

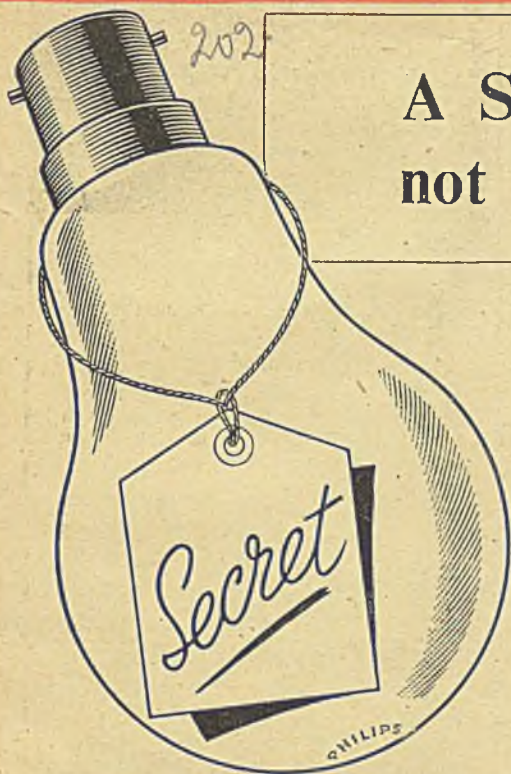
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ELECTRICIAN

THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY



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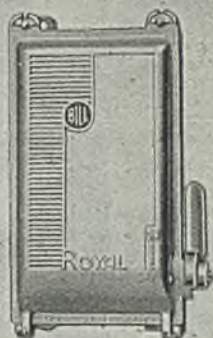
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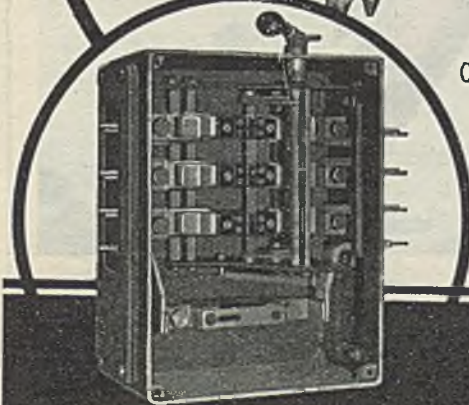
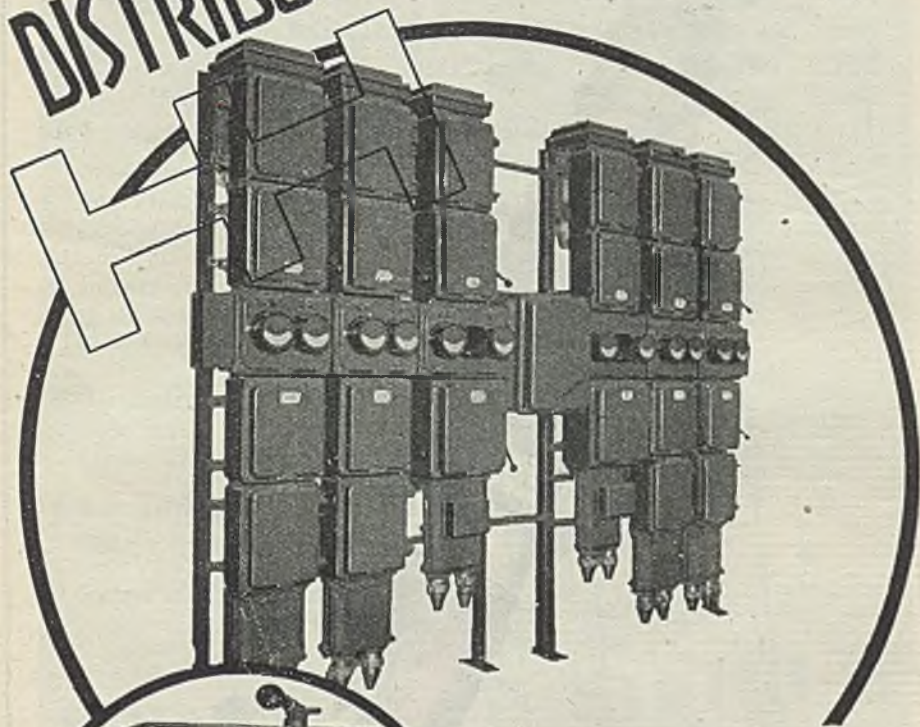
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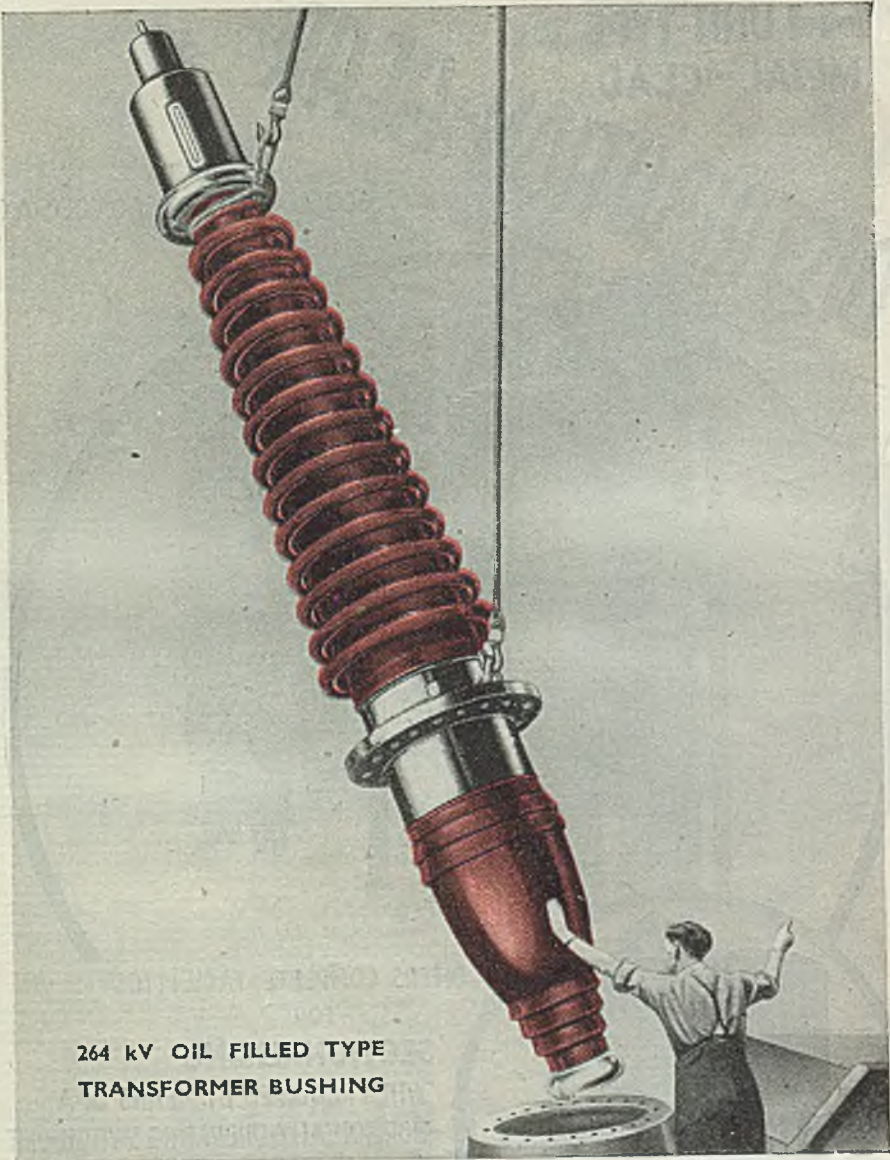
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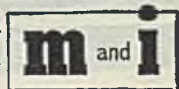
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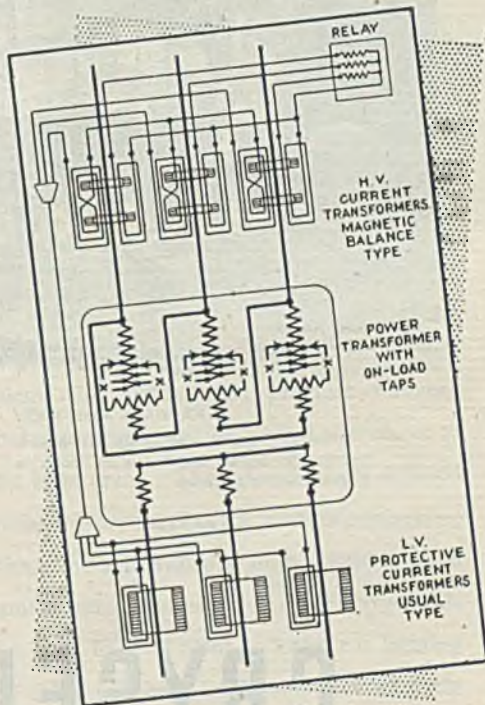


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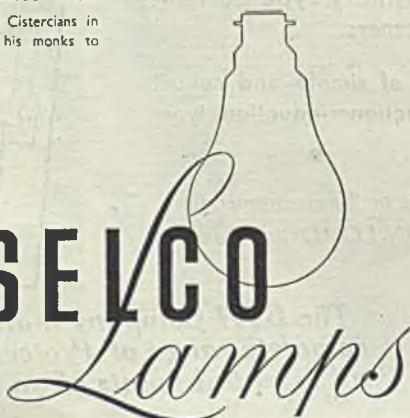


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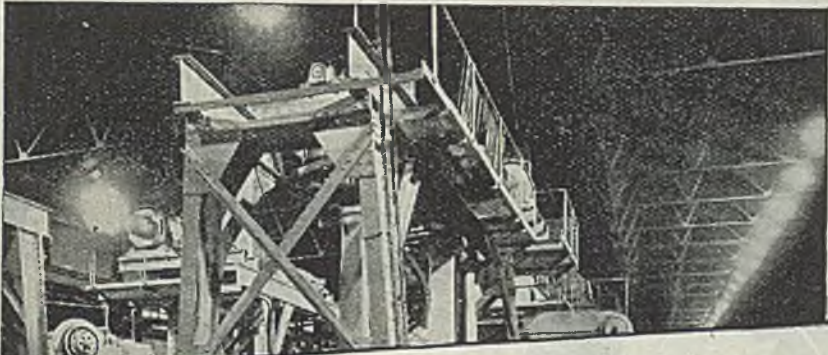
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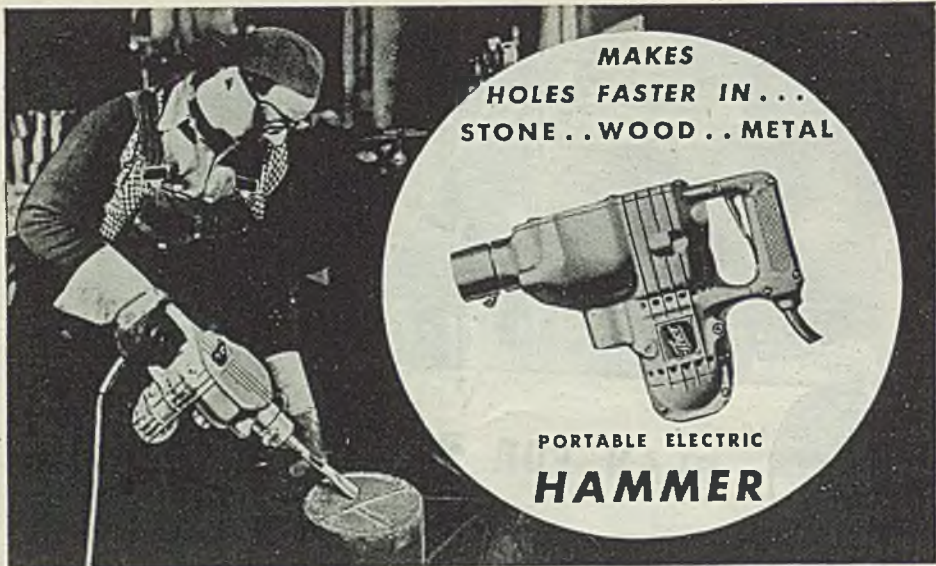
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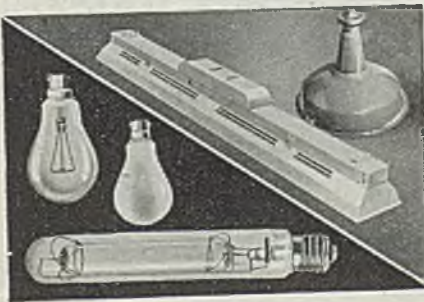
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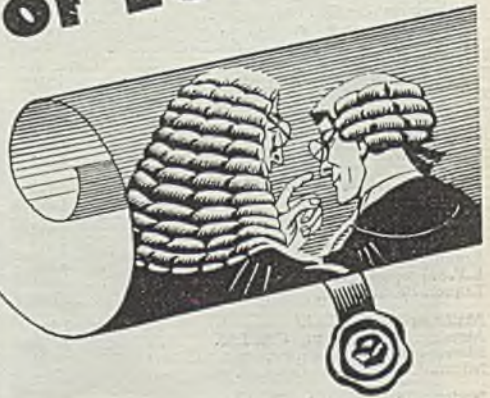
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Telegrams: Cromptonpark, Strand, London

27 DECEMBER 1946

THE ELECTRICIAN

B

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Crompton

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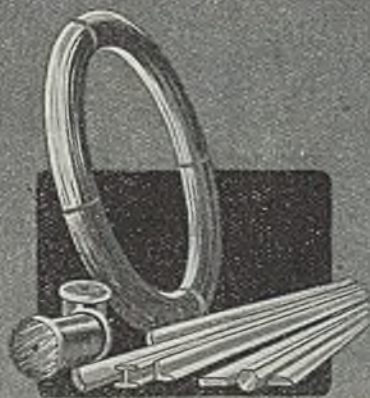
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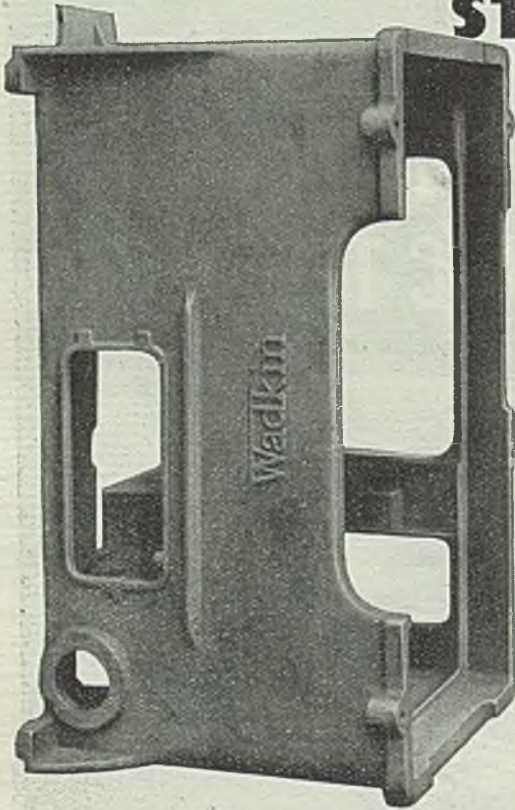
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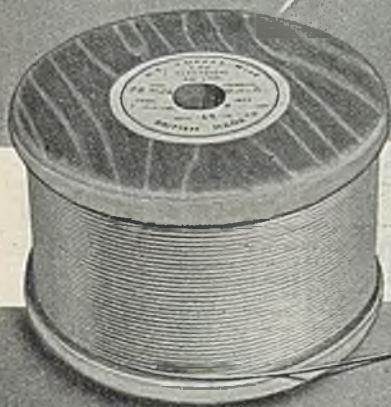
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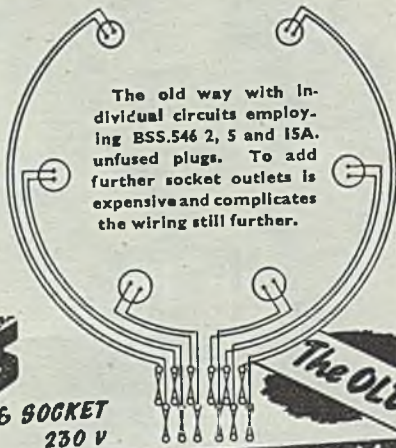
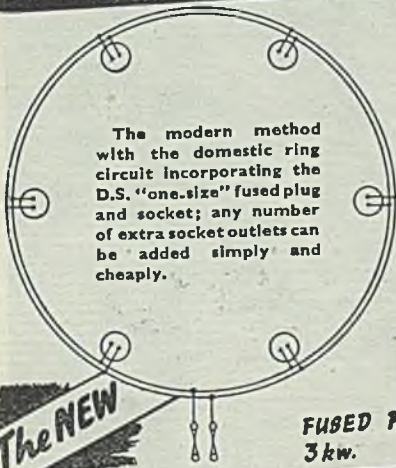
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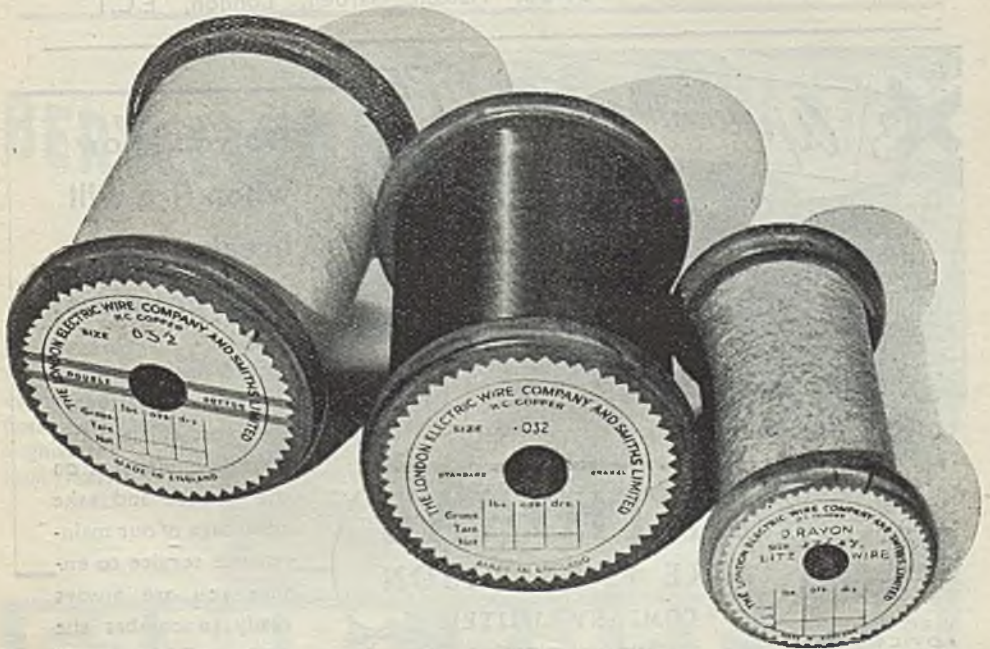
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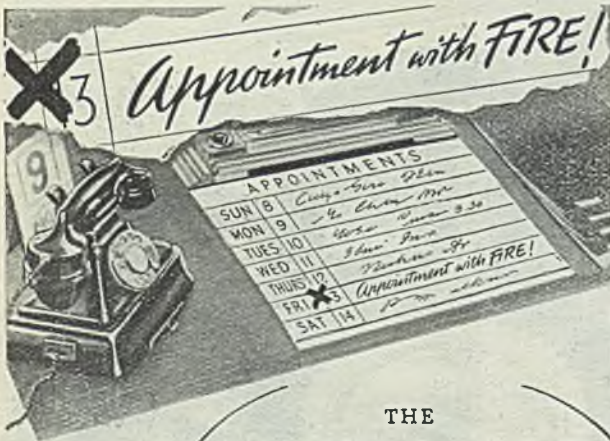


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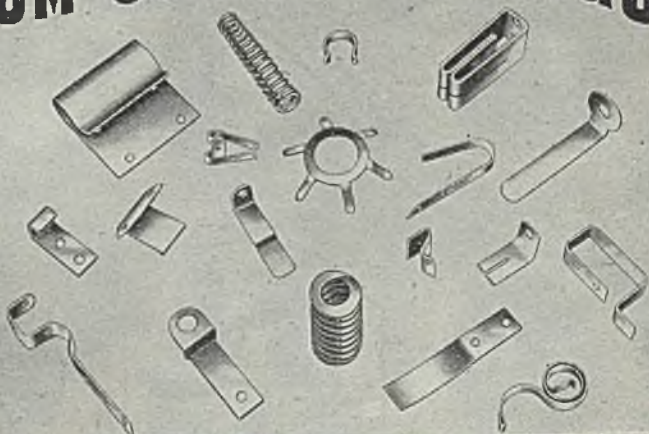
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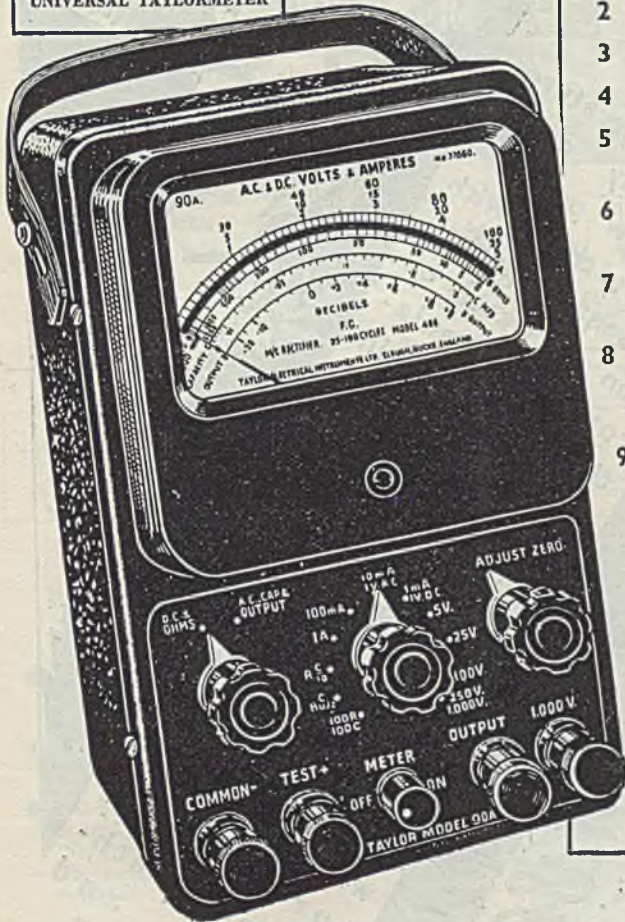
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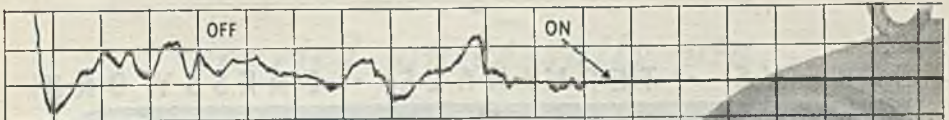
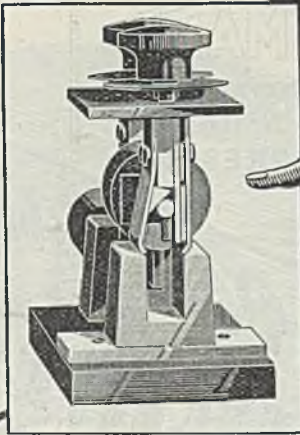
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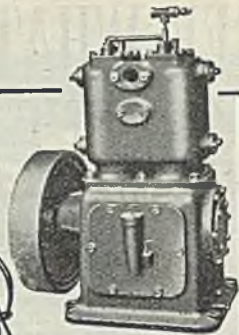
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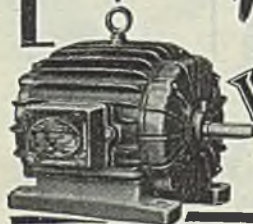
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COUNTY BOROUGH OF HUDDERSFIELD
ELECTRICITY DEPARTMENT.
APPOINTMENT OF TWO SWITCHBOARD ATTENDANTS.

APPLICATIONS are invited for the position of Switchboard Attendant at the St. Andrew's Road Generating Station of the Huddersfield Corporation at a salary in accordance with the National Joint Board Scale, Class "H," Grade 9a, £365/381.

Applicants should have had experience in the operation of large power station plant together with E.H.T. switchgear and Central Electricity Board grid supplies.

Applications stating age, qualifications, practical and technical experience, and accompanied by at least two copies of recent testimonials, should be submitted.

The appointment will be subject to the Corporation's Conditions of Service and to the provisions of the Local Government Superannuation Act, 1937. The successful candidates will be required to pass a medical examination.

Applications should be forwarded to the undersigned not later than the 10th January, 1947, and enclosed in a sealed envelope endorsed "Switchboard Attendant."

F. A. ELLIS, M.I.Mech.E., M.I.E.E.,
Borough Electrical Engineer and Manager,
Market Street,
HUDDERSFIELD.

METROPOLITAN BOROUGH OF ISLINGTON.
ELECTRICITY DEPARTMENT.

Appointment of Engineering Draughtsman.
APPLICATIONS are invited for the position of Engineering Draughtsman on the permanent staff of the Council.

The salary and conditions of service, in accordance with the National Joint Board Schedule, will be from Grade 9A, £360 3s. per annum, to the maximum of Grade 8, £499 16s. per annum, in Class G, according to the qualifications and experience of the successful candidate.

The position offers scope for initiative in design connected with the development of a superimposed 33 kV transmission scheme, the reinforcement of the existing distribution system and future planning in connection with the standardisation of voltage and supply.

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

Candidates are required to disclose in writing whether, to their knowledge, they are related to any member or holder of any senior office under the Council. Canvassing either directly or indirectly will be a disqualification.

The Council are unable to make any arrangements whatsoever for the provision of housing accommodation for the successful candidate.

Application forms, which may be obtained from the Engineer and General Manager, Electricity Department, 341/3, Holloway Road, N.7, should be completed and returned to him endorsed "Engineering Draughtsman" by not later than noon on Friday, 10th January, 1947.

Town Hall,
Upper Street, N.1.

W. ERIC ADAMS,
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LONDON Electrical Wholesalers require representative with car to cover London area and outskirts. Good commission paid with small car allowance.—Write Box L.T.D., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4, stating experience.

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POSITIONS VACANT.

Assistant Engineers (6) in the Department of Posts and Telegraphs (Dublin)

APPLICATION forms for and particulars of the above-named posts may be obtained from the Secretary, Civil Service Commission, 45, Upper O'Connell Street, Dublin. **Salary Scale:** Man: £150-£15-£200 a year plus bonus. Woman: £150-£10-£300 a year plus bonus. At present the bonus (including Emergency bonus) on £150 is £164 2s. A successful candidate who can show to the satisfaction of the Minister for Posts and Telegraphs that he/she has had approved practical experience of (a) Telecommunications Engineering or (b) General Engineering (i.e., any branch of Engineering other than (a) or (c) both, may be allowed to enter the appropriate salary scale at a point above the minimum equal to one increment for each completed year of such experience subject to limits of seven increments for (a) or three for (b) or seven for (c). **Age Limits:** 21-35 years on the 1st December, 1946. An extension of the upper age limit may be allowed in the case of persons with certain specified service in the Defence Forces or in the Auxiliary Defence Services. **Essential Qualifications:** Each candidate must (i) hold a recognised University Degree in Engineering and have taken a technical Electrical Engineering subject in the Final examination for such Degree or hold a recognised University Degree in Science and have taken Experimental Physics as a subject in the Final examination for such degree or have passed in Parts I and II or joint Section A and Section B of the Associate Membership Examination of the Institution of Electrical Engineers; (ii) have a knowledge of Mathematics at least equivalent to that required to obtain Honours in that subject at the Department of Education Secondary School Leaving Certificate Examination.

Latest time for accepting completed application forms: 5.0 p.m. on the 22nd January, 1947.

LONDON COUNTY COUNCIL.

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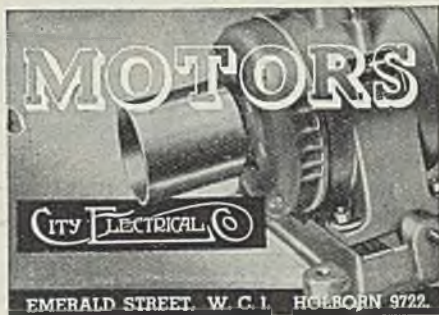
Application forms obtainable by sending stamped addressed foolscap envelope to the **DEPUTY CHIEF ENGINEER** (quote 46/19), County Hall, Westminster Bridge, London, S.E.1, returnable with copies of three recent testimonials within 14 days.

All other things being equal, preference will be given to candidates registered under the Disabled Persons Employment Act, 1944. Canvassing disqualifies.

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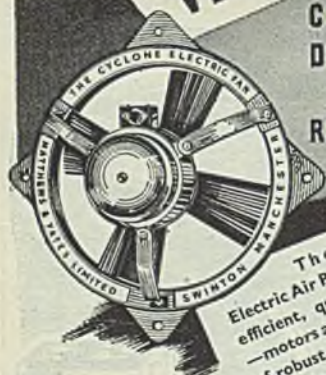
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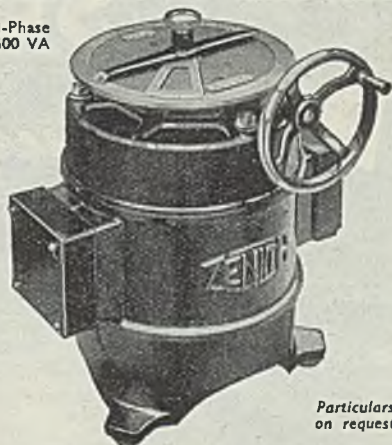
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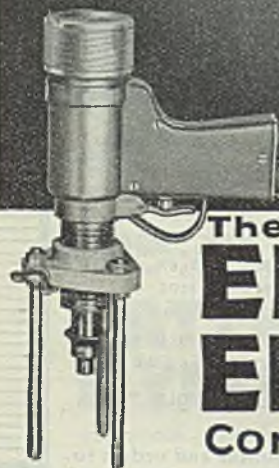
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THE ELECTRICIAN

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The Road Ahead

THOUGH during the year now drawing to a close some controls have disappeared, those that remain include restriction upon the use of paper. Despite this crippling effect upon its initiative and expansion, THE ELECTRICIAN has, during the year, not only maintained its high place in electrical journalism, but has also attracted a body of potential subscribers embarrassing in their numbers and in the present circumstances, impossible to satisfy to an extent which the demand warrants.

When last month THE ELECTRICIAN was awarded a little more paper, this was used to reduce the waiting list, to give readers a few more pages, and to allow the industry—still all too inadequately—an opportunity of making better known by advertisement, details of its activities and developments.

In anticipation of this increase in paper and in order to help in breaking down the post-war austerity which set in soon after the summer of 1945, THE ELECTRICIAN brought about in October last, changes in its cover design and editorial layout, the results of which have been two-fold. First, existing subscribers have been generous in their praise, and second, the publicity created has made the already long waiting list of new readers, even more embarrassing in its length.

Attention is drawn to these points in the hope that it may bring about even further co-operation of readers

in helping to alleviate at least some of the widespread disappointment felt by those others in the industry who are unable to obtain copies of *THE ELECTRICIAN* for themselves. It is appreciated that in many instances a single copy of *THE ELECTRICIAN* is already shared by four or more readers each week, and for that co-operation we are indeed grateful. The demand is such, however, that with even twice the present number now sharing, disappointment would still be felt in many quarters.

It is our resolve to supply each reader of *THE ELECTRICIAN* with a copy for his own personal use as soon as the Paper Control will allow names to be transferred from the waiting to the subscription list, and to supply to the periodical distributive trade as many copies as it may want; indeed, that is no more than the service for which the publishing machine is designed and which is now prevented from being operated only by official obstruction.

New Year's Day next week will, no doubt, produce its usual crop of "good resolutions" and we suggest that among them, a decision to pass on to an electrical friend each week the current issue of *THE ELECTRICIAN* would be most public-spirited. Until such time that we are permitted to print sufficient copies for which we have orders, a large number of potential readers must, unfortunately, be disappointed. If, however, each copy of *THE ELECTRICIAN* is shared by an even greater number of persons than now, disappointments will be fewer and an even higher percentage of the personnel of the industry will be given the opportunity of being better informed on current electrical activities.

For our part, plans are already prepared, for release when paper becomes freer, which will give readers an even better service, fuller reports of the activities of the industry and a higher percentage of technical and exclusive contributions.

Views on Current Affairs

Handling Overseas Inquiries

WE have commented on many occasions upon the apparent lack of interest displayed by a few British exporting firms in answering inquiries from overseas, and this week yet another instance of inattention to detail was brought to our notice. An inquiry was directed to a manufacturer in this country by one of our readers, in the Services and stationed abroad, for details and price concerning a new domestic appliance. The inquiry was taken by the manufacturer to be one from an importing agency and the details withheld, in that the firm's overseas agencies had all been allocated. There was nothing in the original letter of inquiry to suggest that its author was anyone other than a potential purchaser and user of the appliance as an individual, and the assumption on the part of the manufacturing firm that the inquiry was, or might have been, from an importing agency seeking business seems hard to justify. There may, of course, have been good reasons why the manufacturer wished to withhold details from

our overseas reader, but their handling of the inquiry has resulted in criticism of their efficiency, if nothing more serious. As those manufacturers carrying on a large-scale export business already know, the establishment of goodwill among the users and consumers of the goods in the importing country is a first essential, and the instance which has prompted this note is therefore, discouraging, to say the least.

Exports and the Future

THE occasion for the opinion expressed above is all the more regrettable when consideration is given to the efforts by other manufacturers to promote our overseas trade, and when reviewed against the country's need for increased exports. The fact that goods are now being sold in what is generally regarded as a seller's market, may possibly permit of indifferent handling of inquiries without serious loss of trade; the time will come however, when supply will be better related to demand and the seeds sown by any present-day mishandling of inquiries produce a harvest richer in disappointments than orders.

Reference has been made in these pages time and again, to the fact that the easy market of today will not last long, and in order that our present place in the scheme of things may not be lost, any slipshod or take-it-or-leave-it methods must be avoided, especially when it is appreciated that many overseas countries are now manufacturing for themselves, goods which before the war were imported. Success will require a lot of hard thought, imagination and hard work, and the sooner those new to the manufacturing export world wake up to the fact, the better for themselves as well as others. The example set by their older brothers is born of long experience and is well-worth following.

Trade with Poland

BECAUSE Warsaw, the capital city of Poland, and formerly an important centre of secondary industries, was deliberately and almost completely destroyed by the German Army after the abortive rising in 1944, and because Breslau, Danzig and other cities were destroyed almost to the same extent, the Polish authorities are seeking credits whereby they may import such capital goods as electrical generating plant, motors and telecommunications equipment. Some of Poland's needs in respect of these items have apparently been met hitherto by U.N.R.R.A., but the present intention is to import in the more usual way over the next three years, capital goods to the value of 708 million zloté. Realisation of the programme is dependent upon the receipt of credits totalling some £250 million between now and the end of 1949, and time alone will show whether foreign assistance on so extensive a scale will be forthcoming. The potential market for British-made electrical machinery is said to be good, but with so large a credit attached to it, its attraction must be limited.

I.E.E. Benevolent Fund

REFERENCE was made in these pages this time last year to the fact that though the membership of the I.E.E. in the September before was 27 550, subscribers to the benevolent fund numbered only 11 650, representing an average contribution per member of 4s. 11d. The position this year is not much better for with a membership on September 30

last of 30 225, the number of subscribers to the fund is only 11 859, and the average amount contributed per institution member is 5s. 7d. Drawing attention to the position, Mr. V. Z. DE FERRANTI, president, points out that the Committee of Management has a growing list of pitifully deserving cases of members or their dependents in sore distress, and appeals for greater support. This is the Silver Jubilee year of the Royal Charter and among the many ways in which this might be celebrated, none could be more public-spirited than a special effort to bring about a record rise in the income of the benevolent fund. In the case of Dr. P. DUNSHEATH'S appeal last year we said that there must be many among the institution membership, who, intending to contribute to the fund, have either forgotten or have put off the necessary form filling until "tomorrow." To those with the first reason this note will serve as a friendly reminder and to those with the second we would say—yesterday's tomorrow is here to-day.

A Desperate Situation

THE critical position facing the country with respect to coal was thrown into sharp relief last week, when Birmingham Electricity Committee suggested that unless a Government Order was made requiring industrial and commercial establishments to close down one day per week, requiring domestic consumers to be more economical, and prohibiting the retail sale of heating appliances, the Birmingham undertaking would soon be in desperate straits. Since October, 47 000 tons of coal have been drawn from stock, delivery is at least six weeks behind programme, and continuous representations to the appropriate authorities to remedy the position have produced no results. The Committee's view is that the S.R. & O. restricting industrial consumption to 97½ per cent. is inadequate in its severity, and restriction to 87½ per cent. is needed locally to avoid any greater enforced reduction. The Birmingham undertaking is not alone in its difficulties, more is the pity, and the effect of the restrictions will be to slow down the pace of production, which in its turn must influence employment and exports. So much for Mr. SHINWELL'S confused optimism of six months ago.

NATIONAL FARM SURVEY

ITS ELECTRICAL IMPLICATIONS

by E. W. GOLDING, M.Sc. TECH., M.I.E.E.

THERE has been such general agreement amongst the various bodies which have made recommendations for post-war reconstruction upon the necessity for much more widespread rural electrification, and such an insistent demand by agricultural interests for increased electricity supplies to farms, that the matter is now of prime importance. The electricity supply industry has made it quite plain that it is willing, and indeed anxious, to proceed with the work, the main cause of delay at the moment being the shortage of essential materials. But for the war, in fact, there is no doubt that supplies would already have been given to the large majority of farms.

THE FIVE YEAR PLAN

In this last connection plans, drawn up by a joint committee of the National Farmers' Union, the Power Companies' Association and other electrical and agricultural organisations, have been made known for a five-year programme of farm electrification involving an expenditure of £72 000 000 and covering supplies to some 150 000 farms which are, at present, without electricity. This number, together with the 78 000 agricultural holdings already connected, will give a grand total of 228 000 farms in England and Wales, or some 78 per cent. of the holdings exceeding 5 acres in extent, which may soon be receiving a supply.

In such a situation the publication of the "National Farm Survey of England and Wales. A Summary Report," published by the Stationery Office, although not specifically related to the rural electrification problem, is most opportune and the report itself is well worthy of careful study. This survey, carried out between 1941 and 1943, had as its first object the formation of "a permanent and comprehensive record of the conditions on the farms of England and Wales—the compilation of a modern Doomsday Book." The collection of information was carried out by the County War Agricultural Executive Committees and their district committees, the Advisory Economists attached to the Provincial Agricultural Advisory Centres being responsible for the scrutiny and assembly of the information collected. The survey provides data on the numbers of farms of various types and sizes, their convenience of layout and of situation,

their condition, both from the point of view of buildings and of the land, and classifies them under different types of occupier. One section dealing especially with water and electricity supplies will naturally interest the electrical engineer reader, but there are many facts which emerge from the tables of statistics in other sections of the survey which are so interesting—even, perhaps, surprising—that they merit consideration in so far as they bear on the question of the supply and utilisation of electricity in the future. The problem of taking a supply to 150 000 farms, many of which are somewhat isolated, is in itself quite formidable if, as must be assumed, this is to be done on an economic basis, but the full utilisation of such supplies, when provided, is a question of equal importance since it is only by the development of an adequate load that rural distribution can be made to pay its way. Obviously the job of electrification is not completed when the supply is made available; the farms must be wired and provided with suitable electrical equipment, and it is thus useful to have some guidance, even on broad lines such as must inevitably result from a nation-wide survey, on the equipment most likely to be needed, in what parts of the country it will be required, by what class of farmer, and so on.

FEW PRIVATE PLANTS

Turning first to the section in the survey dealing with the present situation in farm electrification, we find that, of the 78 000 agricultural holdings of over five acres in extent having electricity at the present time, only about one in ten has a private plant, the rest being connected to public supply. It is not perhaps surprising to find that the counties having the largest proportions of connected holding run in a continuous belt across the centre of England from the north west to the south east, since these counties have large urban populations. In five counties—Hertfordshire, Middlesex, and London, Nottinghamshire, Surrey and West Sussex—the proportion is 50 per cent. or over. An interesting table shows that the size of the holding has a direct bearing on its connection to supply, for while 46 and 59 per cent. respectively of holdings of 300-700 acres and over 700 acres have a supply, the percentages for the ranges 5-25 acres and 25-100 acres are only 25 and 24 per cent.

Statistics relating to the utilisation of electricity on farms show that 38 per cent. use the supply entirely for lighting the farmhouse, and a further 15 per cent. use electricity for light and power in the farmhouse. This implies that only 47 per cent. of agricultural consumers use electricity for farm—as distinct from domestic—purposes.

LABOUR SAVING NOT APPRECIATED

It is clear from this that electricity has so far been valued mainly as an economy and that its importance from the point of view of saving labour in the various agricultural processes has not yet been fully appreciated or, at least, that advantage has not been taken of the possibilities. It is not easy to say why this is so, because strenuous efforts were made in pre-war days to demonstrate to farmers the benefits of electrical operation of farm machinery and appliances. It may be due partly to a lack of the capital required for the necessary installations during the difficult period through which agriculture passed prior to the war, or, again, another explanation may be that an appreciable number of the farms were comparatively new connections which had somewhat naturally taken a supply for domestic purposes first and had not developed utilisation to the stage of power applications. Whatever the reason, the present situation is one which the electrical industry will be anxious to rectify.

The survey points out that availability of supply, rather than the type of farm, is the deciding factor in whether a holding is connected or not. In view of the present preponderance of connected farms having electricity only in the farmhouse, this conclusion is natural but it does not appear to present a true picture. The applicability of the electricity supply to farming processes is sufficiently wide for a supply to be required whatever the type of farm, although, admittedly, the relative annual consumptions of electrical energy will vary on farms of differing types.

It is shown that the percentage of holdings having electricity in the farm buildings increases with the size of the dairy herd until, in the case of farms having over 100 head of dairy cattle, this percentage reaches 64. From this we might draw the conclusion that the advantages of electrical operation have already to a large extent been appreciated by the dairy farmer. It is obviously necessary to bring about the same appreciation by those engaged in other types of farming, but it is surely not likely that a farmer will decide for or against having an electricity supply according to the type of his farm.

The first point when considering factors influencing future requirements is the number of agricultural holdings involved. In

the Agricultural Statistics issued annually by the Ministry, the number of holdings of different sizes has always included those of between one and five acres and, again, this number had perforce to include all holdings scheduled as agricultural, regardless of their actual use or occupancy. The survey excludes holdings of less than five acres for two reasons: (i) although there are some 70 000 holdings of between one and five acres they cover less than 1 per cent. of the agricultural land; (ii) since many of the small holdings are used for horticultural purposes they can best be included in a horticultural survey for which arrangements have been made. Again, an attempt is made to determine the true number of effective self-contained agricultural units, taking into account the fact that an appreciable number may consist of only one or two small fields, without buildings, and used by butchers or bakers for grazing purposes. The final conclusion reached is that there are, in England and Wales, 290 600 self-contained units (over five acres), of which 267 000 are single occupancies, the remaining 23 600 being held by some 10 000 occupiers so that the total number of occupiers is 277 000.

It may come as a surprise to those not closely connected with agriculture, and who usually think of a farm as being centred on the farmhouse and buildings, that about 11 per cent. of all holdings are without a farmhouse and 7 per cent. are without farm buildings. The percentages are much greater in the 5-25 acres group than in the larger sizes, being 21 and 16 per cent. without farmhouses and farm buildings, respectively. It is interesting to note that the farms without houses or buildings are situated mainly in the south and east of England. Obviously the existence or otherwise of a house and buildings must have a direct bearing on electricity supply to a farm.

FULL AND PART-TIME FARMERS

The occupiers of agricultural holdings are full-time farmers to the extent of 74.3 per cent. of the total and occupy 88 per cent. of the land. A further 11.2 per cent., occupying 5.7 per cent. of the land, are "part-time" farmers having farming as their main occupation but having also some other source of livelihood. The remainder are classified as spare-time or hobby farmers and others not specified. The proportions of part-time and spare-time farmers are relatively greater on the smallest farms, the percentage of full-time farmers being around 90 for farms above 100 acres.

The class of farmer is likely to influence his interest in electricity supply, as

also are his terms of occupancy—tenant or owner—and the length of tenure of his holding. What are the facts relating to occupancy? The survey shows that 65 per cent. of farmers in England and Wales are tenants and that these farm mainly in the northern and north midland counties of England. In the southern counties farms are more usually owner-occupied, the percentages of owners in Essex and Surrey, for example, being 55 and 53 respectively. The average number of years of occupation for all holdings is 13 and there is very little variation from this average in the case of various size groups, except that the length of tenure rises to an average of 17 years for the largest farms (over 700 acres). Clearly, therefore, throughout the range there is no prospect of lack of interest in electrification because of the likelihood of frequent movement from one farm to another.

The rents paid by farmers may give some indication of their ability, or willingness, to pay for electrical energy. Generally speaking, expensive land will be intensively farmed and both the income derived from it and the need for labour and labour-saving equipment will be high. We find that the average rent per acre for all holdings (above five acres) in England and Wales is 27s., but there is a wide variation from the average in the different counties, and also for different size groups. Taking the latter first, for 5-25 acre farms the average rent is 52s. per acre, while the rent falls progressively down to 19s. per acre for the largest farms: less than 2 per cent. of all farms have a total rent exceeding £500 per annum. Considering next the counties, the highest rents per acre occur in Lincolnshire (Holland Division) 57s., Cambridge (Isle of Ely) 46s., and Middlesex and London 42s.

DAIRY FARMING

If the type of farm does not affect its need for electricity supply it will certainly influence the electrically-operated equipment required and the probable annual consumption. Examination of the statistics shows clearly the "overwhelming importance of types where dairying is either supreme or at least of substantial significance." About 45 per cent. of all holdings fall under this description, and one cannot help feeling considerably encouraged by this because it is in its application to dairying that electricity shows to perhaps the best advantage.

To date, the use of electricity on the farm has been confined to domestic purposes and to light and power in the farm buildings, and development of power applications in the buildings is likely to be

the order of the day for some time to come. Nevertheless, some attention has been paid in the past, and will continue to be paid, to electrical operations in the field, which, if successfully developed, would undoubtedly have a very great influence upon farm technique and also upon the economy of rural electricity supply. In this connection it may be important to know, as stated in the survey, that 25 per cent. of the total agricultural area has heavy soil and 55 per cent. medium, while—fortunately—there is only 1 per cent. each of peaty bog and peaty fen.

To conclude, a very thorough and useful job of work has been done by those responsible for the survey, and it would be a great pity if full advantage were not taken of it by all interested, not merely in agriculture but in rural life and requirements.

News from the Continent

A group of French electrical construction companies are to construct generating plants and erect power lines in Poland with material bought in France to the value of 2 milliard 400 million francs. A 220 kV line will link Warsaw and Lodz with the coal region of Silesia, and stations will be of 300 000 kW capacity.

A working plan for the electrification of Slovakia includes the construction of seven large hydro-electric plants between 1946 and 1952. The aim is the modernisation and extension of industries already operating, as well as the starting up of new industries and general improvement in the standard of living. Distribution of electricity will be reorganised, and organisations already existing, except those in Bratislava, will be grouped in a nationalised concern.

According to a study recently produced by the Spanish Electricity Union, which includes 85 per cent. of the generating undertakings in the country, the electricity crisis in Spain will be resolved, provided the years 1947 and 1948 are not exceptionally dry. Numerous barrages in the process of construction will assure adequate hydro-generation as from 1949, even in spite of exceptionally dry weather.

A 10 000 kW turbo-generator and two boilers, each producing 150 tons of steam, have started work at the Zoujevo electric plant in the Donetz. Supply is now assured to the surrounding mines and plants, and by the end of this year it is envisaged that the pre-war potential of 350 000 kW will have been re-established.

INSIDE OF ELECTRICAL MACHINES

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

IN this article, Part XVIII* of the series, is illustrated the application of insulation to brushgear of various types. Methods of insulating the windings of fractional horse-power motors are also described.

Brushgear Insulation.—The use of synthetic resin mouldings (plastics) is shown in Fig. 1. The upper moulding forms the brush-rocker for certain fractional horse-power machines. In larger machines, such as those used for general industrial purposes, the rocker is invariably of metal

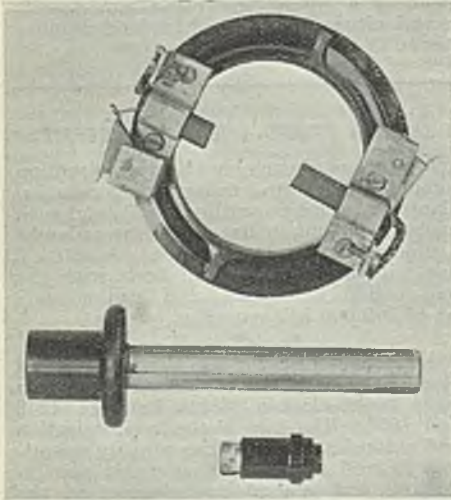


Fig. 1.—Application of plastics to brushgear

and the insulation is applied to the spindle. One method of doing this is shown by the centre figure. The lower picture indicates how insulation may be applied to brush-holders. This is a common form used in domestic apparatus.

The upper illustration in Fig. 2 illustrates one of many different forms of brush-spindle for traction motors. The insulation consists of a square tube of moulded synthetic-resin paper forced on to the square shank of the spindle and seen to the left of the porcelain. The porcelain, which serves to provide a definite creepage distance to earth, is cemented on the paper tube. The outer end is closed with a plug of synthetic resin paper board, made to fit tightly in the end of the tube and cemented in position.

Micanite is moulded on the shank of the spindle shown on the left. To avoid shrinkage of the insulation in service, it is given a long baking in the mould at

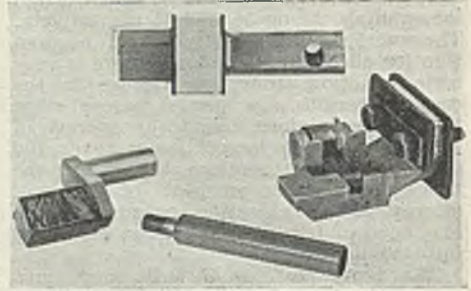


Fig. 2.—Various insulations for brushgear

a temperature of 150° C. In spite of this it may "give" a little and it is advisable to tighten the spindles while the machines are hot on test. Alternatively, the assembled rockers may be put in a stove for heating and afterwards tightened. The end is sealed with a plug of micanite, and the surface is protected by a lap of silk tape and several coats of shellac varnish. The right-hand figure shows the use of

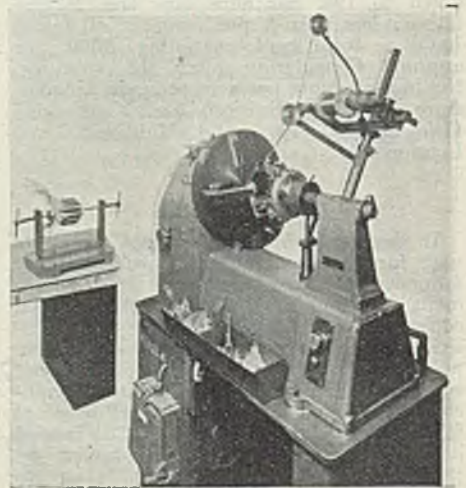


Fig. 3.—Two methods of winding small armatures

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

synthetic-resin paper board for insulating brush holders. Synthetic-resin paper tubes are slipped over the bolts. This

principle is frequently employed for insulating the brush arms of large d.c. machines of the type shown in Fig. 1 in Part XVI of this series. This insulation is Class "A", but can readily be made Class B by using micanite.

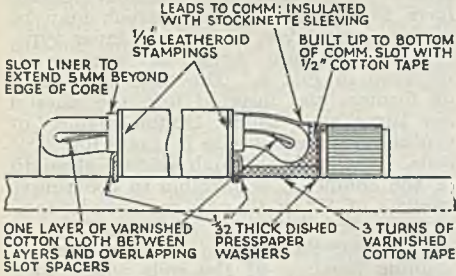


Fig. 4.—Section of armature wound with formed coils

The bottom component consists of a synthetic-resin paper tube pressed on to a knurled steel spindle. It is a very useful brush spindle for the smaller sizes of industrial machines, both d.c. and a.c.

The moulded types in Fig. 2 must be kept as thin as possible. In no case should the thickness of the insulation exceed $\frac{1}{16}$ in.

Fractional Horse Power Machines.—

There are many types of fractional horsepower machines. There is the straight d.c. type which will only run on direct current, the universal type which will run on d.c. and a.c., various types of single-phase a.c. machines, and also normal three-phase motors. We are not concerned with the basic principles in the operation of these various types, but only the insulation of their windings. For our purpose the whole series may be divided into two groups, those with a d.c. type of winding, and those with an a.c. type. Descriptions will follow this grouping.

Wire Coverings.—With such diverse types and sizes of machines it is natural

that many kinds of wire covering are employed. The increasing availability of synthetic-enamelled wire will, no doubt, result in many of the coverings which had to be used in the past becoming obsolete. This refers particularly to single- and double-silk, enamel-silk, enamel and paper, and single- or double-cotton coverings. In view of this impending change it may be worth-while recording briefly the uses made of the various coverings. Any one with experience in using these coverings will know how frail and troublesome some of them can be.

Silk-covered, enamelled and enamel and silk-covered wires, owing to their thin covering, have been in favour for the smaller sizes of machines, chiefly for armatures and field coils.

In Fig. 3, two methods of winding armatures are shown, Former-wound coils are employed in the armature on the left. These may be of any type of textile covered wire, but not ordinary enamelled

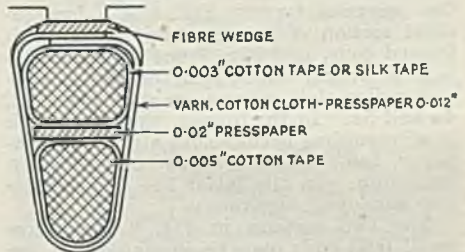


Fig. 4a.—Slot insulation of Fig. 4

wire. The only satisfactory manner in which an armature can be wound with ordinary enamelled wire is to rotate it about its shaft and feed the wire into the slots as shown in the machine on the right. Double-enamelled wire may be used for small stators, but needs careful handling if short circuits are to be avoided. In larger F.H.P. machines, either d.c. or a.c., fine d.c.e. proved the most

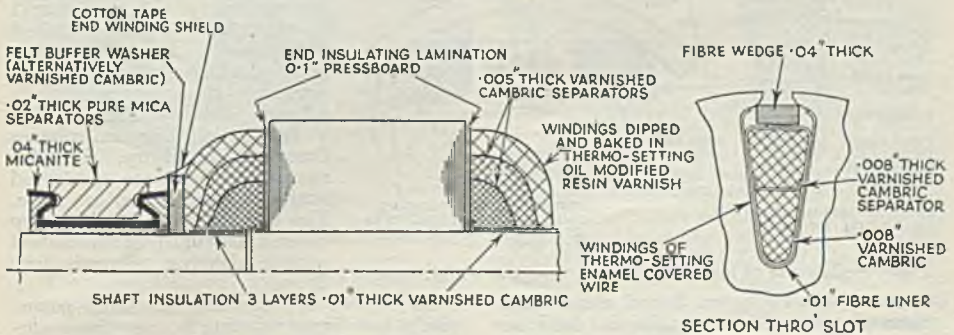


Fig. 5.—Section of armature, with wire wound direct into slots. Fig. 5a.—Slot insulation of Fig. 5

reliable covering until the arrival of the synthetic enamel covering.

Direct Current (F.H.P.).—Under this heading are included the plain d.c. and

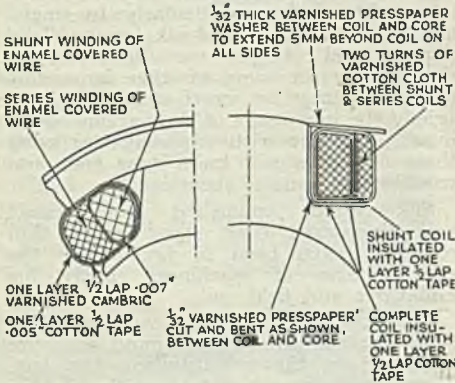


Fig. 6.—Two methods of insulating compound field coils of F.H.P. motors

the universal types. Fig. 4 is a longitudinal section of an armature wound with formed coils, and Fig. 5 one in which the wire is wound direct into the slots. Corresponding slot sections are shown in Figs. 4a and 5a. In the former, the slot trough is of varnished cotton-cloth stuck to presspaper, sometimes known as composite slot insulation. In the latter the components are employed separately.

The two sections in Fig. 6 show how small field coils may be insulated. If the coils are very small varnished silk or rayon may be used in place of the varnished cambric shown in the left section, and a piece of varnished pressboard interposed between the coil sides and the pole.

For larger types of F.H.P. machines micanite insulation is specified for some

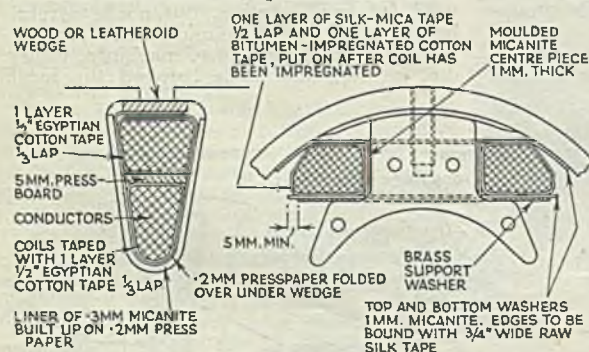


Fig. 7.—The use of micanite insulation in d.c. F.H.P. motors

purposes, especially on board ship. Diagrams showing how micanite is used are reproduced in Fig. 7. The inner slot liner of .2 mm. (.008 in.) presspaper is

required for enabling the coils to be fed through the slot opening.

Alternating Current Machines (F.H.P.).—These comprise several types. Some have single-phase windings with an auxiliary winding for starting. Others have three-phase windings which may be of the single layer, or the two layer type.

A single-phase type of winding is depicted in Fig. 8. The coils are wound on formers and inserted into the slots a few turns at a time. Double-enamel or synthetic-enamelled wire is useful for these coils. Owing to the high electric strength of the enamel it is possible to use simple troughs of 12 or 15 mils varnished presspaper as shown in the section in Fig. 9. Similar material is fixed between the end winding portions of the coils where they come close together. The wedges may be of wood, leatheroid or synthetic-resin paper board.

A three-phase stator winding of the single

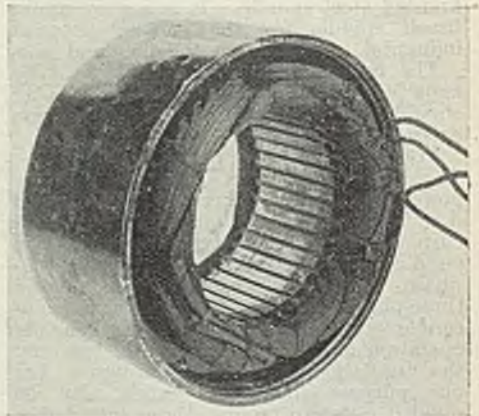


Fig. 8.—Single-phase F.H.P. stator

enamel or synthetic enamelled wire is suitable for these windings. The slot trough may be of the varnished-cloth presspaper variety (12 mils thick) or of 12 or 15 mils varnished presspaper. In spite of the good electric strength of the covering it sometimes fails when a pressure test of 1 500 V is applied between phases during manufacture. For this reason the coils are reinforced with one layer of cotton tape. The coil leads are insulated by having a length of varnished cotton sleeving slipped over them.

In motors approaching one horse-power size a two layer winding is sometimes employed. Mica presspaper troughs may also be used, especially with textile covered

wire. With this type of winding there may be the full phase voltage between the two half coils in a slot. It is therefore important to ensure that the two are well insulated from each other. A method of doing this is shown in Fig. 11, where a separate inner liner surrounds the upper half coil. The insulation between coils in the end winding may be provided by taping, or suitably shaped pieces of varnished presspaper may be inserted between them.

Tests During Manufacture.—The various tests for short-circuits, open-circuits, etc., described in Part XVII of this series are applied to these machines. The high-voltage tests, however, are not based on B.S. 168, to which reference was made in

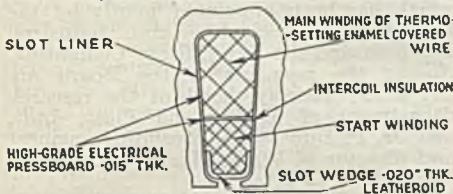


Fig. 9.—Section through slot of single-phase stator, containing both main and start windings

that article, but to B.S. 170, which is dealt with in the section below. As a general rule, the high-voltage tests applied to small windings during manufacture are in the nature of "flash" tests, i.e., the voltage is applied for only a few seconds. The voltage is usually 1 500 V.

Tests After Manufacture.—Tests are covered in B.S. 170-1939, Electrical Performance of Fractional Horse-Power Electric Motors and Generators with Class A Insulation. Only the high-voltage and

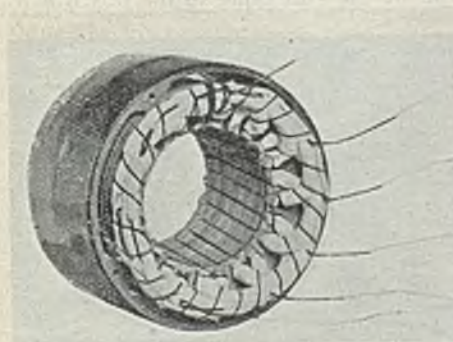


Fig. 10.—Three-phase F.H.P. stator

insulation resistance tests come within the scope of the present article.

The specification stipulates that the high-voltages given in Table I are to be applied only to a new and completed machine in normal working condition with all its parts in place and, unless otherwise agreed,

shall be carried out at the manufacturer's works, preferably at the conclusion of the temperature test of the machine. It is to be applied between the windings and the

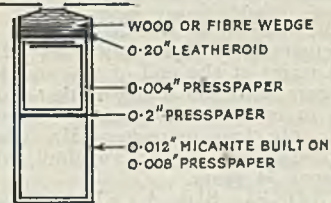


Fig. 11.—Slot insulation for three-phase winding

frame of the machine. The duration of the test shall be not less than 5 seconds for machines of continuous ratings up to and including $\frac{1}{2}$ H.P. per 1 000 r.p.m., or 250 W

Item No.	Description of machine	Test-voltage (r.m.s.) Volts
1	For all machines wound for 50 volts or less.	500
2	For machines wound for voltages higher than 50 volts up to and including 250 volts.	1 000
3	All machines wound for more than 250 volts.	1 000 plus twice rated voltage.

or VA per 1 000 r.p.m., and not less than 1 minute for larger machines. The voltage is to be alternating at any frequency between 25 and 100 cycles per second. The insulation resistance should be not less than 1 megohm at 500 V d.c. This test is invariably carried out with a 500 V megger.

Electrical Overseas Trade

ELECTRICAL exports for November were of the total value of £6 026 633, compared with £1 336 203 in November last year and a monthly average of £1 814 114 in 1938. Electrical goods and apparatus totalled in value £4 091 688, as against £890 496 for the corresponding month last year and electrical machinery also showed a substantial increase, the value of generators shipped being £529 937, motors £278 380, other machinery £789 969, vacuum cleaners £164 716, and welding machinery £108 686. The value of exports over imports for the month showed a balance of £5 795 317. The number of wireless sets exported numbered 47 699, compared with 1 215 in November last year. The value of the exports for the eleven months of the year was £47 617 279, contrasted with £24 372 967 for eleven-twelfths of last year and £29 955 278 in 1938, while the imports for the same period were of the value of £681 667, showing a credit balance of £46 935 612. Imports for eleven-twelfths of 1938 were £3 564 166.

Electrical Personalities

MR. JAMES B. GLEN, borough electrical engineer of Tynemouth for 12 years, is to retire at the end of this month after 42 years with the undertaking, which has been in existence 46 years. There have been only two managers—Mr. Glen and his predecessor, Mr. C. Turnbull, who was manager 34 years.

COLONEL SIR A. STANLEY ANGWIN, assistant director-general (engineering) and engineer-in-chief of the General Post Office, has been appointed chairman of the new board of directors of Cable and Wireless, Ltd., who will operate the undertaking from January 1, when it passes into full State ownership. Mr. John Innes, who is now deputy secretary of the Ministry of Fuel and Power and was formerly director of the Tele-



COL. SIR A. S. ANGWIN

communications Department of the G.P.O., will be managing director. Sir Stanley Angwin was president of the I.E.E. in 1943-44, and details of his career were given in *THE ELECTRICIAN* of September 3, 1943. Sir Edward Wilshaw, the outgoing chairman of the company, with which he has been associated for 53 years, will remain chairman of Cable and Wireless (Holding), Ltd.

Mr. A. J. GILL, deputy engineer-in-chief, is to succeed Sir A. Stanley Angwin as engineer-in-chief of the General Post Office. He entered the service of the G.P.O. in 1913.

MR. JOHN RATTER has been appointed civil engineer (maintenance) in the department of the Chief Engineer, L.P.T.B., to date from January 1.

MR. R. L. BATLEY, generation engineer in the Swansea electricity undertaking, has been appointed superintendent engineer of generation in the service of the Liverpool Corporation.

MR. F. A. KLOPPERT, who has been managing director of Philips' works at Blackburn since last February, has been appointed production director of the firm's English organisation and takes up his new duties on January 1. His successor will be Mr. C. De Wit, who was for ten years on the financial executive of the firm's English organisation. The Blackburn works were visited last week by Mr. F. J. Philips, of Eindhoven, Holland,

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

son of Dr. A. F. Philips (president and founder of the Philips organisation).

VISCOUNT FALMOUTH, head of the Fire Research ("F") Division, D.S.I.R., and a past president of the E.D.A., is chairman of the Fire Research Board which has been appointed jointly by the Department of Scientific and Industrial Research and the Fire Officers' Committee. Among the members of the Board are Dr. S. F. Barclay, head of the research department of Mather and Platt, Ltd., and Dr. P. Dunsheath, consulting engineer and director of W. T. Henley's Telegraph Works Co., Ltd.

SIR ROBERT WATSON-WATT, Scientific Adviser on Telecommunications to the Air Ministry, gave a lecture in French on "Radar," under the auspices of the British Council, in Paris, on December 18. He used the British radar section of the U.N.E.S.C.O. exhibition to illustrate the lecture. This was the first of a series of lectures by eminent British scientists being arranged in Paris by the British Council in co-operation with French organisations.

MR. JAMES LOTHIAN, formerly the assistant traffic superintendent at the G.P.O., Edinburgh, is now with U.N.R.R.A. in Yugoslavia, having been lent by the Post Office to the U.N.R.R.A.



MR. JAMES LOTHIAN, telecommunications specialist at U.N.R.R.A. presentation of a radio-telegraph transmitter to Yugoslav Ministry of Posts

Yugoslav Mission as industrial rehabilitation specialist for telecommunications. The photograph reproduced on this page was

taken at a recent ceremony near Belgrade to mark the handing over by U.N.R.R.A. to the Yugoslav Ministry of Posts of a 5 kW radio-telegraphy transmitter, type TFS 31, manufactured by the Marconi Wireless Telegraph Co., Ltd., Chelmsford. This transmitter will provide Yugoslavia with the first reliable international telegraphic link it has had since the war with such places as London and Moscow. The chief radio engineer, M. Svetozar Simic, is seen on the left of the picture.

SIR EDWARD WILSHAW, chairman and managing director, and the following directors and officials of Cable and Wireless, Ltd., will vacate their offices as a result of the acquisition by the Government of the shares of the company: Joint managing directors: The Hon. Jocelyn Denison-Pender, Mr. R. E. Luff. Directors: Mr. E. G. Brooke, Lord Courtauld-Thomson, Lt.-Col. Ivor Fraser, Mr. A. H. Ginman, Admiral H. W. Grant, Lord Inverforth, Brigadier H. J. Lenton, Hon. George Peel, Sir Harry Twyford, Sir John Wardlaw-Milne. Officials who are members of the board of management: Mr. J. U. Burke, assistant secretary; Mr. W. G. Edmonds, staff manager; Mr. H. W. Grove, traffic manager; Mr. W. G. R. Jacob, engineer-in-chief; Mr. E. K. Jenkins, secretary; Mr. F. H. Maitland, assistant secretary to board of management. Other officials: Mr. D. L. Flexman, contracts manager; Mr. A. Sabater, joint deputy traffic manager; Mr. J. H. Hannigan, deputy staff manager.

Obituary

MR. G. WUTHRICH, general manager and chief engineer of Oerlikon, Ltd., on December 16. Mr. Wüthrich came to London at the turn of the century and during the intervening years devoted the whole of his boundless energy in an outstanding manner, to the service of his firm. He was a member of the I.E.E. The cremation took place on December 20. at the Golders Green Crematorium.

PROF. PAUL LANGEVIN, the French physicist, in Paris, aged 74 years. He was well known in England, having studied at the Cavendish Laboratory under J. J. Thompson. During the 1914-18 war he worked at Harwich on methods of submarine detection. An authority on the ionisation of gases and on relativity, he made an international reputation by pioneer work in the electron theory of magnetism. For this he received the Copley Medal of the Royal Society in 1940. Recently he had acted as an adviser to the French Atomic Energy Commission, and had worked on nuclear fission.

MR. R. N. VYVYAN, formerly engineer-in-chief of the Marconi Company and one of the early pioneers of wireless, at

Falmouth on December 14, aged 70 years. Mr. Vyvyan joined the technical staff of the Marconi Company in March, 1900. He supervised the erection of the Poldhu station for the first transatlantic experiments, also built the famous wireless station at Cape Cod, and, later, that at Glace Bay, Canada, which for some years was the western link in the first regular transatlantic wireless service. At that time he was managing engineer in Canada for the company. In 1909 he was made superintending engineer of the company. He then conceived the idea of an Imperial wireless chain, a project with which he became so intimately connected. Mr. Vyvyan was associated with Marconi and Franklin in the development of the short-wave beam system used in the Imperial wireless stations and was responsible for the construction and engineering design of those stations. Mr. Vyvyan was appointed engineer-in-chief of the Marconi Company in 1923 and consulting engineer in 1932. From 1930 till 1932 he also held the position of joint engineer-in-chief of Imperial and International Communications, Ltd., which became Cable and Wireless Ltd. He retired in 1936.

Educating Engineers

THE aims of engineering education and methods of selecting young people for higher technical training were among points discussed at a meeting of the Engineers' Guild, on December 18. Opening the discussion, Prof. C. L. Fortescue began with a definition. The real function of education of any kind, he thought, was to give the individual opportunity to develop his faculties to a maximum, in order to make the greatest contribution to the welfare of the community. In view of the capital involved in training a man to the highest standard, the greatest care should be exercised in selection. The professional engineer, he thought, might well do the same early training as the semi-skilled man. He did not agree with the attitude of some sections of industry, which appeared to seek men likely to give quick returns, rather than those with the best brains. Concluding, Prof. Fortescue said that those who failed examinations were not necessarily bad engineers, and they should be given other opportunities. Indeed, a major problem to-day was overcoming the feeling of frustration among those who would never reach the higher positions. Among speakers who took part in the discussion, Dr. L. E. C. Hughes emphasised the importance of a thorough knowledge of the "fundamentals." There was scope, he thought, for training for higher administrative positions.

Electricity Consumption

Requirements of Statutory Order—Birmingham Proposal

AS foreshadowed in *THE ELECTRICIAN* of December 13, and after a review of the prospects of fuel supplies for industry during the coming winter, the Ministry of Fuel has issued S.R. and O. 2087, which will apply to every industrial consumer and also to every non-industrial consumer, which normally consumes more than 130 000 units annually.

The scheme will take the form of a Statutory Order requiring industrial consumers to restrict their consumption of electricity in the 4-weekly period beginning December 30, and in each of the two following 4-weekly periods. The object of this order is to secure that consumption of electricity by industrial undertakings as a whole during each of these three 4-weekly periods shall not exceed in the aggregate, consumption in the 4-weekly period immediately preceding a meter reading made early in December, 1946.

It is recognised, however, that owing to changes in the volume and character of output, process changes, weather variations, etc., it would not be equitable rigidly to restrict every undertaking to its actual consumption in the base period. The order accordingly provides that consumption in each of the three 4-weekly periods shall be reduced by 2½ per cent. below the base level. At the same time, arrangements will be made by which the savings in electricity secured by this 2½ per cent. reduction will be made available for assisting on an *ad hoc* basis those firms whose consumption it would be unreasonable to restrict so severely. Applications for such *ad hoc* assistance should be addressed to the Regional Controller of the Production Department concerned and should be accompanied by evidence supporting the claim.

CHECK BY METER READING

The Statutory Order will also require each consumer to read its electricity meters weekly, to keep a record of those readings and to hold that record available for inspection.

Proposals for reducing consumption and to prevent more severe restrictions before the end of the winter, have been sent by the Birmingham Electric Supply Committee to the Minister of Fuel. These are: (1) The restriction on industrial and commercial establishments to be increased for-wth, preferably by a Government Order requiring them to be closed for approxi-

mately one day per week, the closed day to be staggered so as to produce uniform reduction throughout the working week. This would, in addition to saving fuel, reduce the risk of load shedding due to plant shortage. (2) An immediate Government Order requiring all domestic consumers to exercise the most rigid economy and imposing penalties in every case of unnecessary or wasteful use of electricity. (3) An immediate Government Order prohibiting all retail sales of domestic electrical heating apparatus, except where covered by medical or priority certificates.

FUTURE DANGERS

"These suggestions are exceedingly drastic," the Committee says, "but it must be emphasised that, in the light of the information at present available to this undertaking, any lesser restrictions or any delay in their application can only lead inevitably to even more severe restrictions before the winter is over."

The Committee, in a statement issued last week, refers to S. R. and O. No. 2087, and points out that by its application the overall saving in coal likely to be effected by the Birmingham undertaking, it is estimated, would be about 3 per cent. to 4 per cent.

The fuel position with which the undertaking is faced, the statement continues, is that, if the present rates of coal delivery and consumption are maintained, then, in the light of experience in previous winters, the coal stocks will be completely exhausted by about the end of January, and from that time until the end of March the undertaking will be entirely dependent on deliveries and, without stock, will be unable to generate more than about 75 per cent. of the current required to meet the demand.

Since October 1, it had been necessary to draw more than 47 000 tons of coal from stock and the present actual stock position is at least six weeks below the programme.

In the absence of any assurance of immediate and substantial increased coal deliveries, it is evident that the restrictions brought about by the Order are totally inadequate, and more drastic restrictions are imperative. It is estimated that an overall restriction in consumption of approximately 12½ per cent. beginning at January 1 is needed locally to avoid any greater enforced reduction during any week up to March 31.

Domestic Fuel Policy

Supply Industry's Memorandum on Simon Report

MANY of the recommendations made by the Fuel and Power Advisory Council, under the chairmanship of Sir Ernest Simon, in its Report on Domestic Fuel Policy, are criticised and opposed in a memorandum issued by the Electricity Supply Industry, giving the observations of a committee appointed by the Electricity Supply Joint Committee (representative of all municipal and company electricity supply undertakings in Great Britain) and by the Council of the British Electrical Development Association, to consider the report. The chairman of the Committee was Mr. Leslie Gordon, clerk and solicitor to the London and Home Counties J.E.A.

A good deal depends, states the Committee, in the consideration of the report of the Advisory Council, upon the formulæ used in arriving at the comparative statements of the various efficiencies referred to in the definitions, and how those formulæ are built up. The electricity industry challenges the formulæ, and the conclusions based upon them.

PUBLIC PREFERENCE

It is contended that it came within the terms of reference to the Advisory Council to give attention to the trend of public opinion, and that the evidence submitted by the Electricity Commissioners and by the electricity supply industry left no doubt upon that point. Further evidence of this trend of public choice in favour of electricity is quoted.

The industry agrees with the summary of objectives and many of the recommendations forming Chapter XV of the Advisory Council's report, if amended to give effect to the industry's observations. The objectives are in fact the recognised aims of the electricity supply industry, namely: (a) To ensure good standards of heating in the house; (b) to ensure low costs and more convenience for the Householder; (c) to secure national fuel economy; (d) to ensure smoke abatement.

"Since electricity is admittedly the only medium which can be used as the sole source of all lighting, heating, cooking, water heating, refrigeration, mains radio, vacuum cleaning and all other power requirements on domestic premises," states the Memorandum, "the supply industry suggests that, consistent with the preservation of freedom of individual choice, a more realistic line than that suggested by the Advisory Council would be for the industry and the Government to combine in an effort

to ensure the widest possible use of electricity for all purposes at a price which would enable all domestic users to take advantage of the service. The Advisory Council appears to have overlooked the fact that, in regard to generation, distribution, new and approved appliances, and methods of use and control, electricity is still passing through a rapidly moving evolutionary stage. The nature of the supply of electricity will remain unaltered for all foreseeable time, but the methods of producing, distributing, and using it will alter and improve. In these circumstances, it is not a sound policy to commit the housing programme of the country to a system of heating which may shortly become completely out of date."

Comments upon the recommendations of the Advisory Council are given below.

HEATING APPLIANCES

On the proposal that the Government should encourage the production of improved heating appliances for all fuels and for all domestic purposes, and that it is particularly important to develop multi-fuel appliances to burn efficiently and as smokelessly as possible both bituminous coal and smokeless solid fuels, the comment is that the use of solid fuel should be reduced to a minimum, to avoid costs of transport, refuse disposal, domestic labour, internal decoration and material deteriorations, and atmospheric pollution by smoke. It is suggested that the first place should be given to developing heat appliances using electricity.

AN OBJECTIONABLE PROPOSAL

Strong objection would be taken to the proposed free issue of solid fuel appliances by the Government as part of the subsidy in subsidised houses, unless corresponding arrangements were made in respect of electrical apparatus designed for the same purpose. The principle of free issue of special heating appliances purchased with taxpayers' money is deprecated.

The proposal that the main winter space and water heating load should be taken by solid fuel, is not acceptable on the grounds that it involves greater costs in connection with the construction of premises, transport and handling of fuel, the disposal of waste and continued atmospheric pollution; in addition, it unduly limits the use of electricity, and disregards present and future developments.

Objection is taken to the proposal that intermittent space and water heating for short periods should be taken by gas and electricity on the ground that its application in practice on anything like a national scale may prejudice the most effective use of electricity for all purposes throughout the country. A deliberately restrictive policy is not in the best interests of the consumer or the nation.

FREE COMPETITION WELCOMED

On the recommendation that subject to the above proposals, the domestic heating field should be left for free competition between the various fuels, the comment is: There is no objection to free competition with other fuels over the whole sphere, but objection is taken to competition being limited to a sphere which might have the effect of creating a situation in which the industry could not provide the maximum benefit which would be possible under free competition.

The recommendation of the Advisory Council with regard to the division of the load between different fuels, if put into effect states the Memorandum, would render the carrying out of the recommendation that the ultimate objective should be to lay on electricity to every house, even in thinly populated rural areas, more difficult, if not impossible, from a financial point of view, and thus prejudice the fuller rural electrification policy which the industry is actively pursuing and which it is the expressed intention of the present Government to support.

The observation on the suggestion that the Government should encourage the largest practicable increase in the production of smokeless solid fuels suitable for domestic purposes, is that the administration of the coal industry in such a way as to limit the development of the electricity supply industry would be a retrograde step, and inimical to the prosecution of a full production policy in industry and a full amenity policy in the home.

PRICE CONTROL

As to the proposal that free competition should continue between gas and electricity for domestic heating, subject to the condition that the prices charged should be appropriately related to costs, the comment is that if the recommendations of the Advisory Council with regard to solid fuel are carried into effect, free competition is impossible for electricity and gas, while the prices charged are already regulated by the Ministry of Fuel and Power to safeguard the consumer. In these circumstances the industry would strongly object to any outside authority having

jurisdiction over prices as a basis of competition.

Objection is taken to the proposal that the outcome of the competition between gas and electricity and the influence exercised by the system of tariffs upon the progress of the two industries should be kept under constant examination. "It does not seem," comments the industry, "that the observations contained in the report upon tariffs are relevant to the terms of reference to the Advisory Council. If, however, they should be deemed to be relevant, the industry wishes to place on record its disagreement with the method of putting the case regarding electricity supply tariffs as set out in Appendix IV to the report. The history of the electricity supply industry is in itself sufficient to answer the queries raised in the report."

It is suggested that only by the most extensive use of electricity can that part of the recommendation which refers to standards of heating being provided "at the lowest possible cost" be realised.

The industry does not object to houses having a flue suitable for solid fuel appliances in the living room, but objects to the limitation with regard to other rooms. This limitation imposed upon electricity services is contrary to the codes already suggested by the Ministry of Health, the Ministry of Works and other Government departments.

INFORMATION CENTRES

With regard to the proposal that the Government should establish information centres in London and in other principal cities in the regions, with skilled staffs of heating engineers, architects and scientists, and with showrooms, where examples of all the best types of appliances could be seen, the comment is that the electricity supply industry is of the opinion that these services, which are, in fact, already provided to a large degree by the individual industries concerned, should remain the responsibility of those industries. In the interests of economy and efficiency some degree of co-ordination may prove to be desirable. It is considered that the activities of any centres should not be directed by the Government. They should be of an explanatory nature in order that the largest measure of healthy competition may be preserved and a free choice to the consumer ensured.

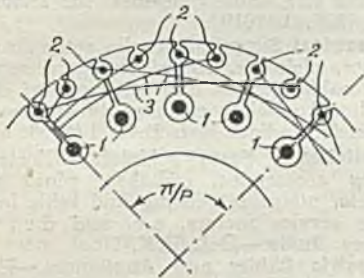
The Memorandum has been sent to the Prime Minister, the Chancellor of the Exchequer, the Ministers of Works, Health and Supply, the President of the Board of Trade, Members of Parliament and officials of local authorities, official electrical associations and organisations of architects and builders.

Electrical Inventions

Squirrel-Cage Rotor

A squirrel-cage motor, of conventional construction, is described, in which the rotor has a starting winding of low reactance and high resistance, while the running winding is of high reactance and low resistance. The running winding is accommodated in holes at the bottom of every second slot, and the starter winding lies in holes near the outer end of each slot.

The bars of the starting cage winding which lie radially outside the running cage bars, it is stated, carry a smaller current than the other bars of the starting winding. This not only reduces the effective heat capacity of the starting cage, but also produces thermal



stresses in the parallel connected bars, which expand differently owing to the difference in current flowing in alternate bars.

The arrangement suggested is shown in the drawing. There is a running cage bar 1 at the bottom of every second slot and a starting cage bar 2 near the outer end of each slot. All the starting cage bars are connected to a ring at one end of the rotor only. At the opposite end, each starting cage bar lying in a slot containing a running cage bar lying in a slot containing a running cage bar is connected, by an overhung end construction 3, to the corresponding end of a starting cage bar one pole pitch away and in an unoccupied slot. By this means, the normal slot arrangement can be used, and the resistance of the starting cage includes the overhanging end connections, thus increasing the heat capacity of the winding. The rotor currents in corresponding slots are fully equalised.

General Electric Co., Ltd., and E. Friedlander. Application date, July 12, 1944. No. 582 063.

Self-Excited Alternator

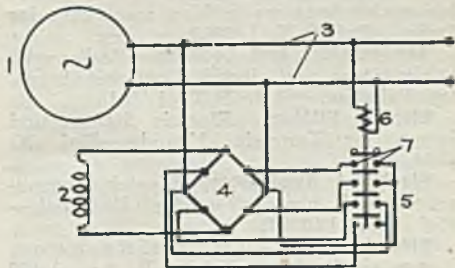
In the type of alternator in which the d.c. exciting current is derived from the alternator output through a rectifier circuit

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

composed of dry-plate units, difficulty may be caused by the fact that the resistance of such rectifiers to small voltages is much greater than their resistance to larger voltages. The exciting current may, therefore, not be maintained at a sufficiently high value at low output voltages.

In the example described, an alternator 1 has its field winding 2 excited from the output through the bridge rectifier circuit 4. In each arm of the bridge are several dry plate rectifiers connected in series, the external connections being such that some of the elements can be short-circuited by the relay 5.

The operating winding 6 of the relay is connected across the circuit 3 and four pairs of contacts 7. Being responsive to the a.c. output voltage, the relay closes the contacts 7 at low voltages and opens them when the output is high. The prin-



ciple on which the invention depends is that the rectifier need not be able to withstand a voltage higher than that to which it is momentarily exposed and that, if a number of elements is connected in series, both the rectifier resistance and the voltage it will withstand increase as the number of elements is increased.

If the rectifiers are connected to the alternator output through transformers, the relay 5 may be used to vary the transformer tapping ratio.

General Electric Co., Ltd., and E. Friedlander. Application date, March 13, 1942. No. 582 086.

Inquiries from Overseas Buyers

OVERSEAS readers of *THE ELECTRICIAN* who wish to import goods manufactured by British firms in the electrical and allied industries are invited to write to *THE ELECTRICIAN*, Bouverie House, 154, Fleet Street, London, E.C.4, giving details of the equipment in which they are interested and quoting bankers' references, and, where possible, the names of their British purchasing agents. Details of their requirements will then be inserted for a period in this section under a reference number, free of charge. The section appears in the last issue of each month.

REPLIES to these inquiries should be enclosed in separate envelopes, bearing the reference on the top left-hand corner, the remainder of the envelope being left blank for insertion of the buyer's name and address, and should be enclosed in a covering envelope addressed to *THE ELECTRICIAN* at the above address. Stamps to cover Foreign or Dominion and Colonial postage must be affixed to replies.

On request, regular advertisers will be furnished with the names, addresses and, where known, the references and purchasing agents of any of those readers to whom they wish to forward catalogues or letters. Stamped addressed envelopes should accompany applications for this information.

Electric Pump.—Electric pump for Ceylon.—Ref. B.X. 1/3024.

Electric Motors and Appliances.—Electric motors, electrical domestic appliances, for Delhi, India.—Ref. X. 2072.

Electrical Goods.—Radio sets, electric refrigerators, cooking stoves and fans, for Arabia.—Ref. B.X. 1/3033.

Domestic and Dairy Appliances.—Electric water heaters; milking machinery for India.—Ref. B.X. 1/3013.

Refrigerators and Cookers.—Radio sets, refrigerators, and electrical cooking stoves, for Palestine.—Ref. B.X. 1/3015.

Electrical Fittings.—Electric fittings and lamps, for Kampala, Uganda.—Ref. X. 2004.

Electrical Appliances.—Electrical appliances and accessories, for Baghdad.—Ref. B.X. 1/3027.

Electric Motors.—Fractional H.P. motors, $\frac{1}{2}$ H.P. single-phase, 220-240 V. a.c., 1 450 r.p.m., impulse start, for Australia.—Ref. B.X. 1/3011.

Cookers, Irons and Kettles.—Electrical appliances (irons, stoves, cookers, kettles, boiling rings), for Singapore, Straits Settlements.—Ref. X. 2002.

Domestic Appliances.—Table electric fan, electric irons, domestic electric appliances and electrical goods, for Jullundur City, India.—Ref. X. 2035.

Electric Equipment and Tools.—Batteries, radio sets, refrigerators, electrical equipment, electric tools and Diesel engines, for Baghdad, Iraq.—Ref. X. 2082.

Lighting Equipment.—Electrical appli-

ances of all types, fluorescent lighting, and small Diesel-electric light plant, for Nyasaland.—Ref. B.X. 1/3034.

Electrical Fittings.—Electrical fittings, including switches, holders, fans, lamps, bulbs and wire; radio sets, irons, for Kenya Colony.—Ref. B.X. 1/3035.

Electrical Equipment.—Ceiling and table fans, water heaters, refrigerators, boilers, lifts, centrifugal and well pumps, lighting sets and generators, for India.—Ref. B.X. 1/3019.

Electrical Supplies.—Radio sets, gramophones, pick-ups, record changers, amplifiers, cables, bulbs and all types of electrical and wireless equipments and accessories, for India.—Ref. B.X. 1/3023.

Switches, Fans, Meters.—Electrical wiring accessories, switches, plugs and sockets, adaptors; ceiling and table fans; house service meters, a.c. and d.c., for Lahore, India.—Ref. E.X. 20.

Electric Cables and Appliances.—Electric cables and appliances, mining machinery, tools, belting, etc., required by mines, railways and industries, for Southern Rhodesia.—Ref. E.X. 21.

Electrical Appliances.—Electric fans, irons, cookers, water heaters; electric table, ceiling and wall lamps; electric lamps and glass shades; electric cables and wires; electrical household accessories; radio receivers; electric torches, dry cells, batteries and spotlight bulbs, for Port Louis, Mauritius.—Ref. X. 2083.

Electric Motors, Switchgear, Cables.—Electric motors, 3-phase, 50 cycles; low tension circuit-breakers, 100-1 200 A, and ironclad unit type industrial switchgear, 15-200 A; cables and wires; conduit and fittings, wiring accessories; time switches (electrically-wound), domestic appliances; nurses' call and inter-communication systems, for Palestine.—Ref. E.X. 19.

Refrigerators, Plugs, Switches, Appliances.—Refrigerators, commercial freezing plants, brass lamp-holders, circuit-breakers, 5 A 2-pin plugs (20 000) Bakelite switches (20 000 5 A), desk fans, ceiling fans, auto-control irons, convertograms, electric kettles, electric roasters, electric toasters, electric hair dryers, other electrical appliances and accessories, for Bombay.—Ref. E.X. 17.

Book Reviews

Irish Electrical Review and Handbook, 1946 (Dublin: the Parkside Press). Pp. 152, inclusive of Appendices and Index. Price 5s. net.

Electrical contractors, and others, whose business requires a knowledge of the electrical industry in Eire, will find in the present volume a useful work of reference. After a brief history of the development of electricity supply in Eire—in which the Erne and Shannon hydro-electric schemes played an important part—the book gives details of the capacity and plant of the country's generating stations and describes the type of transmission equipment normally employed. The usual generating voltage is 10 kV, at 50 cycles: long-distance transmission is carried out at 110 kV and the secondary distribution is at 38 kV and 10 kV. Consumers' supply is available at 380 V for power and 220 V for domestic purposes. This section of the book ends with statistical data showing the number of consumers and the power loading in most Irish towns. Some useful tables of electrical imports and exports are to be found in the chapter on electrical trade, which contains also a directory of the larger importing concerns.

A Plan for Kingston-upon-Hull. Prepared for the City Council by Sir Edwin Lutyens and Sir Patrick Abercrombie. (Hull: A. Brown and Sons, Ltd.). Pp. 92, with 13 folding maps and 46 plates. Price 15s. net.

Of Hull's 80 000 houses, 3 324 had been completely destroyed by the end of the war, and there had been a total of 114 738 reported damages. There was, in addition, need for an immediate slum clearance, estimated at 5 900 houses. In the centre of the city, nearly half the principal retail establishments were destroyed, while in the industrial areas, two out of every three flour mills and a slightly better proportion of other factories had been completely demolished. So rapid was the growth of the city during this century that some form of replanning had become desirable, even before the war. The bombs did not so much create the problem as precipitate it—and, more important, make it possible to conceive a far more comprehensive scheme than could otherwise have been contemplated. A civic survey had already been completed, under the direction of Mr. Max Locke, by a group of planners and experts, in 1943, and a mass of valuable statistical material was available when the Hull Reconstruction Committee called in the services of the late Sir Edwin Lutyens and Sir Patrick Abercrombie to draw up

a plan for the city. Their work was completed in 1945, and this book is the first tangible result. The Plan is divided broadly into sections. The historical background of the city, from its first Charter in 1299 to the present, is first described, and the objects of the Plan are then outlined. Subsequent chapters examine in detail the special problems, hinging always upon preserving and improving the present port facilities, of new residential and industrial areas, schools, open spaces, communications and the almost countless factors which have to be considered in integrating the amenities of a city to serve the best interests of some 300 000 people. Many changes will doubtless be necessary in the details of the Plan before rebuilding is complete: meanwhile, it stands as a courageous monument to its chief designers, which will ultimately make Hull not only a pleasanter, but—possibly more important in the coming years—a more efficient industrial centre. In conclusion, a word of congratulation should be said to all those responsible for the production of this striking book. With its fine coloured maps and numerous photographs it is in every way worthy of its important subject.

The Practical Electrician's Pocket Book. Edited by ROY C. NORRIS. (London: "Electrical and Radio Trading.") Pp. 486. Price 4s. 6d. net.

The 1946/7 edition of this useful book appears with several new features, among which are sections on lighting with fluorescent tubes, large-scale catering installations, electronic instruments and the uses of electricity in horticulture. Many of the customary chapters, such as the summary of wiring regulations and notes on generators, motors and electric welding, have been brought up to date while, on the practical side, hints are given on the rewiring of small motors and the servicing of refrigerators. After 400-odd pages, in which guidance on almost any installation or maintenance problem can readily be found, the book concludes with a table showing the supply voltages, etc., of local undertakings in the United Kingdom.

The recent formation of an amateur angling association as a sub-section of the Ekco Social and Sports Club has met with popular support and already more than fifty of the firm's anglers have become members. Membership is open to ladies, and wives can accompany their husbands. A programme of sea and fresh water meetings has been arranged.

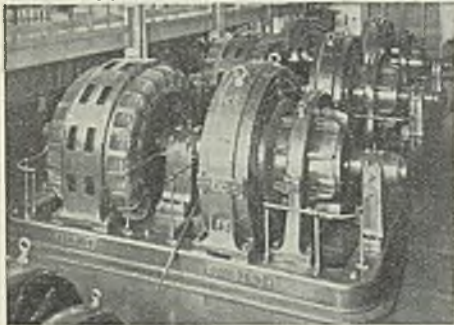
What Manufacturers are Doing—I

Meeting Overseas and Home Demands — New Developments

DURING the last year Bruce Peebles and Co., Ltd., received heavy demands for large rotating electrical plant and power transformers, and for all kinds of motors. Exports continued to expand and considerable orders from each of the Dominions, from India, and from foreign countries figured prominently in the company's activities.

Conspicuous among orders for rotating machines was the contract for the complete generating plant for the Loch Fannich (Ross-shire) scheme of the North of Scotland Hydro-Electric Board, comprising two 16 000 B.H.P. Francis turbines for operating on a water head of 500 ft., coupled to 10 000 kW, 11 kV, 500 r.p.m. vertical shaft alternators, complete with all accessories and auxiliary equipment. The company was also given the contract for two 300 kW vertical shaft alternators driven by Kaplan turbines operating on a water head of 16 ft. for the Loch Morar scheme (Inverness-shire) of the Board. Numbers of service alternators are being supplied for use on various water power development schemes of the same authority.

The company has developed four general types of alternators with varying methods of cooling to suit local conditions. They are: Open and air-duct ventilated types; enclosed type with air filters embodied in the machine; and totally enclosed air-circuit type with water coolers forming an



2 500 kW motor converters, made by Bruce Peebles and Co., Ltd., in an Indian municipal station. Six 1 500 kW sets for the same authority are on order

integral part of the machine. The last two are of special interest because installation costs are lower with the avoidance of excavations for basement air ducts. Export orders included a 3 750 kW machine for Colombia and some of smaller capacity

for Australia, South Africa, and India; and among home requirements are three 1 750 kW machines for a fertiliser factory, and a 2 500 kW set for a textile mill. Orders received, or completed, for converting plant included six 1 500 kW motor con-



A 150 kW marine type d.c. generator for a floating dock. Disc lubrication is provided to meet tilting conditions

verters and a 1 000 kW rotary converter for electricity supply authorities in India.

The call for motors and associated control gear for industrial electrification showed a considerable increase. There were also increased demands for marine motors for shipboard requirements, and for flameproof motors for the mining industry. Orders for export included two 900 B.H.P. slow-speed induction motors capable of exerting a starting power of 2 000 B.H.P. for driving tube mills in an Australian cement works; two 700 B.H.P. slow-speed synchronous induction motors for driving compressors at a West African gold mine. A development in induction motor design was a new type of squirrel cage rotor construction positively securing the motor bars in the slots and obviating the possibility of vibration of the windings, with associated noise, during the starting cycle, and ensuring secure axial anchorage of the complete "cage."

Orders for transformers from a few kVA up to the largest sizes for voltages up to 132 kV broke all previous records and the volume of work completed in 1946, or on order, may be judged by the total of about 750 000 kVA.

An important extension to the large transformer shop was put into commission during the year for the manufacture of coils of all types, from the smallest to the largest sizes.

There has been an increasing demand for mobile oil-immersed rectifiers, which the company recently developed, for charging batteries on mine electric cars underground.

Future of Pulverised Fuel

American "Cyclone" Furnaces and Other Plant

A PAPER on "The Future of Pulverised-Coal Firing in Great Britain," by C. H. Sparks (Babcock and Wilcox, Ltd.), was submitted for discussion at a joint meeting of the I.E.E. and the Institution of Mechanical Engineers, on December 19.

After reviewing the history of this method of firing, the author said that a major reason for the impetus which had brought it from the experimental to the practical stage, in the United States in particular, was the steady increase in coal prices during and immediately subsequent to the war of 1914-1918.

Pulverised-fuel firing could be successfully applied over the full range of sizes normally used in power-station work, but where fuel conditions were favourable, travelling grates competed at any evaporations up to 250 000 lbs./hr., and retort-type stokers were in some cases employed for slightly higher outputs. In power stations, units would not be much less than 150 000 lbs./hr., and the largest units so far foreseen did not much exceed 500 000 lbs./hr. evaporation.

After showing a table demonstrating the increasing percentage of fuel used in pulverised form, Mr. Sparks said that the real reason for the upward trend was that the pulverised-coal-fired boiler unit had a proved reliability at least as satisfactory as that of the best stoker. Among the many advantages of the method in dry-ash bottom furnaces, there was no doubt that the fortuitous freedom from the formation of bonded deposits on the boiler superheater and economiser pressure parts had been one of the most important. A smaller margin of stand-by plant was generally acceptable, and a number of new installations were being designed as units with only a single boiler delivering steam to a 30 000 or 50 000 kW turbo-generator.

IMMUNITY FROM FOULING

The immunity of powdered-fuel-fired boilers from fouling of their heating surfaces had been the subject of much investigation, and, in particular, it had been established that the distillation of incombustible volatiles took place from the high-temperature coke zone. In the dry-ash bottom furnace, because of the speed of reaction, little if any of these incombustible volatiles was driven off from the ash particles.

After defining the object of boiler design as the simplest method of liberating all the heat in the fuel at a uniformly high

rate, irrespective of its quality, and to reduce the ash to a condition at which it might be handled and disposed of with the minimum expense, Mr. Sparks said that he would trace the journey of the fuel through the system. At the present time, owing to shortages, power stations had little or no choice of the coals which were delivered, many of which were of lower heating value and considerably higher ash content than the design conditions provided for.

DIRECT FIRING FAVOURED

With regard to the size of coal delivered, the upper limit was of no importance, but excessively fine fuel could cause considerable difficulties. All fuel supplied should be in such a condition that it would feed itself by gravity down the chute, but unfortunately this rule had been, and was likely to continue to be, transgressed. Once a satisfactory method of drying the fuel had been established, changes took place in the layout of the milling equipment, some favouring the direct-firing and others the semi-direct firing system, from which the drier was finally eliminated. With few exceptions, new users as well as the majority of those with the longest experience selected direct-firing for their new plants on account of its simplicity.

Pulverisers at present available, the author continued, were divided into three main types. High speed mills reduced the fuel by impact, and largely by attrition of the particles in suspension by means of revolving beaters and paddles, and were usually employed for the direct firing of small boilers. Low speed mills, which reduced the coal by impact and crushing, as well as by attrition of a ball charge cascading and floating within a revolving cylinder, were specially suited to handling unduly hard or abrasive coals. The medium-speed mills employed crushing or grinding means, and were suitable for all coals except those of an extremely hard or abrasive character.

Fans were employed with all three types of pulveriser to pull, and in some designs to push, the hot air through the system. In direct firing, the hot air provided, in addition to the drying medium, the means of lifting the fine particles from the grinding zone and it finally played an important part in the combustion process.

Before undertaking the design of a pulverised-fuel-fired boiler, a great deal of information was required respecting the coals which were likely to be fired, particu-

larly in regard to the volatile and the ash contents. With anthracite coals, the ignition-temperature was high, but with the higher-volatile coals, it was low, and little difficulty was experienced in maintaining stable ignition over a wide range of load. The success of any combination of burners and furnace depended on the ability to complete the combustion of the fuel particles with the minimum of carbon loss, in conjunction with the maintenance of trouble-free ash disposal. The completion of combustion and the flexibility of the furnace depended on the maintenance of sufficient temperature to ensure stable ignition, the mixing of the required weight of air with the fuel and sufficient time to permit the largest particles to be completely consumed.

EXCESS AIR

The author then considered in some detail other factors of boiler design and the problem of slugging, and then turned to excess air. The requirements were, he said, to exclude all air which might find its way by infiltration in the setting, and secondly to use as much air as possible, compatible with satisfactory efficiency and furnace temperature, so as to offset the tendency to slugging in dry-ash bottom furnaces.

One of the problems of ash disposal was of finding some method of using the large quantity of this troublesome residue—which might soon reach a million tons annually. In view of its selection as the means of burning all fuel which could not be disposed of by other methods, pulverised fuel was faced with a testing time. Ash was the enemy of pulverised coal, both inside and outside the furnace; it was, therefore, with misgiving that those who had been longest associated with this development faced the threat of coals of still poorer quality.

Saying that many attempts had been made to burn pulverised coal in a confined space, each of which had been doomed to failure on account of the ash disposal or high carbon losses, Mr. Sparks next spoke of the cyclone furnace. This equipment, he said, had been evolved by the Babcock and Wilcox Co., of New York, after experiments for fifteen years in the firing of crushed, as opposed to pulverised, fuel. It aimed to reduce the whole of the ash to a fluid state, so that it could be quenched and reduced to a solid state for disposal, thereby obviating the necessity for cleaning the boiler surfaces externally and, incidentally, eliminating all fly-ash and carbon losses.

In operation, a special crusher broke down the coal, aided by heated primary air, to pass a four-mesh screen. The stream was delivered tangentially into the scroll

of the air inlet, the fuel particles being directed on to a molten film of ash, where they burned out rapidly. The gases generated left through a throat situated in the vortex, while the fluid slag ran forward to a tap hole and discharged into a secondary furnace.

In operation, an experimental boiler had so far been free from trouble, and boiler units arranged with a series of cyclones discharging to the main furnace chamber were already foreseen and might be in operation before many years had elapsed.

After describing the requirements of overfeed firing with spreader stokers, a method which, he said, seemed likely to enjoy a new era of popularity, as it seemed to fulfil the important conditions required of a universal means of fuel burning, Mr. Sparks summed up his paper. He foresaw that the pulverised-coal-fired boiler would suffer in availability as fuel conditions deteriorated. Nevertheless, it seemed probable that this method of firing must continue to maintain its place of importance, particularly for the disposal of all coal too fine for burning in a crushed, as opposed to a pulverised, state. Overfeed fired boilers could already meet power station requirements for moderate capacities between the limits of 75 and 150 tons evaporation per hour, whilst cyclone-furnace-fired boilers might overlap and eventually take care of any larger capacities which might be required.

The Electricity Bill

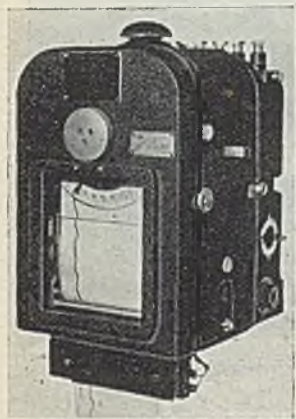
On December 20, the last day before the Christmas recess, the Electricity Bill was presented to Parliament in dummy form, and given a formal First Reading. The full title reads: "To provide for the establishment of a British Electricity Authority and Area Electricity Boards and for the exercise and performance by that Authority and those Boards and the North of Scotland Hydro-Electric Boards of functions relating to the supply of electricity and certain other matters; for the transfer to the said Authority of any such Board as aforesaid of properties, rights, obligations and liabilities of electricity undertakers and other bodies; to amend the law relating to the supply of electricity; to make certain consequential provision as to income tax; and for purposes connected with the matters aforesaid."

The Bill was presented by Mr. Shinwell, and supported by Mr. Morrison, the Chancellor of the Exchequer, the Attorney-General and Mr. Gaitskell. The full text is expected to be published in the second week of January, and the Second Reading is fixed for Tuesday, January 21.

Equipment and Appliances

Marine Echo Sounder—New Radio Set

CONSIDERABLE attention was paid to the London demonstration of the Hughes Admiralty supersonic recording echo sounders, about 500 of which have



Display unit of echo sounder, with sea-bed contour visible on the recording strip

recently been fitted, as a means of locating fish-shoals, on trawlers and drifters. Many thousands of these instruments, in addition, were used on Allied naval vessels during the war. The device employs two magnetostriction oscillators, one for transmission and one for reception, mounted within or outside the hull of the ship. At time intervals governed by a rotary switch, a condenser discharge is fed to the transmitting oscillator, causing a pulse of supersonic energy to pass out through the water to the sea-bed. At the same time, a recording stylus commences a sweep at even speed, across a sheet of electro-sensitive paper. The echo pulse, returning from the sea-bed after a time proportional to the depth of water, is received at the second oscillator, amplified, and applied as an electric current to the stylus, which leaves a sepia mark on the recording paper. Successive marks on the slowly moving paper form into a continuous chart, showing variations in depth to within fine limits between 0—500 fathoms. The latest model, type M.S.20, permits readings of depth to be made direct from a rotating scale, and has half the speed of paper travel of earlier types. The instrument is marketed by Marine Instruments, Ltd., of Barkingside, Essex.

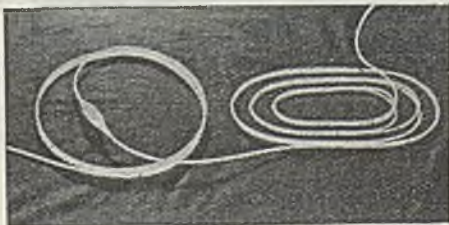
Valve Millivoltmeter

Although designed primarily for the measurement of voltages at audio-frequencies in high-impedance circuits, the G.E.C.'s new audio-frequency millivoltmeter is also recommended for use in a.c.

power engineering. It provides a convenient and simple method of measuring the small millivolt drops which occur in circuit-breaker contacts, bus-bar connections, heavy duty cable links and similar cases. The accuracy is approximately 3 per cent. of the full scale reading on all ranges with true sine wave output. The circuit comprises a two-stage amplifier with negative feed-back, which stabilises the gain at 100. This is followed by a diode rectifier and a d.c. amplifier which has a degenerative action and so eliminates errors due to change in valve parameters. The amplifier is connected in a bridge circuit and the out-of-balance current indicates the voltage. The short-term overload capacity is said to be extremely high, and even if full mains voltage is accidentally applied to the lowest voltage range (15 mV), no damage will result if the instrument is quickly disconnected. The highest overload which can possibly be applied to the moving coil is approximately 100 per cent., and this is not sufficient to cause damage even if continued indefinitely. The voltage ranges are 15, 50, 150 and 500 mV. and 1.5, 5, 15, 50 and 150 V, and the frequency coverage is 25 cycles to 20 kc/s. It operates from 200-250 V, 40-100 cycles supply, with a power consumption of 50 W. The indicating instrument is of robust moving coil design with an open 5 in. scale. In its polished walnut case, the meter weighs 27½ lb. and it measures 16 by 10 by 10½ in.

Electric Gardening Aid

The "Tenatherm" self-heating cable, made by Tenaplas, Ltd., of Upper Basildon, Pangbourne, Berks., can be used for many horticultural purposes and



Self-heating plastics cable

presents a solution, it is claimed, to a number of gardening difficulties. The unit consists of approximately 12 yards of polythene tubing, containing a heating element, joined to a length of twin con-

ductor. Being hermetically sealed, the heating unit can be immersed in water without detriment and with no danger of shocks. In use, the heater is wound round the sides of flower pots, embedded in seed boxes or buried about 5 in. deep under hot beds. With the exception that the cable must not cross over itself, nor any of the turns be allowed to touch one another, it can be placed in any convenient position and, by virtue of its plastics sheathing, is unaffected by prolonged contact with many common gardening chemicals. Any surplus length of the element can be immersed in a small tank or watering can. The complete unit, which is provided with an on-off switch in addition to a fused two-pin, 5 A plug, consumes 100 W and is suitable for a.c. or d.c. voltages from 220-250 V.

Compact Mains Receiver

An attractive, edge-lit, removable tuning dial is a feature of the new Philips 209 U a.c.-d.c. portable receiver. The makers state that although it is much smaller than



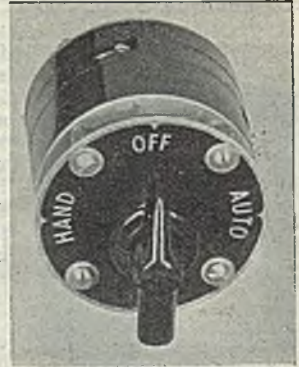
The new Philips table model

their usual design, it is in no sense a "midget" set. There are three wavebands and an internal plate aerial, which makes an outdoor aerial unnecessary on all but distant stations. The radio circuit is an interesting three-valve plus rectifier superhet, two Mullard UCH 21 valves playing the part, in one case, of frequency changer and in the other of combined I.F. and audio-frequency amplifier. The third valve is a double-diode pentode, for detection, a.v.c. and output. The cabinet, as may be gauged from the photograph, is

compact, and the dimensions are: Width 11 in., height 7 in. (excluding dial), and depth 6 in. The total weight is 7 lb. 9 oz., and the power consumption 41 W at 220 V.

Two-way Power Switch

Brookhirst Switchgear, Ltd., are marketing a new rotary switch, intended for use with control and power circuits and rated at 10 A, 440 V. Four positions are provided by a quick make-and-break mechanism operative in both directions, and any number or combination of circuits may be accommodated by adding further contact discs. Two flush-mounting designs are available, one in which the switch is fitted from the back of the board, and the other with the switch mounted on a cover plate so that the whole assembly can be withdrawn from the front. Concealed but easily accessible terminals facilitate wiring.



Brookhirst 10 A rotary switch

Combined Lamp and Table

An original idea in the field of decorative home lighting is an illuminated coffee table, made by the Artlight Co. and Herbert Gordon, Ltd., of Clapton, E.5. The table top is made of indestructible glass, specially treated for light diffusion, while the base and flare are constructed of "Artlight" illuminated coffee table heavy gauge aluminium and suitably weighted. The table, it is stated, combines a useful article of furniture with a light source adequate to illuminate a room of moderate size.



Electricity Supply

Burnley.—The suitability of a site near Barden Lane for the erection of a new generating station, is to be investigated.

Coventry.—The Electricity Committee is seeking sanction to borrow £123 796 for the erection of a primary sub-station in the Whitley area.

Rotherham.—Enlargements to the power station, which will be ready for commercial operation by September, 1950, will cost £1 100 000.

London.—The Metropolitan Water Board has approved an estimate of £100 000 for the purchase of Diesel plant for future installations at various stations.

Darlington.—Sub-stations on the Houghton Road housing site are expected to cost £11 620, and the Town Council has applied to the Electricity Commissioners for sanction to the loans.

Croydon.—The installation of additional equipment at sub-stations, at a cost of £2 490; mains extensions, at a cost of £395; and distribution improvements, at £2 300, are planned by the Electricity Committee.

Blaydon-on-Tyne.—Until electricity is made available to tenants of prefabricated houses at Weatherside, they are to be allowed to live rent free. The Urban Council has asked the North-Eastern Supply Co., Ltd., to hasten a supply.

South Shields.—During the year ended March 31 last, the electricity undertaking made a net loss of £1 915. The Electricity Committee has decided to take no action at present on the question of increasing charges.

Birkenhead.—Sanction is being sought to a loan of £50 000, for mains and services. The Electricity Committee is to provide supply to Ledsham, at a cost of £1 619, and to improve supply to the Burton and Sutton areas at £1 987.

Dartford.—Following the lead of Fulham Borough Council, the Electricity Committee has placed four types of "Civic Concord" radio sets on sale at the showrooms. The sets are to be offered for sale or hire purchase.

Burton-on-Trent.—Experimental fluorescent lighting is to be installed in Horninglow Street at a cost of £500 with eight B.T.H. lamps. The Electricity Committee has obtained sanction to borrow £3 740 for supply to the Rolleston housing estate.

Berkshire.—The Minister of Fuel and Power is to be asked to receive a deputation from the residents living near Challow Station, Berks., to place before him the full facts of their application for a supply of electricity. Recently these residents invoked an Act of 1889 to demand a supply

and elected a committee to organise the demand. The Wessex Electricity Co., in reply, stated that the cost of bringing a supply to the community would be £3 322, and could only be entertained if a consumption of £687, for a period of five years, could be guaranteed.

Mansfield.—Tenants of the prefabricated bungalows have been informed that extensions to their electrical installations can only be sanctioned if carried out by a competent wireman and that extensions not so carried out must be disconnected, unless certified by the Borough Electrical Engineer.

Acton.—Arising out of representations, the London Power Co., has agreed to replace the wooden cooling towers at the Acton Lane generating station by concrete structures and to instal ducting to conduct emissions from the boilers to the gas washing tower.

Hove.—In view of the rising domestic load, the Electricity Committee is considering a recommendation that steps should be taken for the re-imposition of the war-time ruling that, where alternative forms of heating, such as coal fires, are available, no further connections for heating should be permitted.

Thurnby.—Smouldering of overhead cables through overload has been caused by the use of unauthorised electric fires, heaters and other appliances at the squatters' camp. Because of the fire danger, Billesden R.D.C. has cut off the supply of current to the camp, after squatters refused to take any notice of warnings issued by the Council.

Liverpool.—Extensions and new works which are to be carried out include a sub-station at the Strand, at £3 516; a sub-station at Litherland, at £8 789; dust-removing plant at Clarence Dock power station, at £1 767; six additional 33 kV transmission cables from Clarence Dock to the new sub-stations, at £795 790; supply extensions, at £9 706; and three sub-stations at Gateacre, at £3 279.

St. Pancras.—The Electricity Commissioners have informed the Electricity Committee that they are not prepared to consider a proposed increase in charges unless and until revenue is reduced by an amount equivalent to the income expected to be derived from such increase. In the circumstances the Committee has adjourned consideration of the matter until the spring, when the financial position of the undertaking will be clarified.

Orkney.—The North of Scotland Hydro-Electric Board have supplied electricity to the village of Finstown, near the Bay of

Firth, Orkney. This is the first village to receive electricity under the Board's scheme to bring supplies to the isolated districts in the North of Scotland. Twenty-two consumers, including the local hotel, Post Office and four shops have been connected to the main transmission line from the generating station at Kirkwall. The shops and many of the houses have installed fluorescent lighting, and a large number of applications have been received.

Menai Bridge.—A new domestic two-part tariff is to be available to consumers on April 1, 1947. Each house will be assessed on a "points" system, under which bedrooms are one point and all other rooms two points. Halls, bathrooms, sculleries (additional to kitchen) and lavatories, will not be included in arriving at the assessment. There will be a fixed charge of £2 10s. per annum up to seven points with additional charges thereafter. All units will be 1d.

Montgomery.—A committee is preparing a report for the County Council for the prevention of flooding by the River Severn, improved water supplies and better electric power. The report recommends that the Clywedog River and the Severn should be dammed in the Caersios area. The county is insufficiently supplied with electric power, and it is suggested that the water should be impounded and used for hydro-electrical purposes. A water supply may also be considered. The committee recommends that the attention of the Ministries concerned should be called to the problem.

Blackburn.—Extensions to the Whitebirk generating station, costing £1 250 000, have been approved by the Electricity Commissioners. The following plant will be installed, ready for operation in September, 1950: A 40 000 kW turbo-alternator; three boiler units, each with a maximum capacity of 150 000 lb. per hour; the

necessary buildings and civil engineering works; and a cooling tower, capacity 1 800 000 gal. per hour. The Electricity Committee has recommended that Mr. R. H. Harral, electrical engineer, be the engineer-in-charge. He will be paid an aggregate of £5 500 for services on the extensions.

Hawarden.—Demands on the electricity undertaking were reported at a recent meeting of the Council to have reached the stage when the present high tension system was approaching its maximum capacity. The engineer (Mr. A. J. Richardson) stated that steps would have to be taken to install additional plant, and he indicated that the scheme to extend the present 33 kV supply from Lower Kinnerston to Saltney, which would double the present capacity, would be submitted to the next Committee meeting. The Council approved a recommendation that application should be made to the Electricity Commissioners to borrow £10 500 for new mains, meters, and switchgear.

South Shields.—A motion to refer back a minute in the report of the Electricity Committee showing that there had been a loss of £1 915 on the undertaking in the past year, was rejected by South Shields Council. Coun. Younger, who made the motion, criticised the Committee for taking no action about increasing tariffs, although the undertaking had shown a loss. Coun. Stephenson said the Committee had thought it was unnecessary to increase tariffs as it was confidently expected that for the current year there would be a surplus. He pointed out that so far this year revenue had increased by £6 000 and a further increase of £6 000 was expected. The Town Council has applied for sanction to borrow £10 000 for converting Cleadon tramway to trolley-buses and £3 000 for extending the trolley-buses to the Lawe.



The historical exhibition in Chester Town Hall, part of the recent golden jubilee celebrations

HIGH TENSION PROBLEMS

by THEODORE RICH, O.B.E., A.M.I.E.E.

THE papers in the section dealing with overhead line construction at the recent International High Tension Conference in Paris, tended to show that, in general, certain principles had been accepted, and the descriptive papers relating to the structural designs of supports for very high tension lines, which used to be such a feature at H.T. Conferences, were not much in evidence.

SOIL AND WATER RESISTIVITY

A paper by E. K. Saraoja, of the Association of Electricity Supply Undertakings in Finland, on "Soil and Water Resistivity in Finland," is of interest as affecting the earthing facilities for lines and installations, the attenuation of radio waves, and the induction between power and telephone currents. Finland is a country in which the old granite rock, which has a very high resistance is, in many places, covered by morainic drift and marsh soil, clay and other soils of good conductivity being rare. The average soil resistivity in Finland is about the same as in Sweden, the values being much higher than those usually found in Central Europe. The resistivity depends largely on the water content and in that of the water concerned. During winter the top surface freezes and the resistivity can be increased by a thousandfold, but earthing electrodes placed below the frost limit are not much affected. Some interesting data are given in the paper.

In his paper, K. Berger, of the Swiss High Voltage Commission, gives particulars of research dealing with the behaviour of earth connections under high intensity impulse currents, the tests were made at the Gösigen testing station. It is obvious that the ordinary methods of measuring the resistance of an earth connection can have very little value if the surge-current that is to be met with can alter the physical state of the medium concerned. For the main tests a hemispherical pit was made of brick, 2.5 metres in diameter; it was lined with metal netting to act as one electrode and covered by a thin layer of clay to make it watertight. The soil to be tested was placed in the bowl so formed and a chromium-plated sphere was half buried in the soil; the sphere was connected to the impulse generator, while the netting electrode was connected up via a current measuring shunt resistance. Practically pure water exhibits the same resistance under impulse, or with low frequency alternating current.

It is found that with low impulse currents the earth resistance does not differ from that measured with low frequency currents. With various soils it is found that the hysteresis loop is the bigger, the higher the impulse current and the longer its duration. The problem is to find at what current densities the resistance becomes variable. The tests show that where the current density does not create field intensities exceeding 2.5 to 3.5 kV/cm. the resistance of the electrodes (tubes, plates, strips, etc.), can be determined at low frequency by the usual methods. With higher field intensity, the ratio between voltage and current at the earth electrode decreases in an ill-defined manner; the earth then behaves like a non-linear resistance as used for lightning arresters. Hysteresis loops are created, the size of which varies with the current and its duration. With extended electrodes, wires or strips of over 30 metres length, a voltage increase occurs during the front of the current impulse, and the ohmic value under surge conditions exceeds the low frequency value, owing to the inductive voltage drop along the earth electrode; in this case the inductance causes hysteresis loops.

The same apparent increase in earth resistance under impulse as for extended earth electrodes is also observed, if the resistance is measured at some point along the lead from the impulse generator. The metal of which the earth electrodes are made is of no importance from an electrical point of view; copper gives the same curves as does iron.

CONDUCTOR FOR 400 KV

M. Ailleret and H. Caillez discussed "The Preparation of a Step in Voltage and Construction of a Double 220 kV Line Suitable for Future Use as a Single 400 kV Line." A number of features of this paper formed the subject matter of a lecture given by M. Ailleret a few months ago at the I.E.E. A south to north load of a million kW is envisaged for 1955. In the paper the question of the type of conductor for 400 kV is discussed. The authors do not think, owing to moisture and corrosion possibilities, that a hollow steel cable covered with aluminium would be desirable. One solution is to wind the steel core on a plastic tube, which would act as a protection against internal corrosion, and to put the aluminium conductors outside; another is to have a steel core and surround it with a series of aluminium tubes rolled from strip with

the main aluminium conductors around them. The question of grouped conductors with spacers is dealt with as another possibility. A line with transformable towers on the system discussed is under construction from the sub-station of Chevilly, near Paris, southwards to the Central Plateau, a distance of 400 km. The total cross-section of the conductors is 411 sq. mm., which includes 86 sq. mm. of steel, the average effective span will be 518 metres. The towers have a base 9.54 by 8.69 metres. In order to improve the lightning protection a galvanised cable is laid round each of the four feet at a depth of 2.2 metres below the surface; before filling in another similar cable is laid at half the depth of the first, both being electrically connected to the footing; the gradient of a step in the immediate neighbourhood of a line tower is thus reduced. The large spacing of the feet benefits the conductance of the earth, and the relatively concentrated nature of such an earthing offers only a short distance to earth. From an impulse point of view such an arrangement is better than a counterpoise. Where bad conductivity is met with star arranged cables are used, or, in special cases, metal tubes are buried under the foundations.

EARTH MOVEMENTS

M. E. Everard described the methods used to carry an overhead line at 30 kV across a piece of land in Belgium subject to severe earth movements resulting from the enlargement of certain mine dumps. The line circuits are double, with the phase conductors, each of 35 sq. mm., placed vertically, and the supports are of steel lattice work. In January, 1938, the increasing weight of the dumps caused so much earth movement that the lines were broken in several places, one of the supports was inclined and twisted and the head of another was badly damaged by twisting. To remedy matters, a new alignment was chosen about 40 metres from the original route. The original supports had concrete box foundations, the new ones had foundations covering five times their ground area and the conductors were supported by chain insulators, the dead ends of which were connected to cables and counterweights with suitable pulley arrangements. This allowed a material amount of movement to take place at the head of the supports concerned without breaking the conductors or causing short circuits. Since 1928 the base of one of the supports has moved 19.6 metres. The line is inspected every week.

A paper, especially valuable as showing the effect of climatic conditions on the

design of tower structures was contributed by A. H. Frampton and H. J. Muchleman on the transmission developments in the systems of the Hydro-Electric Power Commission of Ontario, primary problems being lightning storms, line glaze and ice storms, and the æolian vibration associated with long-span high-conductor-tension construction.

"WISHBONE" PATTERN ARMS

The original system, designed in 1908, consisted of 244 route miles of double-circuit and 36 miles of single circuit construction, operated at 110 kV—the highest voltage then looked upon as practicable. The first double-circuit lines had towers 65 ft. 6 in. high, five earth wires and a standard span of 550 ft., the weight of the steel structures with footings being 4 508 lb. Lightning storms, on about 20 days per year, were not so much a factor as anticipated and the five earth wires were reduced to one. Later, double circuit towers were constructed 67 ft. high for standard spans of 630 ft., the weight of the steel structure with footings being 5 680 lb. In 1917, under war-time conditions, wood pole single-circuit lines were constructed; also for 110 kV, with one ground wire, and standard spans of 350 ft. The normal poles were 45 ft. high above ground with 6 ft. below ground, the arms being of wood of the "wishbone" pattern. There are 806 route miles of such lines now operating.

From 1920 to 1928 there was a trend towards longer spans and higher conductor tensions. Fear of the effect of the release of bound lightning charges tended to restrict the height of the structures, and later vibration troubles tended to limit spans. Operators found difficulties because under certain temperature conditions ice coatings on a heavily loaded span would fall off, giving contact through a vertical jump. Another trouble was a tendency for conductors with a light glazing, under a moderate quartering wind to "gallop" rhythmically above the level of the points of support, giving rise to shorts between conductors. To remedy this the centre cross arm of the three, considered vertically, was made 8 ft. longer, to allow 4 ft. extra clearance. In 1920 the towers were 85 ft. 4 in. high above ground, the spans 880 ft., and the structure weight, with footings, 11 560 lb., with ruling tensions of 8 000 lb., assuming 8 lb. wind pressure with $\frac{1}{2}$ in. radial ice. In 1928 the spans were increased to 1 056 ft., the tower height being increased to 97 ft. 4 in., similar tensions being allowed for with this construction. Æolian vibration caused the breakage of individual strands before even the lines were put into operation. Armour rods were first used

to remedy this effect, and then vibration absorbers were installed, the actual fitting of which caused lengthy losses of circuit facilities. There are 153 line miles of the 1920 and 1928 types of double-circuit construction. During 5 040 circuit miles of operation, 114 outages were due to lightning and 17 to glaze or ice. The former usually involved momentary loss of facilities while the latter affected circuits for many hours.

In 1928 the first 220 kV lines were placed in service; now there are 980 miles of single circuit and 45 miles of double circuit. This advance was made at a time when lightning phenomena were being greatly studied, but not yet clearly understood, and when vibration troubles were of importance. The original single circuit lines had two earth conductors, the towers were 73 ft. in height and the spans 1 056 ft., while the spacing of the three conductors, arranged horizontally, was 25.3 ft. The maximum loading with 8 lb. wind and $\frac{1}{2}$ in. of ice was 10 000 lb. At first, to protect against vibration, a 6 ft. length of conductor was supported above the main conductors with the aid of three clamps, the middle one of which acted as a suspender. This type of absorber has given good results. Later, armour rods were installed. With 220 kV operation, during 17 years, and 12 330 circuit-mile-years, 198 faults occurred; of these, 18 were due to miscellaneous causes, mainly external; and of the remaining 180, 174 were attributed to lightning. The terrain varied from rich farming land to rocky undeveloped bush country, 90 miles being surface rock with pockets of muskog, where low footing resistances were difficult to obtain. In such conditions 90 per cent. of the located lightning outages occurred.

COUNTERING ICE STORMS

Regarding ice storms, six interruptions were due to insufficient vertical clearance between the earth wires and power conductors, and one to abnormal ice loadings. In two cases excessive ice loadings took place on hill tops with light loadings in long spans in adjacent valleys, giving contact with earth wires. Experience showed that the anti-vibration devices were successful.

In 1940-41 when 275 miles of single circuit and 45 miles of double circuit line were constructed for 220 kV it was not found possible owing to war-time restrictions to benefit in full by previous experiences. The spans were increased from 1 056 ft. to 1 150 ft., the ground wires were raised by 8 ft. and the weight of the structure was slightly increased. In the earth sections it was found that footing resistances would not exceed 15 ohms, and therefore it was decided that no improve-

ment would be necessary. In the rock section covering about 95 miles a continuous counterpoise of two $\frac{1}{4}$ in. steel conductors was used, each being buried to a depth of 18 in. under the outer phase wires. In some places they had to be laid over the top of the rock.

VIBRATION TROUBLES

Regarding vibration, extensive laboratory and field investigation had taken place and it was considered that with the adoption of vibration absorbers the increased more economical span of 1 150 ft. could be utilised. With the new construction half the line was fitted with Stockbridge dampers and half with dumb-bell terminal absorbers developed in the laboratory of the Commission. Festoons were used at the supports of the ground wires. During the last few years, with 1 265 circuit-mile-years of operation, 15 faults occurred, two being due to instability, six to external interference, six to lightning and one to ice loading. Apparently the use of the counterpoise installation has greatly improved matters regarding lightning.

Owing to special circumstances a double circuit line was constructed in 1941, hollow core copper conductors 1.02 in. outside diameter being used, of seven segments, of an ultimate strength of 21 200 lb. The ruling span was reduced to 880 ft. and the total height of the suspension tower was 128 ft., the weight being 22 709 lb. One ground wire only was used, placed 30 ft. above the level of the point of support of the upper phase conductor. The line being in good agricultural land, no particular treatment of the footings was found necessary, and no special precautions were taken against conductor vibration. During the last four years, five outages have taken place—all single-phase-to-ground lightning flashovers. As the result of experience the most recent designs of single and double-circuit lines cover adequate lightning protection, good vertical clearance for glaze operation and the adoption of dampers where the spans create stresses within the danger limit. The authors consider that high-speed protector and circuit-breaker equipment is desirable to prevent permanent conductor damage in the case of lightning outages.

A large selection of good quality surplus general purpose machine tools will be available at additional selling depôts, which the Ministry of Supply is opening at Stormy Down Airport. Pyle, nr. Bridgend, Glamorgan, on January 8, and at Madingley Road, Cambridge, on January 22. The tools may be inspected between 10 a.m. and 4 p.m., Mondays to Fridays.

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:—

St. Faith's and Aylsham, December 28.—Electrically operated pumping and pressure distribution plant for seven sites. Particulars from W. Herbert Bateman and Partners, Halifax House, Bank Plain, Norwich.

Brighton, December 30.—Manufacture, delivery, setting to work of electrically driven booster pump, motor, control gear, etc., at Aldrington station, capable of normal output of 60 000 galls. per hour. Particulars from Waterworks Engineer, 12, Bond Street, Brighton, 1; deposit, £2 2s.

Exeter, December 30.—Supply, delivery and erection of two 12 000 kVA transformers. Specification from City Electrical Engineer, Electricity Offices, 46, North Street, Exeter.

Leeds, December 30.—Supply and delivery of electrically operated pumping plant, with motors, switchgear, etc. Particulars from Sewerage Engineer's Office, Civic Hall, Leeds.

Newport, Mon., December 31.—Electrical installations in 134 houses on Alway Farm estate. Specification from Borough Electrical Engineer, Electric House, Dock Street, Newport, Mon.; deposit, £1 1s.

Ulverston, January 1.—Supply and installation of 11 kV and 400 V cable, switchgear and 500 kVA transformers. Specifications from Electrical Engineer, Electricity Offices, Theatre Street, Ulverston.

Manchester, January 3.—Supply, delivery, and erection at Partington Gas Works of one 150 kW mercury arc rectifier equipment. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2.

Shoreham-by-Sea, January 4.—Taking down of existing street lamps and erection of new steel or concrete columns, complete with lanterns, sodium discharge lamps, etc., giving a mounting height to lamp of 25 ft. Specification from Surveyor's Office, 31, John Street, Shoreham-by-Sea; deposit, £3 3s.

Keighley, January 11.—Supply and delivery of street lighting posts and fittings for housing schemes at Bracken Bank and Woodhouse. Particulars from Town Clerk, Town Hall, Keighley.

Hastings, January 13.—Manufacture, supply and delivery of two 2 000 kVA Scott-connected transformers, and two

switch kiosks. Specifications from Borough Electrical Engineer and Manager, 12 and 13, York Buildings, Hastings.

Manchester, January 13.—Supply, delivery and erection, over period of two years, with option to terminate at end of first year, of 6.6 kV sub-station switchgear. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2.

Sheffield, January 15.—Tenders for purchase and removal of redundant plant from Neepsend power station, including two turbo-alternators and ancillary plant, 12 500 kW; electric feed pumps; spare motors, etc. Details of plant available from General Manager, Commercial Street, Sheffield, 1.

Newark, January 16.—Supply and delivery of p.i. and armoured cable, for electricity department. Particulars from Borough Electrical Engineer, Municipal Buildings, Baldertongate, Newark, Notts.

North of Scotland Hydro-Electric Board, January 20.—Supply, delivery and erection of h.t. and l.t. distribution lines. Tender documents from Mr. T. Lawrie, Secretary, 16, Rothesay Terrace, Edinburgh, 3; deposit, £1 1s.

Camberwell, January 20.—Supply of electric lamps for 12 months. Particulars from Engineer and Surveyor, Town Hall, Camberwell, S.E.15.

Edinburgh, January 20.—Work at Portobello power station: 33 kV generator transformer and earthing reactor. Specification from Messrs. Kennedy and Donkin, 12, Caxton Street, Westminster, S.W.1.

North of Scotland Hydro-Electric Board, January 21.—Construction, completion and maintenance of the Pitlochry dam and power station, Tummel-Garry hydro-electric project. Particulars from the Engineers, Sir Alexander Gibb and Partners, 30, Northumberland Street, Edinburgh, 3, and Queen Anne's Lodge, London, S.W.1; deposit, £5.

Metropolitan Water Board.—Supply of eighteen 200 kW alternators and six 300 kW alternators, new or second hand, three-phase, 400/440 V, 50 cycles, one or two bearings, with or without switchgear, for coupling directly to Diesel engines running at 600 r.p.m. Further details from Mechanical Engineer, Offices of the Metropolitan Water Board, Rosebery Avenue, London, E.C.1.

Weymouth and Melcombe Regis.—Supply and delivery of two 500 kVA, 11 000/415/240 V, three-phase transformers. Specification from Borough Electrical Engineer, Electric House, Westham Road, Weymouth.

Industrial Information

B.E.A.M.A. Price Adjustment Formula

For purpose of calculating variations in : (a) " Rates of Pay," the rate of pay for adult male labour at December 13 shall be deemed to be 103s.; (b) " Costs of Material," the index figure for intermediate products last published by the Board of Trade on December 14 is 201.8, and is the figure for the month of November, 1946.

New Studio Equipment

Since the end of the war, the General Electric Co., Ltd., has designed a complete new range of cinema studio lighting equipment, which is now being manufactured, and the first deliveries were made recently at the newly-opened Southall studio of Alliance Film Studios, Ltd. These included fifty 2 kW incandescent units, twelve single light broadside units with diffusers, snoots and stands, as well as eight 5 kW incandescent units. All are fitted with Osram lamps. The photograph reproduced on this page shows the first consignment of the new equipment being carried into the Southall studios.



New G.E.C. studio lighting equipment being carried into the Southall studio of Alliance Film Studios, Ltd.

L.P.T.B. Anti-Frost Devices

New " anti-freeze " equipment is being installed by London Transport at more than 120 places on its railway system. Two devices are being used; in the first small baths of an anti-freeze liquid are placed at intervals on the current rails, and the liquid, picked up the electric " shoe-gear," spreads the anti-freeze along the rail as a thin film and stops ice forming. The next train repeats the process. In the second device, electric heaters are built into the track at point junctions situated in the open air, the point blades being kept warm enough to resist the formation of ice and to melt any snow that may settle. Another design keeps the points warmed by circulating electrically-heated oil through pipes in the track. New installations just completed bring the number of these point heaters now working on London Transport railways to 215.

British Electronic Apparatus

Fourteen member firms of the Scientific Instrument Manufacturers' Association of Great Britain, Ltd., which comprises 88 firms and employs about 60 000 people, have formed an electronics section. The

first chairman is Capt. A. G. D. West, director of Cinema-Television, Ltd., and the firms forming the section are: Baird and Tatlock (London), Ltd.; Baldwin Instrument Co., Ltd.; Cinema-Television, Ltd.; Adam Hilger, Ltd.; Henry Hughes and Son, Ltd.; Kelvin, Bottomley and Baird, Ltd.; Marconi Instruments, Ltd.; Mullard Wireless Service Co., Ltd.; Scophony, Ltd.; Short and Mason, Ltd.; the Sperry Gyroscope Co., Ltd.; Sunvic Controls, Ltd.; Taylor Electrical Instruments, Ltd.; and Taylor, Taylor and Hobson, Ltd. One of the main objects

of the Electronics Section will be to further and improve the manufacture of British electronic instruments and apparatus, an industry which has experienced a rapid growth during the last few years.

Trolley 'Buses for Bolton ?

Bolton Transport Committee has decided to recommend the Town Council to adopt electric trolley 'buses on suitable routes. Before coming to its decision the Committee studied two reports—one from a sub-committee which had visited a number of towns to study trolley 'buses in operation, and another from the transport general manager on the comparative costs of operating trolley and oil 'buses.

Greenwich Generating Station

Before the outbreak of war in 1939 London Transport had in hand the conversion of their Greenwich generating station from 6 600 V 25 cycles to 11 000 V 50 cycles. The scheme also included enlargement of the station in order to meet additional loads in consequence of the extensions to the Central Line which were in progress from Liverpool Street to

Epping, and for the new loop from Leytonstone to Roding Valley via Wanstead, Newbury Park, and Hainault. The work included the installation of four new turbo-generators and the re-winding of three existing generators, but, together with the extensions to the Central Line, it was interrupted by the war when only three of the new machines had been installed. With the resumption of work on the Central Line Extensions, an order for the fourth turbo-generator required for Greenwich has been placed, and this will be installed by the B.T.H. Co., Ltd. The machine will be rated at 20 000 kW continuously, and will produce three-phase 50 cycle supply at 11 000 V between lines; its speed will be 3 000 r.p.m. The turbine will utilise steam at 400 lb. per sq. in. at 750° F., and is to be equipped with three stages of bleed-steam feed heating, arranged to yield a final feed temperature of 300° F. m.c.r. The condensing plant will include condenser, duplicate extraction pumps, air ejector and two evaporators. The condenser will be of the surface type utilising circulating water drawn from the Thames and requiring 1 092 000 gallons per hour when at a temperature of 60° F. in

order to produce a vacuum of 28.7 in. with the turbo-generator producing 20 000 kW. A feed pump capable of delivering 300 000 lb. of water per hour at a pressure of 534 lb. per sq. in. is also included.

Electric Drive in Industry

On December 11 and 12 a series of lectures on the subjects of "Electric Drive in Industry" and "Electronics in Industry," was held in Bradford, in conjunction with a small exhibition of equipment, organised by the Corporation electricity department in co-operation with the British Thomson-Houston Co., Ltd. Lectures were given each afternoon and evening by Mr. G. W. Edgley, Leeds district manager, and other members of the B.T.H. Company's staff, to large audiences of industrial executives and engineers, and the company's sound film, "Electronics in Industry," was exhibited. At an opening luncheon, guests included the Lord Mayor of Bradford (Ald. T. I. Clough), the Deputy Lord Mayor (Coun. Alton Ward), the chairman of the Electricity Committee (Ald. R. Barber), the deputy chairman (Counc. J. Foster), and the electrical engineer and manager (Mr. T. H. Carr).

In Parliament

Standard Plug.—Mr. Erroll asked the Minister of Supply what steps he was taking to secure the immediate manufacture, on the widest possible scale, of the universal domestic electric plug and socket recommended by the Ministry of Works Electrical Installations Study Committee in their Building Study, No. 11. Mr. Wilnot replied that manufacturers were proceeding with development work, pending the issue in the near future of a British Standard specification. Owing to the necessity for re-tooling, however, substantial supplies were not likely to be available for about 12 months. Mr. Erroll then asked the Minister of Works whether he intended to encourage the use in Government buildings and housing schemes of the universal plug and socket, and when would the relevant B.S. specification be published. Mr. Tomlinson, replying, said that the British Standard Institution had prepared a draft specification for the plug and socket, which had been circulated to all interested parties for observations. Until the specification was issued in final form, no decision could be made as to its adoption, but it was the general policy of his Department to encourage the use of articles complying with the requirements of B.S. specifications.

Television.—Mr. J. Lewis asked the Assistant Postmaster-General what reports had been submitted to him during the year by the Television Advisory Committee, and Mr. Burke replied that their first report was rendered in February last to the Minister of Information, who was at that time responsible for broadcasting matters. There had since been two further reports from the Committee, in July and December. Replying to a further question from Mr. Lewis, Mr. Burke said that, as recommended by the Hankey Committee, the next television station would be opened in Birmingham. No forecasts of the date of opening could yet be made, but it was unlikely to be earlier than two years hence. Asked what technical progress he had to report on the television services, and how often the Technical Sub-Committee had met since January 1, 1946, Mr. Burke said that before public transmissions recommenced, improvements in the apparatus were introduced to give a better quality of picture. The Post Office engineering department were developing means for relaying transmissions to the provinces by coaxial cable and radio links. The Television Advisory Committee investigated proposals put forward by the radio industry. It had met twice since January 1.

Company News

DECCA RECORD Co., LTD.—The Decca Navigator chain, which, he said, had this year given several successful demonstrations before international organisations, was referred to by Sir Cyril F. Entwistle (chairman) at the annual general meeting. As many as 14 detailed plans for the erection of Decca transmitting chains had been placed before responsible authorities in various countries at their own request. One chain, consisting of three transmitters and a number of receivers, had been ordered by the Danish Hydrographic Department and, when delivered early next year, would be used for survey work in Greenland. Because of its use of low frequencies, the Chairman said, the Decca navigator was the only radio or radar system that could be used for land, sea and aerial survey. The Admiralty was using the system for survey work in the Thames estuary, and over 30 vessels sailing on European routes had been equipped. A new accessory to the system was a tracking control which enabled an aircraft or ship to follow exactly one predetermined course; it should be of great value in air-field control. Amongst other activities of the company was the production of the "Decola" reproducer, which, he believed, was the most revolutionary development since the introduction of the first electric reproducers in 1926. Four of these reproducers had been supplied for installation in the Royal Train, and both the records and the amplifying equipment at the "Britain Can Make It" exhibition were supplied by the company. Large numbers of records had been shipped to America, and they had recently formed in the U.S.A. the London Gramophone Corporation, for the purpose of importing the "Decola" and other reproducers and accessories. This, they thought, was the first time any such efforts had been made to market English products of this nature in the U.S.A.

ELECTRICAL AND MUSICAL INDUSTRIES, LTD.—Speaking at the annual general meeting, Sir Alexander Aikman (chairman) referred to the resignation from the board of the company's first chairman, Mr. Alfred Clark, and said that the main effort during the last year had been towards the reconversion made necessary by the fact that during the war the company had devoted 98 per cent. of its capacity to work for the services. Only a small proportion of the reconversion plan had so far been achieved, and even if there was a speed up in the supply of materials and manpower, a good year would elapse before the flow of goods from their fac-

ories reached a level which could provide a satisfactory economy. Seconding the motion for the adoption of the report and accounts, the managing director (Sir Ernest Fisk) said that in the field of television research, the company had the only complete and extensive facilities in the Empire. With some of the new inventions which had come out of their laboratories during the past year, they were in some respects scientifically and technically ahead of the rest of the world. It was interesting to note, he said, that the price of television sets being sold in England was appreciably lower than the price of similar instruments in the United States. Speaking of future developments, Sir Ernest said that the company had recently made arrangements whereby the company held manufacturing rights within the Empire for the Armstrong frequency modulation equipment, both for transmission and reception. Another new invention for which they had secured patent licences was the Scott dynamic noise suppressor. This was an electronic device which permitted reproduction from gramophone records of the full range of musical quality, while eliminating "scratch" at one end and "rumble" at the other. A new method of televising motion picture films had also been devised in the E.M.I. laboratories.

ASSOCIATED EQUIPMENT Co., LTD.—After referring to labour and management relations, in his speech at the annual meeting, Mr. C. W. Reeve (chairman) said that the materials supply position was grave and, while it was possible to understand the facile excuses put forward by Government spokesmen, they had yet to learn why insufficient foresight was exercised when so-called planning on a national scale commenced. They looked to the Government to tell them what international or national factors were likely to affect industry or trade, but not to plan the detailed work of businesses. The very essence of overcoming problems in industrial affairs and of avoiding interruptions and delays was the capacity to assume responsibility and the enjoyment of authority to take immediate decisions. These two qualities were entirely absent from the make-up of Civil Servants. While the "production drive" captured the imagination and occupied the vocal capacities of Ministers, the means to carry out that drive were not available. The shortage of sheet steel was assuming the proportions of a national scandal, and some of their colleagues in the industry had had to remodel and reduce their production programmes for next year.

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.

PLASTONA, LTD. (formerly NEW POWER SAVER CO., LTD. AND SOLAR ELECTRICAL CO. LTD., London, S.W.—November 14, mortgage and charge, to Midland Bank, Ltd., securing all moneys due or to become due to the Bank; charged on Graham Works, Graham Road, Wimbledon, with machinery, fixtures, etc., and a general charge. *Nil. February 5, 1943.

A. G. BROOKER, LTD., Slough, dealers in wireless sets, etc. November 22, mortgage, supplemental to mortgage dated March 26, 1946, to Shop Properties, Ltd.; charged on land at rear of Sussex Club, Grand Parade, Eastbourne. *£10 000. April 22, 1946.

GRANT SWITCHGEAR, LTD., London, N.—November 22, assignment securing to Midland Bank, Ltd., all moneys due or to become due to the Bank; charged on certain contract moneys. *—March 31, 1945.

LONDON SIGNS AND ILLUMINATIONS, LTD., London, S.W.—November 12, series of £5 000 debentures, present issue £3 000; general charge. *Nil. December 31, 1945.

Satisfactions

"GLOWGEM" ALL ELECTRICS, LTD., London, W.—Satisfaction November 18, of debenture registered June 24, 1946, to the extent of £83 6s. 8d.

AIDAS ELECTRIC, LTD., Northolt.—Satisfactions November 30, £5 500, registered November 17, 1934, and £2 000, registered December 13, 1935.

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.

CARROLL, J. H. (male), 115, High Street, Chadwell Heath, Essex, electrical dealer. £13 15s. 7d. October 11.

CHURCH ELM RADIO (firm), Church Elm Lane, Dagenham, Essex, radio dealers. £12 4s. 10d. October 17.

CROCKER, N. E. (male), 142, Mile End Road, London, E.1, electrician. £11 10s. October 18.

ATHEY, B. R. (male), Clayton Road, Newcastle-on-Tyne, radio engineer. £16 7s. 2d. October 25.

BOOT, Dorothy (married), trading as RADIO SERVICE (SOMT.), 38, St. Cuthbert Street, Wells, Somerset, radio engineer. £14 12s. October 8.

GIBSON, Fredk. W., 54, Thornhill Road, Handsworth, Warwick, electrician. £94 15s. 3d. September 23.

HARVEY, E. (male), 211, Balsall Heath Road, Birmingham, 12, radio and electrical engineer. £16 0s. 6d. October 18.

HILLIER, MR. M., 486, Kingsland Road, London, E.8., radio dealer. £83, October 8; £15 19s. 2d., October 15; £33 10s. 9d., October 24; £41 3s., October 24.

Orders Made

PARSONS, Charles Henry, 48, Winchester Street, Taunton, Somerset, wireless dealer, carrying on business at 38, East Reach, Taunton. Court: Taunton. Date of Order: November 11, 1946. Leave to withdraw application not granted. Application dismissed on the ground of bankrupt not being present to prosecute the application.

Metal Prices

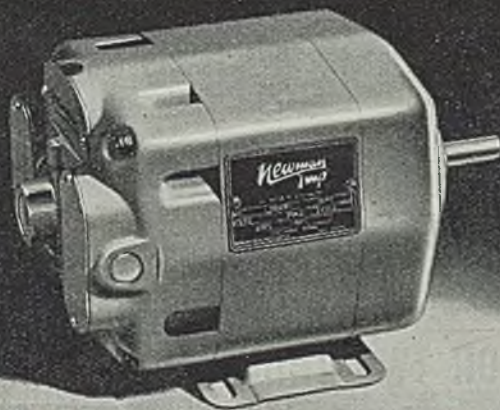
	Monday, Price	December 23 Inc. Dec.
Copper—		
Best Selected (nom.)...per ton	£96 10 0	— —
Electro Wire bars	£98 0 0	— —
H.C. Wires, basis	£112 5 0	— —
Sheet	£138 10 0	— —
Bronze Electrical quality		
1% Tin—		
Wire (Telephone) basis per ton	£134 0 0	— —
Brass (60/40)—		
Rod basis	10½d.	— —
Wire	1s. 3½d.	— —
Iron and Steel—		
Pig Iron (E. Coast Hematite No. 1) ...per ton	£8 19 0	— —
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.	£33 0 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	4s. 10½d.	— —
Aluminium Ingots ...per ton	£72 15 0	— —
Spelter	£55 0 0	— —
Mercury (spot)	£25 0 0	— —

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

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CAPACITOR Start and Run	from $\frac{1}{12}$ H.P.-1000 r.p.m. to $\frac{1}{2}$ H.P.-1500 r.p.m.
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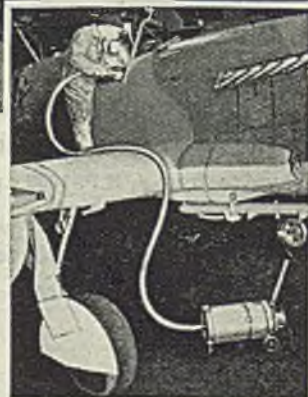
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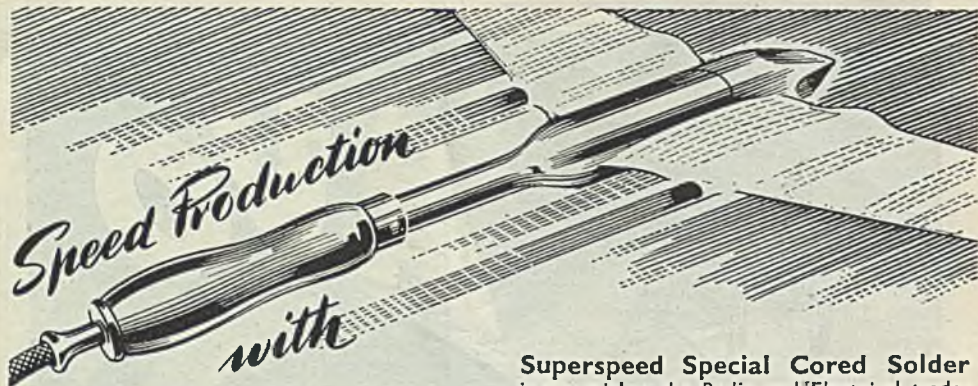
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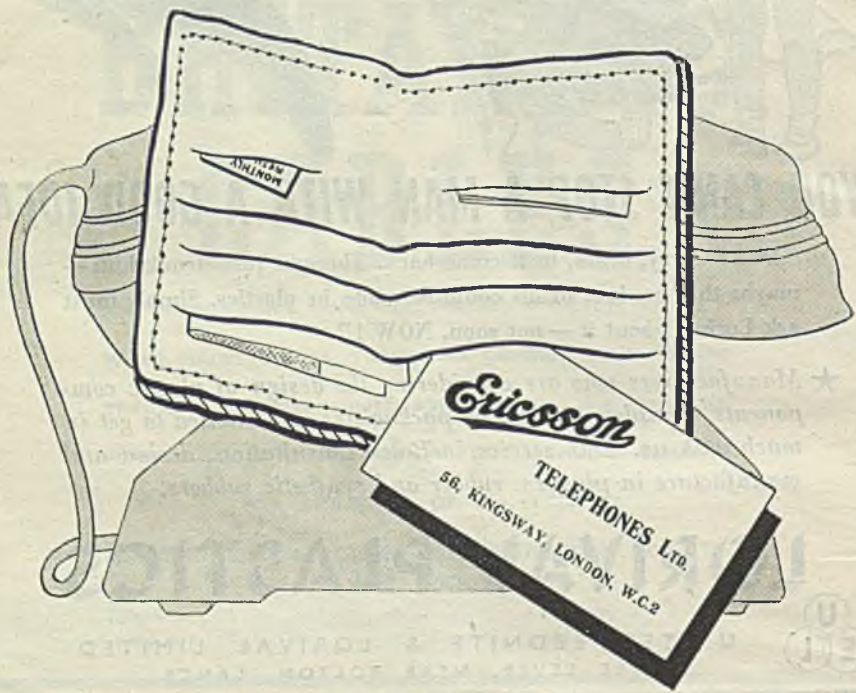


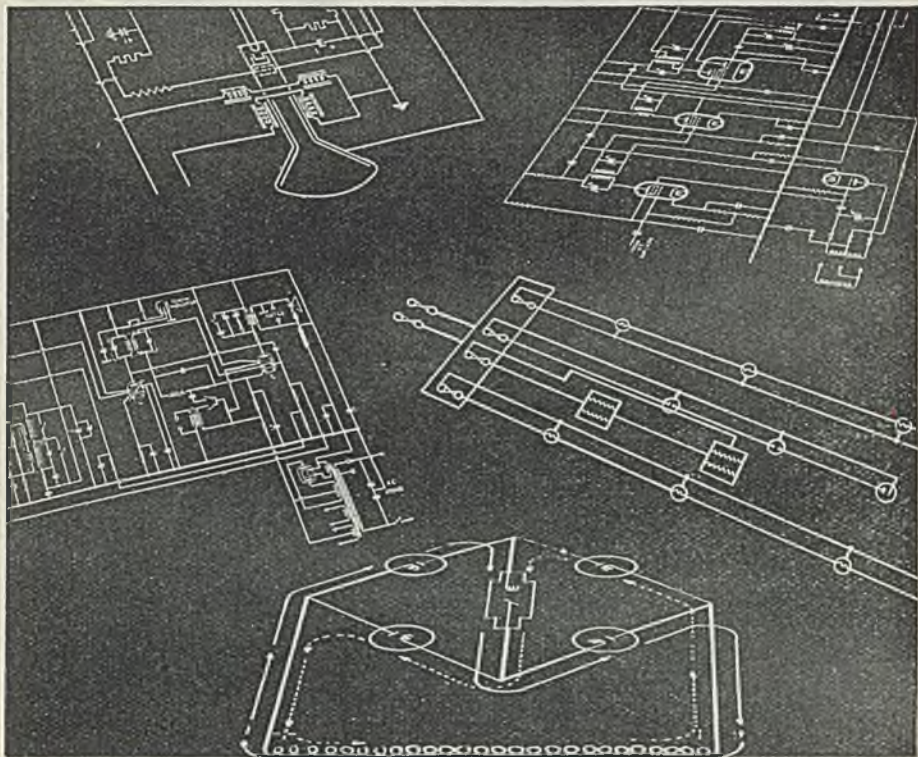
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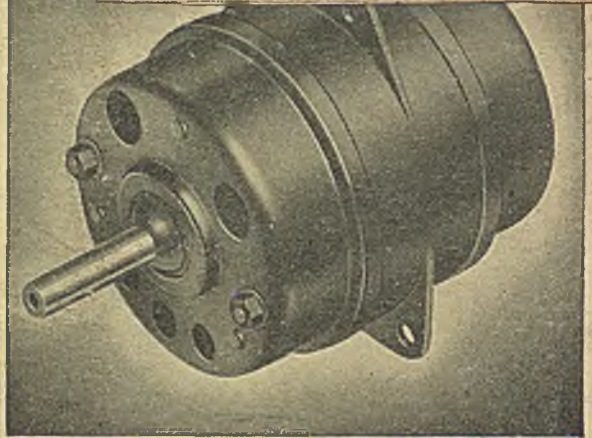
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