—London. "The Extinction of Arcs in Air-Blast Circuit-Breakers," A. Allan and D. F. Amer. "The Influence of Resistance Switching on the Design of High-Voltage Oil Circuit-Breakers," H. E. Cox and T. W. Wilcox. *5.30 p.m.*

I.E.E., DEVON AND CORNWALL SUB-CENTRE.—Taunton. "Street Lighting," E. C. Lennox. *3 p.m.*

INSTITUTE OF WELDING.—Tyne-side Branch. "Radiography of Welds," R. F. Bishop.

Friday, November 8

I.E.E., N.E. CENTRE, STUDENTS' SECTION.—Newcastle-on-Tyne. Annual Dance at the Old Assembly Rooms. *8 p.m.*

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

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

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

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

INSTITUTE OF PHYSICS.—Sheffield. "Intensity Relations of Debye-Scherrer Powder Diffraction Lines," Dr. A. J. Bradley. "Application of X-rays to the Study of Stresses in Metals," Dr. W. A. Wood. *2.30 p.m.*

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.*

ENSEL ELECTRIC CO., LTD., London, W.C.—October 4, mort, to National Provincial Bank, Ltd., securing all moneys due or to become due to the Bank; charged on part of Kingsbury Works, Kingsbury Road, Middlesex, with plant, machinery, etc. *Nil. December 31, 1945.

JOHNSON AND CO. (BRADFORD) LTD., electrical engineers.—October 3, mort. to Halifax Building Society, securing £500 and further advances; charged on stable, garage and other buildings now used as garage, and yard thereto adjoining 12, Southfield Terrace, Birkenshaw. *Nil. March 22, 1945.

O'CONNOR ELECTRICAL INDUSTRIES, LTD., London, W.—August 27, £10 000 mort. to Norwich Benefit Building Society; charged on 45, Morrish Road, Lambeth, and certain land at rear. *—. March 6, 1945.

PORTOGRAM RADIO ELECTRICAL INDUSTRIES, LTD., London, S.W.—October 3, charged, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Spero Works, Wandsworth. *—. May 20, 1946.

S. WILDING COLE, LTD., Birmingham, dealers in motor and wireless accessories. October 3, mort., to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Ingrow Mills, Keighley, with fixtures. *Nil. September 19, 1946.

Satisfactions

JOHN MCCLURE, LTD., High Wycombe, wireless manufacturers.—Sat'n. October 10, of deb. reg. August 30, 1941.

SCHALL AND SON, LTD., London, W., electrical engineers.—Sat'n. October 10, £10 500, reg. March 29, 1934.

UNION LAMP AND LIGHTING CO., LTD. (formerly UNION ELECTRIC CO., LTD.), Wembley, Middlesex.—Sat'n. October 4, £4 950, reg. November 23, 1939.

CELESTION, LTD., Kingston-on-Thames, wireless manufacturers.—Sat'n. September 23, of deb. reg. July 9, 1932.

NIGERIAN ELECTRICITY SUPPLY CORP., LTD., London, E.C.—Sat'n. September 18, of deb. stock reg. August 31, 1933, to the extent of £123 528.

County Court Judgments

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

DAWSON, E. H. (male), 106, Roydene Crescent, Leicester, electrician. £86 1s. 3d. September 9.

MADDY, A. Eric, 561, Moseley Road, Birmingham, radio mechanic, £18 5s. July 16.

LOFTHOUSE RADIO ELECTRIC CO., Bull Ring, Wakefield, radio dealers, £16 7s. 2d. July 24.

Receiving Order

STARR, Albert Edward, 11, Cross Mount Street, Batley, Yorks, and lately carrying on business at 125, Commercial Street, Batley, and formerly at 2, Brewery Lane, Thornhill Lees, Dewsbury, Yorks, as an electrical and radio engineer, under style of "Electronic Enterprises." Court, Dewsbury; receiving order dated October 10, 1946. Debtor's petition.

Metal Prices

	Monday, Price	October 28 Inc.	Dec.
Copper—			
Best Selected (nom.)...per ton	£82 10 0	—	—
Electro Wire bars ... „	£84 0 0	—	—
H.C. Wires, basis ... „	£96 15 0	—	—
Sheet ... ... „	£124 10 0	—	—
Bronze Electrical quality 1% *Tin*—			
Wire (Telephone) basis per ton	£118 10 0		—
Brass (60/40)—			
Rod basis ... ... „	9¾d.	—	—
Sheet ... ... „	—	—	—
Wire ... ... „	1s. 1¾d.	—	—
Iron and Steel—			
Pig Iron (E. Coast Hematite No. 1) ...per ton	£8 19 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... „	£32 10 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.) ... ... „	£21 15 0	—	—
Lead Pig—			
English ... ... „	£56 10 0	—	—
Foreign and Colonial... „	£55 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity) ... „	£384 0 0		—
Wire, basis ... ... per lb.	4s. 10½d.		—
Aluminium Ingots ...per ton	£72 15 0	—	—
Spelter ... ... „	£50 0 0	—	—
Mercury (spot) ... per bott.	£31 5 0	—	—

Prices of galvanised steel wire and steel tape supplied by G.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.

Superspeed Special Cored Solder is essential to the Radio and Electrical trades because—

- It can be used for **rapid work at moderate bit temperatures** thus reducing risk of damage to delicate components.
- It speedily removes oxide film from copper conductors and soldering tags eliminating high resistance faults caused by dry joints.
- The flux residue is hard, dry, non-conducting and absolutely non-corrosive.

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All-over warmth

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

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

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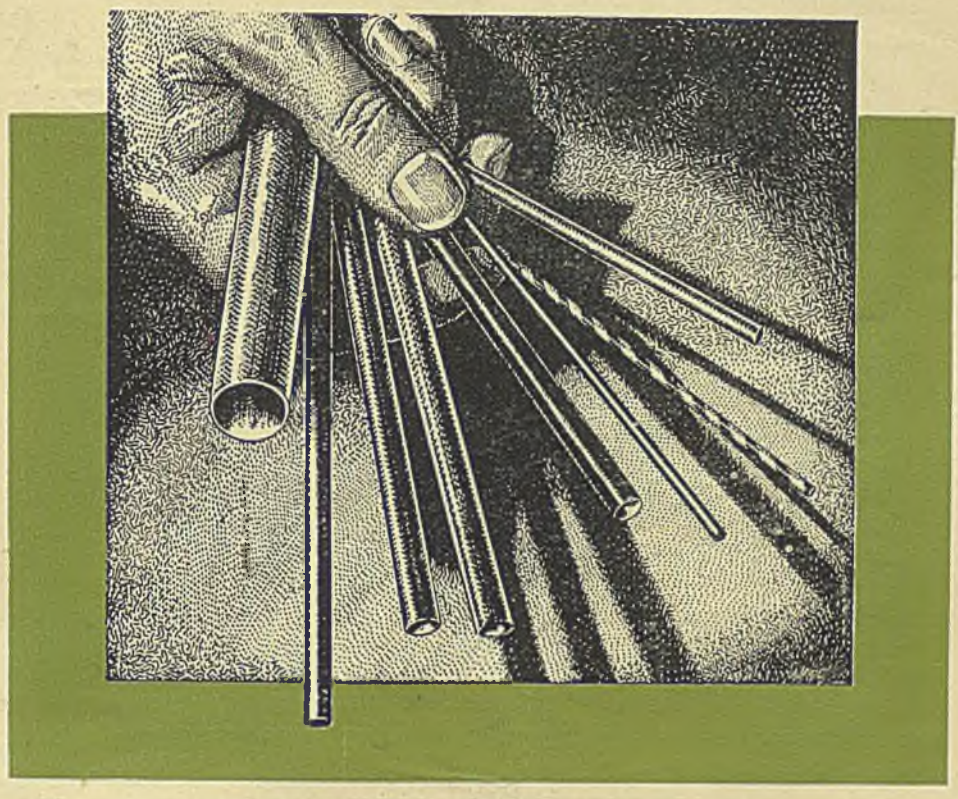

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