THE
ELECTRICIAN

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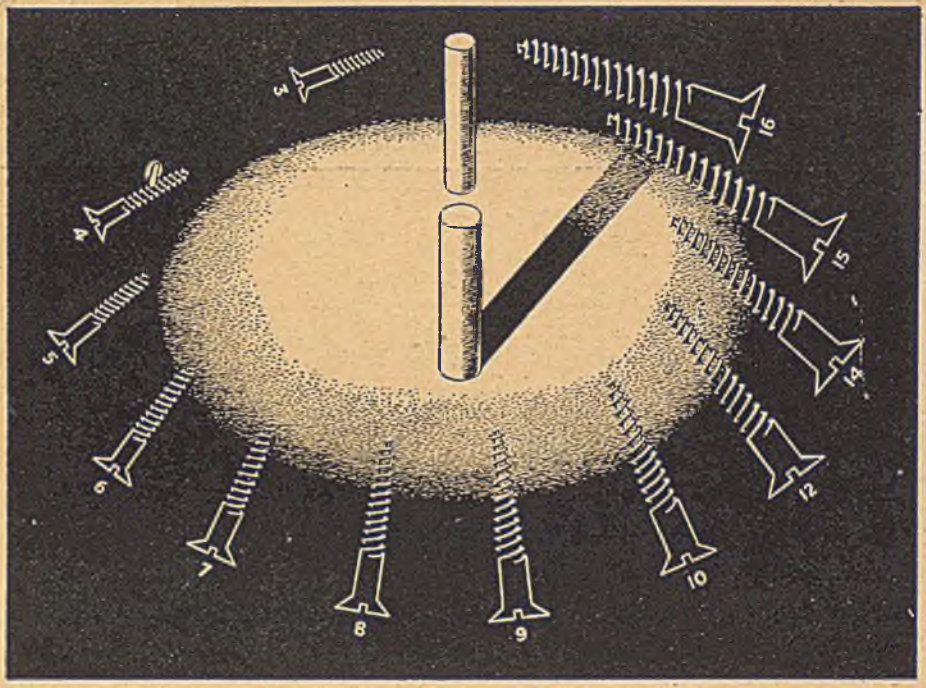
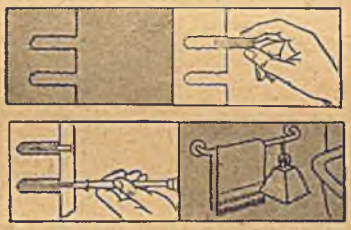
"We'll take 'em all on..."





Slip the plug in the hole. Insert the screw. Now two things happen: a permanent thread is formed and the plug expands and fills every crevice. For really bad holes compress the Adapta in with the special tool. Isn't it easy?

No need to fiddle around with half-a-dozen or more sizes of plug. These two Philplug Adaptas take any screw from 3 to 16 and fill — yes *fill* — any hole you jump. Not even the best of us can be sure of jumping an accurate hole every time. It doesn't matter with Philplug Adaptas. If the hole is a bit too big or not a very beautiful shape, you just crush a Philplug Adapta into it and fill it up. Easy, eh? And a permanent fixture too. Neither damp nor heat weakens Philplug Adaptas — even after years.

PHILPLUG ADAPTA

The plug that fills the hole..

• PHILPLUG PRODUCTS, LTD., Lancelot Road, Wembley, Middlesex. Telephone: Wembley 0140.

C.R.C.4A

MISCELLANEOUS ADVERTISEMENTS

None of the situations advertised in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 or 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.

SITUATIONS VACANT

AN Electricity Supply Authority in the Home Counties invites applications for the following vacancies:—

(a) 6 Electricians for the maintenance and repair of domestic electrical apparatus on consumers' premises.
(b) 1 Assistant Electrician for Works Maintenance—D.C. and overhead experience essential.
(c) 4 Wiremen.
(d) 2 Overhead Linesmen for H.T. line construction and maintenance.
(e) 1 Plumber Jointer for 11 kV jointing.
(f) 1 Electrician for Cooker Repair Shops and Factory maintenance.
(g) 1 Tracer or Junior Draughtsman for Mains Records, etc.
(h) 2 Meter Testers and Repairers.

District Rates will be paid. Applicants to indicate clearly the particular vacancy for which they are applying, and include the following information in their reply:—

Age.
Whether married or single.
Training and experience.
Last civilian employment and nature of work.

At present the Control of Engagement Order limits the age of Male Applicants to men under 18 years or over 51 years of age. Applicants who are thereby prevented from changing their employer may make an application, which will be retained for consideration when the restriction is removed.

Class A men on leave just discharged from the Forces may apply—irrespective of age—provided their period of leave has not expired.

Women under 18 years or over 41 years of age may apply for vacancies (a), (g) and (h).

This advertisement is published by permission of the Ministry of Labour and National Service.

Replies to Box L.Q.M., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.
HHMoL/MC.

ST. DUNSTAN'S proposes to set up a research unit to study and develop sensory devices for the blind under the general guidance of its newly-appointed Sensory Devices Committee. St. Dunstan's requires the full-time services of a RESEARCH PHYSICIST-CUM-ELECTRONICS ENGINEER to work in close collaboration with a Biologist-Physiologist in a suitably-equipped laboratory in London. Salary in accordance with qualifications and experience. Applications or enquiries before January 15th to the Secretary, 9, Park Crescent, London, W.1.

OVERHEAD LINESMAN required by Electricity Undertaking serving Teignmouth, Dawlish and rural area south-west of Exeter, for erection of 11 kV and MV/LV overhead lines and maintenance. J.I.C. wages and conditions.—Apply Teignmouth Electric Lighting Company Ltd., Teignmouth, Devon. (This advertisement is published by permission of the Ministry of Labour and National Service under the Control of Engagement Order, 1945.)

REQUIRED, for Industrial Research Laboratory, Engineer with some years' practical experience of vacuum tube development or production.—Write, stating age, experience and salary expected, to Box 7983, A.K. Advg., 212a, Shaftesbury Avenue, W.C.2.

SITUATIONS VACANT

SKIPTON URBAN DISTRICT COUNCIL.

PLUMBER JOINTER.

THIS advertisement is published with the permission of the Ministry of Labour and National Service. Applications are invited for a Plumber Jointer. The applicant must have had experience in jointing both H.T. and L.T. cables. Rates of pay in accordance with the Joint Industrial Council Scale, B Zone, plus war bonus, and the successful applicant will be subject to the provisions of the Local Government Superannuation Act.

Applications, stating age and experience, to be received not later than the 14th December, 1945.

W. V. SMYTHE,
Engineer and Manager.

Electricity Offices,
79, Caroline Square, Skipton.

AN Electrical Engineering Concern is considering the grouping of its specialised metal and chemical activities into a small single unit, and invites applications from Physicists, Metallurgists and Chemists for work in selling, research and production fields. Opportunity would provide excellent prospects for qualified and experienced men not over 36 years of age. Applications should be made in writing, stating age, qualifications, experience and salary required, to Box 7994, A.K. Advg., 122a, Shaftesbury Avenue, London, W.C.2.

BOROUGH OF FINCHLEY.

Electricity Department.

APPOINTMENT OF SENIOR LADY DEMONSTRATORS.

APPLICATIONS are invited for appointment on the permanent establishment of four Senior Demonstrators in the Intermediate (Female) Grade 2 of the Council's Salaries Scale of £180 minimum, rising by £15 per annum to a maximum of £240, plus the present cost of living bonus of £48 2s. 0d. per annum.

Salaries in the grade will be determined according to experience and qualifications.

Candidates must have had a good general education and hold a recognised diploma in Domestic Science and possess a thorough knowledge of the use of electrical domestic appliances; possession of the E.A.W. Electrical Housecraft Diploma will be an advantage. They must be competent to arrange and conduct Lecture Demonstrations and advise consumers on kitchen planning and the selection and use of electrical apparatus.

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

Applications from women who are serving in H.M. Forces are invited.

Forms of application will not be issued, and applications to the undersigned, containing full details of the candidate's experience, should be received not later than first post on **7th January, 1946,** endorsed "Senior Demonstrator."

C. R. WESTLAKE, M.I.E.E.,
General Manager and Engineer.

Electricity Offices, Squires Lane,
Finchley, N.3.

WORK WANTED AND OFFERED

WE will gladly undertake the making of component parts, etc., on our Lathes, Millers, Drills, etc.—London Electric Firm, Croydon. 'Phone: UPLands 4871.

TENDERS

ELECTRICITY SUPPLY BOARD, DUBLIN.

ERNE POWER DEVELOPMENT.

THE Electricity Supply Board invites Tenders for the supply, delivery and erection of:—
TRANSFORMERS AND SWITCHGEAR AT THE CATHALEEN'S FALL AND CLIFF STATIONS ON THE RIVER ERNE.

Conditions of Tendering, Form of Tender, Conditions of Contract and Specification may be obtained by Contractors from the Chief Design Engineer, Electricity Supply Board, 26, Lower Fitzwilliam Street, Dublin, C.18, by application and on payment of a fee of five guineas, which will be refunded on receipt of a bona-fide tender. Additional copies may be purchased at a cost of one guinea per copy (non-returnable).

Tenders with all the relevant Documents enclosed in a sealed cover endorsed "Erne Power Development: Tender for Transformers and Switchgear," must be delivered to the undersigned not later than 12 o'clock noon on Thursday, the 28th February, 1946.

The Board does not bind itself to accept the lowest or any Tender.

PATRICK J. DEMPSEY,
Secretary.

28th November, 1945.
Electricity Supply Board,
60-62, Upper Mount Street,
Dublin, C.18.

CITY OF MANCHESTER.

THE Electricity Committee invites tenders for the supply, delivery and erection of the following:—

6.6 kV SWITCHGEAR (FEEDER No. 4),—HIGH STREET SUB-STATION.
(Specification No. 842.)

ONE 20-TON ROAD WEIGHBRIDGE AND FRAME.—BARTON POWER STATION.
(Specification No. B.149.)

Specifications, etc., may be obtained from Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of one guinea for each specification, which amount will be refunded on receipt of a bona-fide tender.

Tenders, addressed to the Chairman of the Electricity Committee, to be delivered not later than 10.0 o'clock a.m. on Monday, 31st December, 1945.

PHILIP B. DINGLE,
Town Clerk.

Town Hall, Manchester, 2.
30th November, 1945.

REPAIRS

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

AGENCIES

MANUFACTURERS of Electric Domestic Appliances, Meter, Resistances, etc., desiring representation in Italy are invited to contact the Ufficio Commerciale Elettricita' Industria, via Sant' Andrea, 6, Milan, Italy.

PATENT AGENTS

KINGS PATENT AGENCY, LTD., B. T. King, A.I.Mech.E. (Patent Agent), 146A, Queen Victoria Street, London, E.C.4. ADVICE, Handbook, and Consultations free. 'Phone: City 6161.

A. E. HILL,
Chartered Patent Agent,
27, Chancery Lane,
London, W.C.2.

FOR SALE

SEARCHLIGHTS (sale or hire), Carbon Rods, Ebonite, Fibre Hightensite, Porcelain House-wiring and other Cleats, Reels and Knobs, Mirrors, Lenses, Lamp Lowering and Suspension Gear, T.R.S., lead and other Cables, Winches (hand), hundreds of thousands in use, etc.—London Electric Firm, Croydon.

LEATHER FINGER STALLS.—Made of Chrome Hide. Very strong and hard wearing. Length 3 in. Price 4s. per doz. Prompt delivery. Sample on application.—Willson Brothers, Industrial Clothing Manufacturers, Epsom, Surrey.

DRY CELLS.

OLD-ESTABLISHED firm now in production of all types of dry cells. D.R.3 speciality. Delivery ex works. Quotations by request. Contracts invited.—The Abies Battery Co., 117, Anerley Road, Anerley, S.E.20.

PACKING CASES, all sizes and descriptions, for Home and Export Trade; also S/h. Cardboard Cartons, all sizes.—L. Goldser & Sons, 14a, Rectory Square, London, E.1. 'Phone: Stepney Green 2550.

D.C. MOTORS, ⅛ and ¼ h.p., voltages 25, 32, 50, 100/115 and 200/250. Suitable refrigerators, lathes, washing machines, etc. Unused motors, £7 15s. each; reconditioned, £5 15s. Other sizes available.—Johnson Engineering, 86, Great Portland Street, W.1. MUSeum 6373.

WANTED

WANTED, Ball and Roller Bearings, also loose balls. Commissions arranged for introduction to transactions, Licensed Buyers.—W. Ball Ltd., Blackburn Road, Accrington. Tel. 2200.

THE ELECTRICIAN

Established 1861. *The Oldest Weekly Illustrated Journal of*

Electrical Engineering, Industry, Science and Finance

Bouverie House. 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London. Telephone: Central 3212 (Ten Lines).

Midlands Office: Daimler House, Paradise Street, Birmingham. Telephone: Midland 0784.
Glasgow Office: 116, Hope Street, Glasgow, C.2. Telephone: Central 3970.

The Offices of THE ELECTRICIAN *are closed on Saturdays in accordance with the "Five-day Week" plan adopted by Benn Brothers, Ltd., and its associated publishing organisations. Until further notice the offices will be open between the hours of 9 a.m. and 5.30 p.m. from Monday to Friday.*

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CHIEF CONTENTS OF THIS ISSUE

Factory Conditions

THE report of the Chief Inspector of Factories is always interesting, but the latest, covering 1944, is especially so, in that it is the last report for which its present author, SIR WILFRID GARRETT, will be responsible before his retirement at the end of the year, and because in it, after reviewing the work of his department, he calls attention to the reconstruction period which is before industry. He adds to his remarks a warning that the industrial lessons learned in the 1914/18 war were largely forgotten in the following years, and asks the question whether this will be so again?

There can be little doubt that factory conditions have changed during the last six years, both with respect to production methods and in the type of labour used, but the greatest change has been in the outlook of all engaged in industry. This is particularly so outside the electrical engineering field, for whereas in the latter production and works committees were already known before the war, their formation in trades outside it since 1939 is largely a new experiment. As a result, closer collaboration between managements and factory personnel to bring about the best possible working conditions, has produced a common understanding of the domestic and economic problems involved, with an appreciation of the fact that the factory is not only a place where goods are made, but also a place where a high percentage of the population spend one-third of their working lives.

From an electrical point of view this aspect of the matter is an old story, in that for years before the war considerable efforts were expended to draw the attention of factory managements to the fact that where correct lighting, colouring of walls, motion study, electric drive, the use of electric tools, and so on had been adopted, not only had output increased, but the health of the staffs had improved, while the workers themselves were inspired to even greater efforts.

The better conditions which can be brought about by an intelligent appreciation of the reactions of the human being to his surroundings can also play a part in the reduction of the factory accident rate, as Mr. GARRETT'S report shows. During 1944, for instance, there was in addition to other war-time improvements, a movement to introduce better lighting and more colour into factories, and though it is not suggested that this was wholly responsible for the decrease of nearly 18 per cent. in fatal accidents and nearly 9 per cent. in the number of non-fatal accidents, during

1944, it is reasonable to assume that since such conditions had not before been enjoyed in factories to anything like the same extent, they were in part accountable for the encouraging reductions.

Effect of Controls

RESPECTING Mr. GARRETT'S question as to whether the lessons of war-time factory experience will be forgotten, if it was our responsibility to answer, we would say that providing industry is given the men and materials to modernise its works; providing it is given the opportunity to put to wider application the results of its learning before the full attention of managements and staffs is required for the production of goods for home and export needs, then the conditions of poor hygiene, inadequate lighting and so on, which existed in many factories during the years between the wars will not return. There is, however, a doubt, not so much whether industry will of its own volition be able to prevent their return, as whether managements will be permitted by an ever-watchful and interfering bureaucracy to give expression to their intentions. In this connection, it is revealing that, the Chief Inspector points out in his report that managements have to wait too long for men and materials before they are able to carry out improvements to their factories or extend their welfare work—one example being where an employer spent eighteen months and two years steering his way through the various controls, before he was able to provide for his staff simple facilities for the operation of washing.

Electricity Expansion Programme

THE statement made last week by Mr. HAROLD HOBSON, chairman of the Central Board, to the effect that arrangements are in hand for a 5-year plan to extend the electricity supply industry, involving a capital expenditure of £450 000 000, came as a surprise to many but the arrangements are, in fact, no more than the normal expansion programme of the industry. Mr. HOBSON was speaking at the inauguration meeting of the Caroline Haslett Trust, and in the course of his remarks he explained that of the total expenditure, £150 000 000 would be used for generation and the remainder for transmission, distribution and so on. It will be remembered that about a year ago the Central Board issued details of authorised power station extensions amounting to about £90 000 000, and while the figure above allows for an expenditure of another £60 000 000, it is yet too early for the details to have been sufficiently finalised to warrant publication. In considering the programme as a whole, it must be borne in mind that a high proportion of our generating capacity is overdue for replacement, while by the time this has been effected still further plant will be over-age, as has been pointed out by the Board in its annual reports covering the last four years. As to the extensions themselves, while these will be dealt with in detail in the next annual report, there is every hope that the Board may be able to make them available to the technical Press before the publication of that document.

Overseas Trade

ACCORDING to the Board of Trade returns, United Kingdom exports during the first nine months of this year were valued at £271 000 000, and imports at £871 000 000, representing a gap at the rate of £800 000 000, which must be closed before industry can hope to approach normal conditions. Commenting on the position, one of our leading daily newspapers likens the statistics to those of Micawber's household budget: "Annual income twenty pounds, annual expenditure nineteen, nineteen six, result happiness. Annual income twenty pounds, annual expenditure twenty pounds ought and six, result misery." The Board of Trade returns, while showing that Empire countries have been our best customers, also make it clear that exports fell between the second and third quarters by £3 000 000, that is during a period when the new Government were proclaiming the need for increased exports. Part of this decline is shown to be due to a falling off of relief shipments to the Continent, but even with this allowance the result can hardly be said to reflect credit on the policy of those who now control the country's destiny. Rather does it add support to our plea for taking off the brake imposed on the initiative of our manufacturers.

Electrical Exports

DETAILS of electrical exports, given elsewhere in this issue, show that shipments of electrical goods and apparatus, excluding machinery, during the first

three quarters of the year, were valued at £9 787 000, compared with £9 982 000 for the corresponding period of 1944, and £10 073 000 for 1938. Electrical imports of like goods and apparatus, during the same period, amounted to £18 216 000, compared with £14 993 000 and £2 330 000 for 1944 and 1938, respectively. With the exception of the 1938 total these latter include goods imported under Lend-lease or mutual aid arrangements and goods, other than those concerned with munitions, imported by Government departments. In the circumstances there is reason to hope that the import values during the current quarter will be substantially reduced. Shipments of electrical machinery, which always help to swell the returns, were, during the last quarter, again substantial, and were responsible for the total export value reaching £18 626 026, compared with £18 155 678 for 1944 and £15 993 537 for 1938. Machinery imports showed an appreciable increase in the case of radio valves, and motors for uses other than traction, raising the final electrical import total to £20 828 155, compared with £18 516 526 for 1944, and £2 594 497 for 1938.

Servicing Temporary Housing

A PAPER of considerable interest to the supply side of the industry was read before the Institute of Fuel, yesterday, Thursday, for its author Mr. O. W. Roskill, had much to say in connection with the servicing of the equipment now being installed in the grant-aided housing schemes. The chief points raised are that since supply undertakings may not, in all cases, be consulted upon the type of electrical equipment installed, are they expected to service the equipment with the same willingness as they would appliances of their own selection; and if the Government intends buying in bulk and distributing as it thinks fit, what should be the attitude of undertakings called upon to maintain and service the appliances? Many supply authorities adopt a certain make or type of equipment for hire in their areas in order to simplify the problem of spares, and permit their maintenance staff to give maximum service, but the servicing of grant-aided houses with their already installed appliances may quite considerably cut across this ordered arrangement—in that their equipment may be different from that used by the majority of other consumers in the area. The point at issue may not at this stage be serious, but with the small maintenance staffs available to undertakings coupled with the shortage of spare parts, even the temporary houses now being built may present servicing difficulties not easy of solution.

New Radio Navigation Facilities

IN view of our description last week of the new equipment developed by the Decca Navigator Co. for positioning ships and aircraft by radio signals, it is interesting to note that the company have now entered into a contract with La Société Francaise Radio Electrique on terms providing for the exploitation of the development, including the erection of the necessary transmitting stations, in France, her colonies and the mandated territories. La Société Francaise Radio Electrique, with associated companies, is one of the oldest established and largest organisations in France engaged in the manufacture and operation of radio equipment, and it is the intention of the company to erect transmitting stations to provide a link with the first English chain, and chains elsewhere. The terms of the contract provide, *inter alia*, for the manufacture of equipment both in England and France, together with the payment of royalties which should result in a large visible and invisible export.

Ministerial Responsibility

IT will be remembered that in a statement to the House of Commons on October 29, concerning the division of responsibilities between the Board of Trade and the Ministries of Supply and of Aircraft Production (the latter two of which are to be amalgamated into one new Ministry as soon as practicable), the Prime Minister said that the new combined Ministry will carry the primary Government responsibility in the field of engineering. What he meant exactly is not clear, but re-arrangements for the transfer, have now been completed and took effect as from Monday last. Organisations and firms in the engineering industry, including the electrical industry, which hitherto looked to the Board of Trade for information, must now apply to the Engineering Industries Division, Ministry of Supply, with results, no doubt, just as effective.

French Railway Electrification

By Our Paris Correspondent

FRANCE already possesses 3 500 km. of electrified railway, and is forging ahead with projects to increase the network. Experience over the past twenty years indicates that if France is to maintain the technical supremacy claimed for her railways before the war, she must now extend her electrified systems. The saving of coal which electrification will bring about is particularly attractive, and France, poor in the former but fairly well off in hydraulic power, will make the change-over quite easily.

Economy in Coal Consumption

Before the war 10 million tons of coal were used by railways in France during a year's working, amounting to almost half her total coal imports. Of this amount, electrification is expected to save 1 500 000 tons a year, though there is admitted to be a limit beyond which electrification would not be economical. For example, experience has proved that only when the saving in coal is 300 tons per km. per year is it economic to make the change-over, and this may provide the limit for coming projects.

The S.N.C.F. started studying electrification plans after the armistice in 1940, and, by the end of 1943, 937 km. between Paris-Limoges-Toulouse and Sete had already been electrified. Shortage of materials has led to the work being held up, but as soon as materials become available, the Bordeaux-Montauban line will be converted. Current will be available from existing stations in the Pyrenees and the Massif Central.

Steam and Electric Drive Compared

Comparisons between steam and electric locomotion in France have shown the latter to be superior, since the steam engine has not changed vitally in spite of research, boiler pressure being under 20 kilos per sq. cm., compared with boilers elsewhere having pressures of up to 100 kilos. Production is also affected by lack of condensors, so that any coal available could be more economically used in producing current. The estimated saving is said to be about 40 per cent. Another advantage claimed is that French electric locomotives are not liable to breakdown, as are their steam counterparts.

Already the S.N.C.F. network is 25 per cent. electrified, and lines between Paris and Vierson have been changed over since the war. Larger revenue and increased traffic have resulted from the consequent better services, and freight costs have been lowered. Since 1900, when the Paris-Orssy to Paris-Austerlitz line on the Orleans network was first electrified, there have been two further stages in development. During 1900-1917, 243 km. were electrified, mainly by private initiative. From 1917 the Government showed greater interest, mainly owing to coal difficulties during the 1914-18 war. The adopted voltage was 1 500 V d.c., except in the case of the western suburbs where 750 V pressure is used, and over 3 531 km. of electrification was undertaken.

Further electrification of the railway networks and the construction of hydraulic stations will obviously go a long way to benefiting the surrounding countryside, but one problem which will have to be faced is that of cost. At 1940 rates the cost of electrifying the Paris-Lyons tracks will be about 4 milliards of francs; excluding electric locomotives, stationary equipment will cost about 5 million francs a kilometre. Taking into account price variations since 1940, the estimated cost will be even greater. Plans for the future must also be limited to some extent by the degree of immobilisation which will be necessary while work is in progress.

Paris-Lyons Service

However, all things considered, the balance still seems weighted on the side of electrification. Most important of all present projects is, of course, the electrification of the Paris-Lyons line, which carried considerable traffic in passengers, post and merchandise before the war. Daily, 50 expresses ran between Paris and Dijon, and 30 between Dijon and Lyons. A double track is to be laid between Saint-Florentin-Les-Laumes and Blaisy-Dijon in case either is put out of commission. An extra fast train from Paris to Lyons will be able to make the distance in 4 hrs. 34 mins., with a saving of 600 000 tons of coal a year over 1938 figures. Current used will be partly supplied by the Genissiat works, and has been estimated at about 440 million kWh. Two hundred and forty electric locomotives will have to be constructed. Other extensions planned concern the Paris-Lyons line as far as Marseilles; the Lyons-Geneva tracks; the southern lines circling Paris between Versailles-St. Georges and Valenton; and the northern suburbs, in addition to some lines in the western suburbs. There is also a possibility that light electrification of the tramway type may be undertaken on certain secondary lines.

Differentiation/Instantaneous Speed

By C. TURNBULL, M.I.E.E.

THE common idea, that textbooks are right and that students who ask for new methods only do so because they are dull, is wrong. As Clifford stated some 70 years ago, axioms are conventions which can be developed without contradiction and we are at liberty to vary them to any extent, while that great mathematician Poincare stated that logic without intuition is barren. It appears to the author that we require a system of mathematics which is useful to engineers, and that because our textbooks are too tied to pure mathematics we suffer in consequence. The work of Heaviside was hindered by Cambridge mathematicians because it did not fall in with their ideas, while for the same reason the book "The Foundations of Alternate Current Theory," by Dr. Drydale, has been denied our students, when in fact it is precisely what they need.

There are signs that our educational authorities are waking up to the need for a greater supply of technical men who can apply their mathematics to industry—and the need is pressing if we are to hold our position in the competitive world of today—but before the need can be met our professors must be willing to scrap many of their present methods and to recognise that engineers work more on intuition than on abstraction.

Textbook Explanations

Textbooks usually explain instantaneous speeds by means of infinitesimals, which is only partially satisfactory. Below is explained a method which is engineering. Assume that one is travelling in a car and wishes to know the speed at an instant. This can be done by keeping the speed constant for say one minute and if during this time a kilometre is travelled, the instantaneous speed at any time during the experiment is 60 km. per hour.*

To deal with $d\ sin\theta = cos\,\theta d\theta$ in the above manner, make $r = 1$, and measure $sin\,\theta$ on Oy, so that $OA = sin\theta$. θ is really the length of the arc which subtends the angle, and it is only a convention when we speak of θ as the angle itself. This is important as it is absurd to expand $sin\,\theta$ in terms of θ if θ is an angle, but it is common sense to do it if θ is the length of the arc measured in terms of the length of the radius. To find the ratio of the speed of A along Oy to that of P travelling steadily along the arc, let P leave the curve and follow the tangent as shown in the Fig. 1, and let A travel along Oy keeping in line with it. The speed of P along the tangent is now steady, as also is that of A as it travels along Oy, so that the ratio of their speeds is AT/PT. This is true if we reduce AT and PT to infinitesimals, measured at the

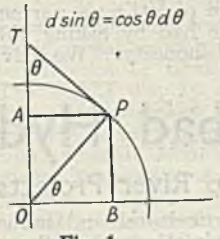

Fig. 1

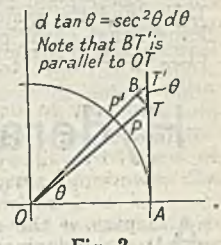

Fig. 2

position when P leaves the arc to follow the tangent, and by convention an infinitesimal portion of the tangent there coincides with the curve so that we may write $d\theta$ for an infinitesimal portion of the tangent, and also of the curve. Similarly an infinitesimal portion of AT $= d\ sin\theta$, so that AT/PT becomes $d\ sin\theta/d\theta$. It is easy to prove that AT/PT $= cos\,\theta$ so that we have $d\ sin\theta/d\theta = cos\,\theta$ or $d\ sin\theta = cos\theta d\theta$.

It is better to measure $sin\,\theta$ along Oy as this gets rid of the sideways movement of the usual explanation. $d\ cos\theta = -sin\theta d\theta$ is proved in a similar manner.

The engineering method for $d\ tan\theta = sec^2\theta d\theta$ is interesting and logical. P goes round the arc at a steady speed and T travels along the tangent at a speed which increases as θ varies from O to $\frac{1}{4}\pi$. Making $r = 1$ we find the ratio TT'/TB and then TB/PP' from which we deduce TT'/PP'. Make TB and PP' perpendicular to OT. The important item is to make BT' parallel to OT, as this gets rid of the idea that our ratios are only correct when the angle TOT' becomes an infinitesimal. Angle BTT = OTA and hence BTT' = θ and TT'/TB = $sec\,\theta$ and TT' = $sec\,\theta$ TB. Also TB/PP' = OT/OP = OT/OA = $sec\,\theta$ and TB = $sec\,\theta$ PP'. But TT' = $sec\,\theta$ TB hence TT' = $sec^2\theta$ PP'. This is true for any length of TT' and PP', and hence we may make them infinitesimals, when they become $d\ tan\theta = sec^2\ 0d\theta$, because at the point of contact an infinitesimal portion of the tangent coincides with the curve, or in other words the curve may be considered as composed of small straight lines and a tangent is formed by producing one of these.

* This was dealt with analytically in THE ELECTRICIAN for July 13 last.

This method of dealing with the problem is more satisfactory than that in the text-books, in that it is better to find the slope of the tangent first and apply it to the curve, than vice versa. The pure mathematician may object that some curves have no derivatives, but this does not concern the engineer who only deals with curves that have tangents.

Writers of engineering mathematics should take a hint from bridge players. When bridge was introduced, whist players were opposed to laying one hand on the table, and the system of letting a partner know what cards one had by asking bids etc. seemed sheer dishonesty. We have got over that and to-day bridge is generally considered to be a better game than whist. Similarly, mathematicians will find that mathematics will become better and more useful when engineers are allowed to use modern methods and when students discuss their problems with the same freedom that bridge players now do. That such freedom is not encouraged by those whose business it is to impart mathematics to students is putting it mildly, but it was by such freedom that mathematics came into existence. See books by Poincare, Eddington, Dingle and the "Introduction to Mathematics," published by Harraps, with many others which are less known.

Hyderabad Hydro Developments

Two River Projects for Power Generation

As part of the agricultural and industrial development of Hyderabad State, work has commenced on two large-scale projects at Tungabhadra and Godavari.

The Tungabhadra project will be one of the world's largest irrigation schemes, besides supplying more than 100 000 kW of hydro-electric power. It is proposed to harness the river Tungabhadra at a point where it drains an area of 10 880 sq. miles. The river receives ample water from the Western Ghats, where in many places the annual rainfall is over 200 in. As most of the supplies are received in the four months from June to September, a large storage reservoir is being constructed to hold 800 000 million gallons. The water will be diverted for irrigation in one of the most arid tracts of the Deccan, where the average rainfall is 18 in.

The canal system covers an area of 1 500 000 acres, and it will be possible to bring under irrigation nearly 750 000 acres.

The contributions of this project to industrial development are substantial—over 500 000 000 kWh of energy can be developed from the falls in the canal. Industries to be served include gold mines, sugar and oil mills. The main programme, however, is to extend the benefits of power to a large number of small habitations, in order to encourage rural development and cottage industries. The total cost of this project will be nearly £15 000 000.

The Godavari industrial and agricultural development project is more ambitious than the Tungabhadra. It envisages hydro-electric and irrigation development, a new industrial town, a balancing thermal power station and exploitation of mineral resources, which include coal, iron ore, mica, graphite and limestone. The first £20 000 000 has been set aside for it and a survey, for the purposes of inland navigation, of the upper reaches of the Godavari river has been approved. The Hyderabad Government has approved of the scheme and an organisation on lines similar to the Tennessee Valley Authority is being set up.

It is proposed to dam the river Godavari where it drains a catchment area of 35 740 sq. miles. Its canal system will be the largest in the world and will cover an area of 3 750 000 acres.

Drops in the canal will be utilised for the generation of hydro-electric power and an output of 750 000 000 kW is anticipated.

An order for nearly 50 000 H.P. of thermal plant is being placed in the United Kingdom.

A conference with the authorities in Madras and Bombay is being arranged for the settlement of the water rights, but as the Godavari river runs through the heart of Hyderabad State for some 600 miles, it is expected that, with sympathetic co-operation, there will be no difficulty. It is hoped to complete the major part of this ambitious programme within the next 10 years.

BOOKS RECEIVED

"The Story of the Atom Bomb." By C. H. Douglas Clark. (London: Machinery Publishing Co.). Pp. 52. 3s. 6d. net.

Radio Receiver Designs. By K. R. Sturley. Part II (London: Chapman and Hall). Pp. xv + 480. 28s.

Journal of the I.E.E. Vol. 92. Part I (General), No. 58, 5s. net; Part II (Power Engineering) No. 29, 7s. 6d. net. (London: Spon).

"Steel and Its Practical Applications." By W. Barr and A. J. K. Honeyman. 2nd. Ed. (London: Blackie and Son). Pp. xii + 156. 8s. 6d. net.

Electricity in Factories

Chief Inspector Reports Reduction in Accident Rate

THE annual report of the Chief Inspector of Factories, Sir Wilfrid Garrett, (Stationery Office 1s. 6d.), shows that in 1944 the proportion of reportable accidents (fatal and non-fatal) caused by power-driven machinery was 15.6 per cent., compared with 16.7 per cent. in 1943, and 17.1 per cent in 1942. The number of fatal accidents due to power-driven machinery (other than lifting machinery) was 102, or 10.2 per cent., as against 115, or 9.4 per cent. in 1943, and 129, or 9.4 per cent. in 1942.

Electrical Accidents

The number of electrical accidents reported (1 072) showed a slight reduction on the maximum of 1 255 reported in 1943. (Details of these were given in the annual report of the Factory Department (Electrical Branch), abstracts from which appeared in THE ELECTRICIAN of August 31 last.) The war years, states the report of the Chief Inspector, had seen a great number of new applications of electricity to factory processes, and it had to be remembered that both the degree of risk and the method of dealing with it had had to be assessed and devised under the pressure inevitable in war production.

In the section dealing with lighting, the report states that it was now evident that one of the lessons learnt from the period of war production was that good lighting was a factor that could not be neglected in an efficient works. While this was accepted by efficient management, there were still many firms and even some industries where good lighting was considered as a luxury rather than as a necessity for production, as well as for the well-being of the worker. Many good installations had been provided during the year and many more had been delayed through the difficulty of procuring the labour for the actual installation, but the pressure necessary to make all firms conform to a reasonable standard must come from an extension of the regulations to all classes of factories, and this should be possible in the near future.

There were many factories, particularly those housed in multiple storey buildings and in congested areas, where artificial lighting was needed in portions of the premises for at least part of the day and sometimes throughout the day. Some of them are not subject to the present Factories (Standards of Lighting) Regulations because persons were not regularly employed there for more than 48 hours a week or in shifts, but inspectors were finding that the standards of the regulations were coming to be more generally accepted in such premises, both by occupiers and contractors where new lighting systems were being installed or existing installations brought up-to-date.

Adequacy of lighting intensity was still getting more attention than glare. A new installation of 150 W lamps was recently found to have been put in without any shades at all and, although this was perhaps an unusual instance as regards new work, it was a symptom of a rather general indifference or ignorance on the subject. The bright display effect of naked bulbs was often mistaken by both occupiers and workers as an indication of good illumination, whereas from the point of view of visual perception it was, of course, the reverse.

Zeal in fuel economy had sometimes outrun discretion when applied to factory lighting. In some cases attempts had been made to obtain a ten per cent. cut in fuel consumption by substituting 25 or 40 W lamps indiscriminately for higher wattage lamps. Few factory installations had any margin to spare for an all-round decrease of this kind and it could only be made at the sacrifice of satisfactory working conditions and production. Perhaps even worse was the procedure of putting alternate lights out of action, which had also been tried and resulted in totally inadequate lighting for the work in the darker areas and excessive contrasts of light and shade. Nor was it satisfactory to dispense with general lighting and rely only on local lights.

Effect of Good Lighting

As an instance it was found that in an optical lens factory where a good standard of process lighting was required, the overhead lights providing the general illumination were in disuse and the work was being carried on in bright pools of light of 15—30 f.c. from the local lights amid a general atmosphere of gloom elsewhere. The intensity of illumination was sufficient at the work, but the good effects were offset by the well-known depressing "tunnel" effect and the danger and discomfort due to dark shadows and excessive contrasts.

Economies could be more suitably obtained by avoiding waste of light at those machines or parts of the premises which were not in use and by making the best use of installations by regular cleaning of lamps and fittings. One inspector mentioned a cotton spinning mill where cleaning increased the lighting intensity in the card room from 3 to 7 f.c. and in the ring room and winding room from 4 to 8 f.c. There had thus been a deterioration of 50 per

cent. in the useful output with the same fuel consumption. A 50 per cent. drop in output on a machine would, of course, have been immediately noticeable and would not have been tolerated, but a drop in light output was not so directly obvious and might be overlooked unless a frequent and regular check was made with a light meter.

Psychology of Colour

An important movement directed to introducing positive colour into the interiors of factories had recently come into being and had gained some force during the year. Although in not a few cases factory occupiers had related the first impulse towards colour to suggestions made in broadcast talks by an inspector, and although it was true that the movement had been stimulated by encouragement from the Factory Department, the real basis would seem to be a revolt against the aesthetic starvation imposed by war work. This revolt found its outlet not only in works music but equally in decoration. Directed to an increasing degree by the advice of the British Colour Council it had started mainly in the canteens, gone on perhaps to the drawing office and finally reached the shops.

Particulars of cases of industrial poisoning or disease notifiable under the Factories Act, included three cases at electric accumulator works, compared with four in 1943, 10 in 1942, 11 in 1941 and 15 in 1940.

Reference is made to radioactive substances and X-rays and to the invaluable assistance offered by authorities—many of whom are members of the Advisory Panel on Radiological Problems in Industry—carrying out research work in this highly specialised field.

The results of the research work carried out by Prof. Sidney Russ and his colleagues at the Middlesex Hospital into the radon content of exhaled air of luminisers and by Dr. L. H. Gray, had now been published.

This work was initiated at the request of the Factory Department over two and a half years ago after consultation with the Medical Research Council and the National Physical Laboratory. Close contact was maintained throughout so that preventive measures could follow as closely as possible on the results of the research work. Contemporaneously with the increased use of radium and other radioactive substances in industry, similar extensions in the use of X-rays made it evident that arrangements would have to be devised on a wider basis for the better appraisement of possible ill-effects on health due to these extensions in industry.

In March, 1943, therefore, the Chief Inspector issued a circular to firms using X-ray plants in industry, drawing attention to the health risks involved and indicating that arrangements had been made in consultation with the National Physical Laboratory to estimate the health hazard in any given case by assessing the weekly dosage to which operators were exposed. This was to be done by getting operators to carry on their persons during working hours dental films, which were subsequently examined for blackening. The same facilities were later extended to firms using radioactive materials, and in May, 1944, the Chief Inspector issued to such firms a further circular drawing their attention to the use of films for test purposes, and also to tests involving estimation of the radon content of expired air and examination of individuals for direct gamma radiations, the result of absorption and retention of radioactive material. Film tests were started by the National Physical Laboratory in April, 1943. During the two-year period, April, 1943, to March, 1945, inclusive, 1 216 films from 138 separate industrial undertakings were examined. In some cases single individuals or premises were subjected to several separate tests.

Result of X-ray Tests

The National Physical Laboratory reported that "the great majority of tests show a very satisfactory state of affairs," few workers being subjected to more than 0.1 to 0.2 roentgen per week. Of five workers for whom films were examined, showing a very heavy dosage (film too black to be assessed accurately), one was found to be guilty of faulty technique, two had exposed themselves unnecessarily to excessive dosage while refilling an X-ray tube shield with oil while it was in use, contrary to instructions; and two were unnecessarily exposed to risk because a faulty contact breaker fitted to a fluorescent screen, by failing to function promptly, permitted exposures of three seconds after the screen was raised before the circuit was broken.

There had been special investigations in three factories using X-ray crystallographic sets. The safe working of these depended on the skill of the operator, but film tests gave a record of exposure of 0.1 roentgen.

Stalybridge.—Mr. J. H. Lumsden, electrical engineer of the Stalybridge, Mossley, Hyde and Dukinfield Joint Board, has put forward suggestions to encourage the greater use of electricity in domestic premises. The suggestions are that no charge be made for services where the wiring installation includes provision for the following appliances:—Cooker, water-heater, wash-boiler, together with socket outlets as scheduled in the Housing Manual issued by the Ministries of Works and Health.

Aircraft Electrical Equipment

R.A.E. Exhibition at Farnborough—Examples of Industrial Development

WITHOUT electricity the modern aircraft could not leave the ground. With its aid the bomber is guided unerringly to its target, which is made visible through fog or darkness, its bombs are aimed with precision, fused and released singly, in salvos, or in any number up to the full load of 24 500 pounders, or more, at predetermined intervals, photographs are taken of bomb bursts, other controls and instruments are operated, communication with the home station and other aircraft is made possible, and the crew, guns and camera are warmed and protected from frost.

The Functions of the Department

An opportunity of inspecting the electrical equipment of a Lancaster bomber was afforded the technical Press at an exhibition, which concluded on Wednesday, held by the Electrical Engineering Department of the Royal Aircraft Establishment, Farnborough, Hants. There were also seen many of the results of the research and development work carried on there, and a variety of test gear.

The electrical engineering department of the R.A.E. is responsible for the supply, storage and utilisation of power in aircraft, and it investigates, designs, tests and develops electrical equipment and installations required to meet those responsibilities. It examines and approves proprietary electrical equipment for aircraft and technically supervises any development contracts placed with the industry. One of its functions is to advise the aircraft constructor on electrical problems. The department works in close liaison with the Service and its members act in the capacity of consulting electrical engineers to the R.A.F.

The exhibition illustrated the equipment used in aerial warfare and the diverse activities of the Department during the war years, and indicated broadly the stage reached in the application of electrical engineering to aircraft. Many of the exhibits had been developed in collaboration with the electrical industry.

The ground supply and test equipment included a variable speed generator tester, mains drive, 3 kW. Power is provided by a three-phase 400 V motor running at 2 900/3 000 r.p.m. The speed can be varied over a range of 2 000/6 500 r.p.m. by means of a gear box made by Frank Tippen and Sons. A petrol electric set (1 160 W at 29 V, or 580 W at 14.5 V) for supplying air transportable radio stations, developed by Mechanical and Electrical Industries, Ltd.; an accumulator charging set (360 W 14-20 V d.c.) developed for mule-pack transport by A. Lyon and Co., a mercury arc rectifier, Type 14C, typical of a range of rectifier units developed by the Hewittic Electric Co., Ltd., and the Nevelin Electric Co., Ltd.; a Diesel Electric set, with an output of 5.6 kVA at 0.8 power factor at 230 V, single-phase, 50 cycles, in the making of which Lancashire Dynamo and Crypto, Ltd., and Crompton Parkinson and Co., Ltd., collaborated; a metal rectifier, type 1A, typical of a range of such sets for charging accumulators operating d.c. ground equipment, developed by Standard Telephones and Cables, Ltd., and the Westinghouse Brake and Signal Co., Ltd.; power unit, type 311, for supplying T.R. 1143 ground set, developed by Radio Transmission Equipment, Ltd., and Savage and Parsons; and a frequency changer developed by the British Thomson-Houston Co., Ltd.

In addition to electrically-heated clothing, an electrically-heated casualty bag, a heated camera muff, and gun heaters, there was shown an electrically heated blanket for setting the glued joints of a Mosquito aircraft. The blanket is thermostatically controlled to give a temperature of approximately 80°C. It is used for setting joints when aircraft are repaired under field conditions. The heating elements are of stainless steel constantan gauze as used for heating clothing. The heat dissipated is 325 W.

Bomb-Release Control Gear

The development of electrical control gear for the release of bombs was demonstrated. This began, it was mentioned, in 1930 with the invention of the electromagnetic release slip designed by Messrs. Vickers of Dartford. Among the latest types of gear for heavy bombers shown were the automatic bomb distributor, Mark VII (32 stations) developed by the A.T.E. Co., and a 12-24-way bomb distributor, providing the selection of any group, or, a single bomb, from one selector mechanism, bomb intervals from .06 to .9 secs. for normal bombing, and intervals from 2 to 8 secs. for reconnaisance work. Also shown in this section were a photo-flash distributor Mk1, with attendant firing and camera gear; an eddy current variable time delay device; control gear for rocket assisted take-off; a G.E.C. 90

point high speed thermionic type bomb distributor; and a G.E.C. mechanical type 8-way bomb distributor.

Among the wiring fittings were displayed the Pirelli-General Cable Works, Ltd., connector system designed for the Wellington aircraft and fitted in more than 16 000 machines of that type; the Crabtree wiring system used in the Shetland aircraft; the Plessey scheme with prefabricated trough as used in the Lincoln aircraft; and the projected S.B.A.C. wiring scheme developed by S.B.A.C., the M.A.P. and the electrical industry. In the latter the various connector block mouldings, single and tier sockets, ferrules and other components are designed for quick and easy assembly and release. The main feature is the reliance on crimp instead of soldered connections, with quick-release terminal blocks.

Climatic Proofing

Among the various types of instruments were some specially designed for use in the Far Eastern theatre of war and proof against extremes of temperature and humidity and immune to attacks of fungus and insects. Another section dealt with the climatic proofing of equipment, and electrical materials, and included new equipment which is climate-proof by reason of its design.

There was a wide range of aircraft power supply units, showing the development of rotary transformers, special types of rotary transformers and motor generators, including units by I. and S. Newton Bros., Ltd., the English Electric Co., Ltd., Mortley, Sprague and Co., Ltd., Mackie, Ltd., Hoover, Ltd.; the first airborne rotary transformer power unit developed by R.A.E. for the operation of various radio communication transmitters; a power unit developed by the G.E.C., Ltd., incorporating the rotary transformer type P; a dual purpose generator, comprising a d.c. generator and an a.c. alternator on a common shaft and housed in a common yoke, designed primarily for single-engine aircraft in which radar equipment was installed.

Among the various primary and secondary batteries displayed was one described as a "possible future accumulator." It had polythene insulation, and the separators were of "Pervic" porous polyvinyl chloride. These separators are made from a polyvinyl chloride mix to which starch has been added. The mixture is extruded and the separators are rendered porous by the hydrolysis and elimination of the starch. A diagram showed the performance of these accumulators to be 12 V 40 Ah.

A miniature alkaline accumulator (1.2 V 0.129 A) about an inch long, was developed for firing a detonator.

In the section dealing with ignition research was a high voltage high speed cathode-ray oscillograph for recording very rapid transient events and capable of making measurement of intervals of time of 100 millionth part of a second. This oscillograph works with an accelerating voltage of 50 000 V, and for the purpose of making records photographic film is placed inside the vacuum chamber. The evacuated beam actually penetrates the emulsion of the photographic film without the intermediary of a fluorescent screen and in that way very much higher sensitivity is obtained than with the ordinary oscillograph tube where the beam strikes a fluorescent screen. With this higher sensitivity it is possible to record events occurring in a 100 millionth of a second. The equipment has been used for recording time and intensity curves of flash discharge tubes. It has also been found useful for recording what happens in spark gaps. A spark gap occurs very rapidly and only equipment of this kind is capable of coping with such speeds. The time recorded of the breakdown of a spark gap was a ½-millionth of a second. Owing to the fact that records are taken on film inside the vacuum chamber it is necessary to break the vacuum down and the chamber has to be continuously evacuated during the operation. By using methods of this kind it is possible to find out a great deal about spark gap formation. The equipment was made by the Metropolitan Vickers Electrical Co., Ltd., with special features to meet the requirements of the R.A.E.

Lancaster Power Units

The Lancaster a/c Mark III, which was open for inspection, was a typical example of the heavy bomber. Its equipment includes an electrically operated distant reading compass, an automatic bomb sight with electrical accessories, and the radar and radio sets used towards the end of the war. The power units consist of an alternator with an output of 1 200 W, on each outboard engine, and a d.c. generator with an output of 1 500 W on each of the two inboard engines. A carbon pile voltage regulator is used as a master regulator to maintain approximately constant the d.c. busbar voltage when the two generators are operating in parallel. The ignition system and all high tension cables are screened to prevent interference with the radar and radio equipment. The batteries are charged by the engine driven generators. The aircraft is built in sections for easy transport, and at each break the electric wiring system is linked up by plug and socket connections. The electrically operated automatic bomb release control gear in this machine has a 32-point distributor.

Turbo-Alternator Rotors

Failures Due to Winding Deformation

A PAPER entitled "The Operation of Large Turbo-alternators to Reduce Rotor Winding Deformation," by Mr. R. H. Coates (Portsmouth electricity undertaking), and Mr. B. C. Pyle (Sheffield electricity undertaking) was read at a meeting of the Institution of Electrical Engineers in London on December 6. In it the authors stated that the failure of turbo-alternator rotors as the result of copper distortion now constituted a major cause of outage of electrical generating plant and called for a closer investigation of the causes of such distortion.

Details were given of rotor failures experienced by the undertakings with which both authors were associated and the nature of faults causing outage.

The possibility of reducing stress in rotor windings by pre-heating was referred to and details of the procedure adopted were given. It was stated that to inject direct current into the alternator rotor when stationary, or rotating on the barring gear, required an external source of current. For this purpose a motor-generator rated at 300 A and 250 V was installed. Additional switches were fitted on the alternator exciter pillars and the generator field controls, voltmeter and ammeter, indicating lamps showing the position of the d.c. switches for each machine, and rotor temperature indicators were mounted on a common panel in the control room, enabling the control engineers to make any readings necessary and suitably control the process.

Pre-heating of Machines

The amount of pre-heating required before running up a machine was obviously governed by the fall in temperature which had occurred since the machine was last on load. An investigation of the various causes responsible for cooling showed that most of the heat lost by the rotor was dissipated during the period of shutting down, namely, between full load and the time the machine became stationary. A typical temperature gradient was from 120° C. at full load to 60° C. two hours later, when the set became stationary. When the set had stopped, the rate of heat loss from the rotor was much slower, for instance, from 2° C. to 0.5° C. per hour over a range from 90° C. to 50° C. The temperature fall during an overnight shut-down from 23.00 to 06.00 hours was about 15° C.; over a week-end the temperature fall amounted to about 25° C.

To improve those conditions, the operating procedure had been modified, and machines shut down for the night were taken off the busbars with as little loss of heat as possible. This was achieved in several ways. The operating conditions finally adopted were as follows.

Operating Conditions

The operators were given an operating temperature range for the machines, i.e., the maximum permissible temperature rise when on load, over the temperature at which the machine was run up and the motor winding was locked by centrifugal force. If the rotor temperature at starting was high, namely 50-60° C., the normal slow-running time when starting up would probably be sufficient for the pre-heating necessary; if that was the case, there was no need to use clamps on the slip rings and brush-holder rings. If the machine had been idle for some time and had a low rotor temperature, the rotor should be pre-heated for a long period. Pre-heating was commenced before applying steam to the turbine, either with the rotor on the barring gear, or, in the absence of such gear, with clamps fitted to the slip rings and brush-holder rings, the brushes being insulated from the slip rings by paper between them. The heating current from the motor-generator set was applied until a temperature of, say, 70° C. was reached, after which the clamps, etc., were removed, and the machine was rotated under steam, the pre-heating being continued up to full speed. It should be noted that in any case pre-heating current was applied, during the normal slow-running period, for by pre-heating as late as possible the maximum difference between the winding-copper temperature and rotor-iron temperature, i.e., the highest differential temperature, was obtained while the machine was run up. As soon as the machine started to speed up, the synchronising plug was inserted and the pre-heating current reduced as the speed increased, in order to keep the machine voltage below full voltage. When up to speed, the pre-heating current from the motor-generator was cut down to zero and the generator was disconnected. The machine was then excited by its own exciter and connected to the busbars.

In addition, until further experience was gained, the maximum rotor temperatures should, on no account, exceed 135° C. It seemed probable that as experience accumulated the temperature range would be reduced and the permissible maximum temperature raised.

Electrical Overseas Trade

Exports £2 500 000 Greater than in 1938

SHIPMENTS of electrical goods, apparatus and machinery during the first three quarters of the current year, were valued at £18 626 026, compared with £18 155 678 in 1944, increase £470 348, and £15 993 537 in 1938, increase £2 632 489. Items which helped to bring about this encouraging position, together with those which failed to reach pre-war values are tabulated below, together with figures covering the last complete quarters of war and peace. From these details it will be appreciated that machinery exports made the most substantial contribution, though submarine wires and cables were also in big demand overseas. Lighting components at £588 636, were an improvement on the figures for both last year and 1938, while other items which helped to swell the total were various insulating materials, lamps, rubber insulated wires, and telephone and telegraph apparatus. During the period under review there was a sharp falling away of shipments of radio equipment, compared with last year, which is accounted for perhaps by the cessation of hostilities and the smaller consumption in consequence, of these goods by our Allies.

Imports of electrical equipment at £20 828 155 were greater by £2 311 629, compared with the same three quarters last year, and £18 134 027 over the 1938 figures. The Board of Trade returns upon which these statistics are based points out that the period covered includes some weeks during which Lend-lease and mutual aid arrangements were in operation, which may account for the not too pleasing situation. Radio valves, for instance, at £10 985 071, compared with £487 068 in 1938, while motors other than traction types at £2 523 853, showed an increase of £2 391 353, compared with the last pre-war year.

IMPORTS

	Three-quarters of year 1938	Nine months ended September 30th 1944	1945
Electric wires and cables, insulated	281 211	2 705 022	1 088 973
Wireless apparatus—			
Receiving sets and receiver chassis, complete, other than radiogramophones, excluding valves ...	91 328	1 154 163	310 244
Valves, complete...	98 034	1 061 442	783 816
All other descriptions	487 068	7 079 037	10 985 071
Telegraph and telephone apparatus, other than wireless	83 189	538 867	702 978
Carbons, electric complete—			
Furnace	36 487	379 061	4 148
Other	20 700	101 791	97 844
Electric lighting appliances, accessories and fittings, and parts thereof, not elsewhere specified—			
Bulbs, complete, ready for use ...	92 381	481 931	187 156
All other descriptions	347 978	83 257	247 219
Batteries, primary (complete, and parts other than carbons)	31 944	142 274	263 821
Electrical instruments (other than telegraphic and telephonic) ...	288 516	174 144	221 301
Motors, other than tramway and railway	231 895	53 377	87 880
All other motors ...	132 500	3 470 160	2 523 153
All other articles ...	471 259	1 092 000	3 323 851
Total	2 694 499	18 516 526	20 828 155

EXPORTS

	Three-quarters of year 1938	Nine months ended September 30th 1944	1945
Electric wires and cables, insulated—			
Telephone wires and cables—			
Submarine ...	155 605	244 319	255 757
Other	646 228	779 004	666 822
Other descriptions—			
Rubber insulated	1 057 802	1 101 417	1 229 508
Insulation other than rubber ...	1 379 308	1 014 862	1 030 152
Wireless apparatus—			
Receiving sets and receiver chassis, complete, other than radiogramophones, excluding valves ...	330 799	79 278	95 795
Transmitting apparatus, excluding valves ...	254 669	735 603	300 731
Valves, complete	371 452	1 093 137	592 848
Parts and accessories, not elsewhere specified ...	389 419	616 288	379 996
Telegraph and telephone apparatus, other than wireless	2 184 446	1 196 683	1 818 961
Electric lighting appliances, accessories and fittings, and parts thereof, not elsewhere specified—			
Bulbs, complete, ready for use ...	444 961	421 949	588 636
All other descriptions	437 087	291 315	339 992

Exports (*continued*)

	Three-quarters of year 1938	Nine months ended September 30th 1944	Nine months ended September 30th 1945
Batteries, primary, complete	122 147	109 003	114 932
Accumulators—Complete—			
Portable (including accumulators for road vehicles)	437 818	227 629	290 536
Stationary		113 637	25 196
Parts and accessories		107 678	124 946
Electrical cooking and heating apparatus (including industrial)	275 973	80 624	170 626
Electrical instruments (other than telegraphic and telephonic)—			
House service meters, complete	142 122	61 991	79 108
All other descriptions	229 415	354 781	325 379
Insulating materials, not elsewhere specified	174 092	179 697	221 195

	Three-quarters of year 1938	Nine months ended September 30th 1944	Nine months ended September 30th 1945
Electrical machinery—			
Generators	1 414 354	1 818 487	1 183 357
Motors	1 305 405	1 072 341	1 211 206
Converting machinery	911 740	9 913	11 150
Transformers for lighting, heating and power, including coils		1 078 187	1 015 805
Rectifiers for power-house use	31 169	38 191	40 740
Starting and controlling gear for electric motors	457 794	257 235	266,589
Switchgear and switchboards (other than telegraph and telephone)	1 660 801	1 067 573	1 772 491
Electrical machinery, not elsewhere specified	139 470	2 831 569	3 338 022
All other articles	1 039 461	1 173 287	1 139 550
Total	15 993 537	18 155 678	18 626 026

Ripple Control

Standardisation Discussed at I.E.E. Informal Meeting

AMONG questions raised at a London Students' Section Brains Trust meeting in the autumn of 1943 was one which dealt with the desirability of standardising ripple control. The reply of the trust has not been recorded but as a result of the question, Mr. T. R. Rayner, introduced the subject at an informal meeting of the I.E.E. on November 26.

He began by saying that many attempts had been made to design a ripple control system capable of functioning over the existing power networks without alteration to these networks, and without causing interruption to the supply, and that during the last few years several systems had been developed. By far the most universally applicable system consisted of injecting into the distribution network one or more frequencies other than the supply frequency. These frequencies could be chosen so that they would be passed on by the power transformers with reasonable efficiency, thus reducing the number of points of injection required to cover the whole network. Since, however, the signalling frequencies were passed on by the power transformers, it was obvious that signalling currents injected by one authority might be carried through to the network of an adjacent authority via, either the grid lines or other tie circuits. It was therefore essential to investigate this phenomenon.

Asking how many signals would be required, he suggested that the power mains should in times of peace be used only for their primary purpose of distributing power, and that any signals superimposed on the network should be for the purpose of controlling that power. It was, of course, possible to distribute music programmes, police calls and the like, but this could not be to the ultimate advantage of the industry.

Any standard specification to cover ripple control systems must have as its primary object the avoidance of mutual interference between signals, and for this purpose a receiver had to be associated with each transmitter to test the line and make sure that no signal was already on the network. Under these conditions, any authority would be in a position to choose any particular system which most nearly fulfilled its requirements, and within certain limits the designer would be able to exercise all his ingenuity in improving the system. It would, however, be necessary to specify the maximum time for which any one signal might be transmitted and to take definite steps to ensure that this time was not exceeded. It would also be necessary to control the maximum number of signals per hour which could be sent from any one transmitter. These limitations appeared at first sight serious, and in certain circumstances might be such that ripple control could not be employed. Even with the limitations mentioned, however, the facilities were so valuable that the use of the system could

effect very large economies both in running and capital costs. There would, of course, be no bar against any single authority using the whole of the available signals at any frequency which the system would carry, but in this case equipment should be provided to keep the spill-over down to a value which would not cause interference to neighbouring networks.

He outlined a system in which it would not be necessary to repeat any single signal except in every tenth supply district and even then it was probable that a different carrier frequency could be chosen. It was probable that the natural attenuation of the coupling networks—usually the high voltage lines—would be sufficient to prevent interference to an undertaking ten areas away from the transmitter, but if not, then it would be necessary to increase this attenuation artificially by inserting series inductance or shunt capacitors.

Signal Strength and Loading

There would be a marked reduction in the magnitude of the signal at any point as the load on the system was increased. Thus, if the transmitter was made large enough to reach the remote corners of the network at full load, the risk of interference at light load would be increased unless the transmitter power was cut down. Therefore, it would be desirable to specify the maximum signal voltage which might appear at any point of interconnection either as a certain maximum figure or possibly in terms of the load on the network at that time.

He expressed the view that if ripple control were to be used extensively—and the economies possible made it certain that it would be—then some form of specification was necessary to protect the user and to guide the designer. At the same time, such a specification should only cover those aspects which were essential for either of the above reasons and should not be such as to stifle future development.

Future design must be based on accumulated experience and should largely be controlled by information as to the parasitic or harmonic frequencies existing on networks. The mains had not been designed for transmission of signalling frequencies and their behaviour was often difficult to predict, but a great deal of effort would be saved if a record could be maintained of the salient features of systems installed and the magnitude of spill-over currents measured at various points.

In the subsequent discussion it was suggested that development should proceed with complete freedom and without standardisation. Other speakers maintained that there should be standardisation only in certain respects, such as the voltage of the signal. A further view was that having regard to possible changes in the organisation of electricity supply it would be unwise to standardise now because much of what was current practice might have to be changed under any new scheme relating to the country as a whole.

It was emphasised that whilst ripple control systems have been in use for 20 years, by no means the last word has been said on their development. Difficulties in connection with the regulation of spill-over were mentioned, especially where a supply authority controlled several different undertakings.

As regards the suggestion that information should be collected, reference was made to the fact that the Central Board had recently carried out tests; the need for further tests was emphasised, in order that information could be obtained on the various problems involved. Attention was drawn to the fact that a first step towards the standardisation of ripple control systems occurred early in 1939 when the B.S.I. set up a sub-committee to frame recommendations.

Industrial Design

A SPECIAL appeal has been made by Lord Woolton to manufacturers in the electrical industry to get under way immediately with their plans for preparing their entries in the forthcoming "Britain Can Make It" Exhibition, being organised by the Council of Industrial Design. Lord Woolton is chairman of the Panel of Selectors, and in his message he explains that since the exhibition is due to open at the beginning of July, the selection committee should have exhibits from which to make their choice ready by May 1.

Where guidance on procedure is sought, contact should be made with trade associations, or chambers of commerce, or with Regional Offices of the Board of Trade, Ministries of Aircraft Production and Supply. So that this machinery shall work with maximum smoothness, direct contact between firms and the Council should be avoided.

The Board of Trade is prepared to sponsor the release from the Forces of skilled industrial designers who are needed to help their firms in the preparation of exhibits, and those firms wishing to avail themselves of this opportunity should apply to the Council.

Although a great number of firms will have no difficulty in obtaining materials, those who are in any way embarrassed in this respect should notify the Council of Industrial Design through their appropriate trade associations.

Electrical Machinery Traders

Annual Luncheon of the A.E.M.T.—Purpose of Associations

THE Association of Electrical Machinery Traders, which was formed about nine months ago to enable electrical machinery traders to speak collectively with respect to the Government proposals for the disposal of surplus electric machine tools, held its first luncheon in London, on Tuesday, when the chairman, Mr. W. E. Lawton (Industrial Electrical Co., Ltd.), presided.

Progress of Association

Following the loyal toast, Mr. Lawton said that despite its short life the association had been able to raise the status of electrical machinery traders, and its membership now represented 80 per cent. of that section of the industry. In view of this achievement the Government had recognised the importance of machinery traders in the scheme of things, and on the panel appointed to deal with the disposal of surplus stocks there were four association representatives. The membership of the association was in his view unique, in that not only was it made up of men highly skilled in a technical sense, but because of the condition of their respective businesses, men who had proved themselves astute traders. He held the opinion that the trade association played an important part in the national economy, in that because the Government was seeking the co-operation of industry, the trade association was the natural medium through which such co-operation could be brought about with maximum efficiency. The war had seen many changes in the conduct of industry, and though there might still be some in the electrical industry who remained loyal to the 1939 conceptions, the association followed a more enlightened course, with frank and full co-operation as its policy.

At the invitation of the Chairman, Mr. A. L. Johnson, chairman of the High Conductivity Copper Association, followed, and after relating a brief history of trade associations dating from 1665, said that such associations, contrary to the beliefs of some, were formed in order that the public might be better served. The duty of all trade associations was to establish conditions of fair play, to protect the public against exploitation and to promote good relationship. He advanced the view that there should be some co-operative effort by their industry to promote scholarships for the training of personnel, for while individual members of the association had made arrangements for meeting their own needs in this respect, provision should also be made by the industry as a whole for training youths who wished to enter the machinery servicing trade, and to accommodate where needed those who were returning to civilian life from the Services.

So far as wages were concerned, he believed the trade association to be the employees' best protection against exploitation, in that large scale regulation worked to the advantage of both employer and employee. Trade associations at this time were also concerned with the disposal of surplus Government stores, for no one would wish to see a return of the conditions which followed the end of the 1914/18 war, and he welcomed the panel which, made up of all association interests, had been formed to deal with the question.

Mr. H. Weston Howard, chairman, Eastern Regional Board, said that since the Government had decided to relate itself with industry, the fact must be accepted and whether one agreed with the policy or not, industry should make the best of the position. During the war employers and employees had victory as their common objective and it seemed to him that there was now need of some similar goal to take its place.

Mr. H. Vernon (Thomas W. Ward, Ltd.), said that unless care was taken in exercising the power of controls, the dull days of 1930/32 might return. In his view efficient distribution was the blood stream of industry and one of the objects of the association was to assist its flow. Whatever the Government had in mind with respect to the future of industry, whatever form of control it proposed to operate, in no circumstances should the standard of living of the country be sacrificed in order to give practical expression to that policy.

Magnesium Order.—The Minister of Labour and National Service has given notice that he proposes to make special regulations applying to factories where the grinding or polishing of castings or other articles consisting wholly or mainly of magnesium is carried on and that any objections to the draft regulations should be sent to the Ministry on or before January 10, 1946. The special regulations are intended to replace the Magnesium (Grinding of Castings and other Articles) Order, 1943, S.R. and O. 1943, No. 268, which was made under Regulation 60 of the Defence (General) Regulations, 1939, and is, therefore, of only temporary duration. Copies of the draft special regulations entitled the Magnesium (Grinding of Castings and other Articles) Special Regulations, 1946, may be obtained from H.M. Stationery Office, price 1d.

Electrical Personalities

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

Mr. W. H. Copper has been appointed by W. T. Henley's Telegraph Works Co., Ltd., as their London branch manager. Mr. Copper, has been with the company for 25 years and is already well known in the London area. For some time he has been in charge of the organisation which was established in London whilst the company's head office was at Dorking during the war, and this organisation will in future be known as the London branch. There is no change in the address, which is 57/53, Hatton Garden, London, E.C.1, the same address as Henley's head office.

Mr. W. H. Copper

Glasgow Transport Committee has appointed **Mr. A. K. Balfour,** now deputy, as superintendent of the Pinkston power station in succession to **Mr. A. M'Nical,** who is retiring.

Mansfield Corporation Electricity Committee reports the resignation of **Mr. T. Whitehouse,** mains engineer, on his appointment as borough electrical engineer at Weymouth.

The marriage has taken place at Fulmer of **Major A. Jepson,** a director of Messrs. R. L. Jepson, electrical factors, Nova Scotia Mills, Blackburn, and Miss Mary Patricia Hudson, of Fulmer Grange, near Stoke Poges.

At the annual meeting of the Junior Institution of Engineers on November 23, **Mr. L. S. Atkinson** was elected chairman and hon. editor, and **Mr. P. W. Dunn** and **Mr. A. C. F. Mackadam** were elected vice-chairmen.

Mr. James Railton has resigned his offices of chairman of Stothert and Pitt, Ltd., and Torrance and Sons, Ltd., as from December 31. **Sir Llewellyn T. G. Soulsby** has been appointed to succeed him.

Mr. R. R. Evans, for 15 years installation inspector with North Wales Electricity Distribution, Ltd., has been promoted to the generating department of the North Wales Power Co., at Cwm Dyli, and will soon be taking up duties at Maentwrog power station, as shift engineer.

The infant son of Mr. and Mrs. Glanvill Benn was christened James Glanvill by Prebendary Arthur Taylor at St. Bride's, Fleet Street, on Saturday. The godparents were the Dowager Marchioness of Reading (for whom Mrs. K. Bennet stood proxy), Mr. Selwyn Lloyd, Mr. Noel Layton, and Brigadier G. P. Harding.

The new chairman of the Reading Electricity Committee is **Councillor Arthur Rowe.**

Mr. C. F. Batstone has been appointed Midland branch manager of the British Aluminium Co., Ltd., and has taken up his duties at the company's branch office at Lansdowne House, 41, Water Street, Birmingham, 3. **Mr. E. V. Pannell** will be retiring at the end of the year after 34 years' service with the company.

Mr. J. Vaughan Harries is leaving the head office staff of the South Wales Electric Power Co., at St. Mellons, Cardiff, to take up the appointment of South Wales manager for the Brush Electrical Engineering Co., Ltd. Before joining the power company Mr. Harries was electrical engineer at the Lady Windsor Collieries, Ynysybwl, Monmouthshire.

Two employees of W. T. Henley's Telegraph Works Co., Ltd., North Woolwich works, **Mr. G. W. Tomlinson,** a braider, and **Mr. S. F. Lindfield,** of the carpenters' department, have received at a works gathering, presentations commemorating their completion of fifty years of service with the company. **Sir Montague Hughman,** chairman of Henley's, made the presentations on behalf of the company, together with personal gifts from himself and Lady Hughman to each veteran and his wife, and also handed to each of the men presents subscribed to by their work-

Sir Montague Hughman, chairman of Henley's, handing a long-service certificate to a veteran

mates. Fourteen other employees at Henley's North Woolwich works, received long service certificates marking their completion of twenty years' service.

Mr. J. W. Rodger, managing director of Bruce Peebles and Co., Ltd., presided over a victory celebration by long-service members of the firm, whose total service exceeded 3 000 years. The gathering marked not only the end of the war, but also the great effort made by these workers and their comrades in the last six years, and the unique period of long service given by the employees present.

Output committee of management and employees at the Heaton works of C. A. Parsons and Co., Ltd. Sir Claude Gibb is in the chair

The Preston branch of the E.A.W. presented the Mayoress (Mrs. H. E. Rhodes), wife of the veteran chairman of the Electricity Committee, their president, with a handbag and compact as an expression of good wishes on November 27. The presentation was made by Mrs. G. Foster, vice-chairman. Miss C. Dewhurst spoke of the occasion when Mrs. Rhodes officially started the turbine of Ribble generating station No. 2—a ceremony kept secret for security reasons.

Accompanied by **Sir George E. Bailey,** managing director of Associated Electrical Industries, Ltd., the **Right Hon. Oliver Lyttelton,** who was recently appointed chairman of A.E.I., visited the Rugby works of the British Thomson-Houston Co., Ltd., on November 26. The managing director, **Mr. H. W. H. Warren,** and other directors of the B.T-H. Co., introduced the visitors to the heads of the research, engineering, manufacturing, and commercial departments. A tour of the Rugby works and laboratory was afterwards made.

With the object of furthering the cause of the electrical industry, **Lord Forrester,** managing director of Enfield Cable Works, Ltd., accompanied by **Mr. L. A. Booth,** sales director of the company, and **Mr. H. D. Parsons,** publicity manager, visited Eire and Northern Ireland this week. The films, "Tennessee Valley Authority," and "Power Cables," were shown at the Capitol Theatre, Dublin, on Wednesday and at the Royal Cinema, Belfast, yesterday. Government officials and other prominent persons were invited, and Lord Forrester spoke at each performance.

An interesting new step has been taken by the co-operation of the management and shop representatives in the introduction of an output committee at the Heaton works of C. A. Parsons and Co., Ltd. At the committee meetings, held under the personal direction of **Sir Claude Gibb,** chairman and managing director of the company, suggestions submitted freely by any employee are thrashed out, and if an idea is likely to lead to improved production an immediate monetary award is granted, to be followed by a further award if it proves satisfactory in service. Already many ideas which will help in the company's drive for increasing the output of turbo-alternators for the Dominions as well as British power stations, have been put forward and each new suggestion has been found to lead to new sets of ideas. Everyone is encouraged to bring forward suggestions for progress and increased export trade.

According to the current issue of the E.D.A. Bulletin, **Mr. A. Parkin** has resumed duty as area officer for the Northern Counties; **Mr. W. C. Spooner** has been promoted to the position of administrative assistant; **Mr. J. A. Prowse** has returned from service in the Royal Corps of Signals, and has resumed his post as street lighting engineer; **Mr. E. M. Ackery** has returned from the R.A.F. and resumed his post as heating engineer; and **Mr. H. Greaves** has been appointed development engineer specialising in industrial power, in succession to Mr. C. H. de Nordwall, who resigned. Mr. Greaves was formerly electrical engineer with Rolls Royce, Ltd. (Crewe Division).

Among the members of the committee of leading scientists and others appointed by Mr. Herbert Morrison, Lord President of the Council, to consider the policies which would govern the use and development of Britain's scientific man-power and resources in the next ten years, are **Sir Edward Appleton,** a member of the Government's Atomic Energy Advisory Committee, and director of the Department of Scientific and Industrial Research; **Sir Alan Barlow** (temporary chairman), Second Secretary of the Treasury, and a member of the Atomic Energy Advisory Committee; **Professor Blackett,** president of the Association of Scientific Workers; and **Sir George Nelson,** chairman and managing director of the

English Electric Co., Ltd., and chairman of the Census of Production Committee.

On the unanimous nomination of the divisional executive councils, the Executive Committee of the Electrical Power Engineers' Association has ratified the appointment of **Mr. J. F. Wallace,** as general secretary of the association as from January 1 next, in succession to **Mr. W. Arthur Jones** who is retiring. Mr. Wallace has been an assistant secretary for the last 15 years. In 1921 he was appointed Northern area secretary and he has been secretary of the employees' side of the No. 1, No. 2 and No. 13 District Joint Boards for the Electricity Supply Industry. He has been a member of the National Joint Board for some years, and has had charge of negotiations for the association in Scotland, the North of England, the North-East Coast area and North Wales.

The following officers have been elected by the Royal Society: Treasurer, **Sir Thomas Merton;** secretaries, **Sir Alfred Egerton** and **Dr. E. J. Salisbury;** foreign secretary, **Professor A. V. Hill.**

Sir Henry Dale, F.R.S., will retire from his position as Fullerian Professor of Chemistry in the Royal Institution and Director of the Davy Faraday Research Laboratory on September 30, next. The managers have appointed as his successor in both posts **Professor Eric K. Rideal, F.R.S.,** Professor of Colloid Science in the University of Cambridge.

Colonel Sir Wilfrid Garrett, chief inspector of factories, is retiring from that office at the end of the year, or in January, after over 40 years' service. He has held his present position since the early part of the war, having been deputy chief inspector for about two years. Previously he was for a considerable period superintending inspector of factories at Birmingham, and before that he held a similar office at Glasgow. He served with the Royal Artillery in the 1914-18 war.

Miss Caroline Haslett, director of the E.A.W. has received a letter from the Nederlandsche Vrowen Electriciteits Verseniging, Catherijnesingel 32, Utrecht, signed by B. J. Bellear Spruyt, secretary, and in view of its general interest permission has been granted us to make the following extracts:—

"It was with some emotion that we read in THE ELECTRICIAN of October 19, of the E.A.W. 21st anniversary, emotion partly out of gladness for the growth and welfare of your association during all those years we were isolated from any news about it, and for the greater part, out of the deep satisfaction that contact is possible once again. We add our congratulations to those of so many others, and we express the wishes and the expectation that your association will continue to contribute its part to the happiness and welfare of the home. If there is anything this war and the occupation of our dear country, with all its consequences, has taught us, it is the necessity for measures to make things easier for women in their task of housekeeping. The demand for electrical apparatus is stronger and greater than ever, but it will take years for this demand to be completely met. During those years of oppression our Dutch Electrical Association for Women was hardly able to work in any direction. In the beginning there was some possibility of giving advice as to economical cooking and how not to exceed the low electricity rations, but afterwards our activity was restricted in every way, and last year the lack of everything and the terror of men being deported, imprisoned and shot down put a definite end to our work. Practically all our files were lost—burnt or destroyed—but we started afresh right away, grateful above all that your people and the Allied Forces liberated us, and that the oppressors are gone. Work is getting easier gradually and we hope to work off arrears before long.

Obituary

Mr. C. F. Hart, mechanical superintendent of Associated Newspapers, Ltd., from 1907 to 1914, on December 1, aged 78 years.

Mr. James Whitehead, a member of the I.E.E., at Hendon, on November 30, aged 80 years.

Mr. James Watt, chairman of Bruce Peebles and Co., Ltd., and other companies, at Edinburgh, aged 82 years.

Mr. James Henderson, a director of the United Steel Companies, Ltd., and a past-president of the British Iron and Steel Federation, on November 20, aged 77 years. He was for several years chairman of the Iron and Steel Industrial Research Council, and a member of the Advisory Committee of the Scientific and Industrial Research Board. He was also a member of the Council of the Iron and Steel Institute, hon. treasurer from 1934 to 1942 and president of the institute from 1942 to 1944. He was awarded the Bessemer medal in 1939.

Mr. J. B. Palmer, of Metropolitan-Vickers Electrical Co., Ltd. In that organisation he had occupied, successively, the positions of transformer designer, mechanical and development engineer, transformer sales manager and, outside, manager of their Belfast office and acting manager of the Manchester office. In these various capacities he was widely known in the electrical industry, and his pleasant, able personality will be greatly missed. His earlier days included apprenticeship with the Thames Iron Works, Ltd., and experience with the London Underground Railways. He visited the U.S.A. to study h.v. transformer practice.

Service Engineering

Views on Its Growth and Attendant Problems

IN a paper read before the members of the Institute of Fuel at the Institution of Mechanical Engineers, yesterday, Thursday, Mr. O. W. Roskill dealt with the growth of the work of the service engineer and fitter, dealing mainly with domestic fuel and power appliances.

The more widespread use of improved domestic appliances of all kinds, he said, was likely to be one of the most characteristic trends of the next twenty years. Many of the new appliances which would be needed were to be mass-produced to standard designs in Royal Ordnance factories. It seemed possible, therefore, that public utility undertakings might find themselves with substantial numbers of consumers in their areas who were using appliances neither chosen nor installed by the utility undertaking. The consumer would want service and the Government had given no clue as to who would provide it. In general it paid an industry to see that its product was efficiently used, and this applied particularly to all the fuel industries. Electricity undertakings might well look somewhat askance if expected to service appliances from whose choice and installation they had been more or less completely divorced. Nationalisation was unlikely to make any great difference to such an attitude.

Installation and Servicing

Stressing the necessity for close relationship between installation and servicing, Mr. Roskill said that unless installation work was correctly carried out, servicing would become a matter of re-installation. Close co-ordination between installation and servicing was very much easier where both were carried out by, or under the supervision of, the same organisation, as in the case with electricity undertakings, than when they were not. The service engineer increasingly tended to be more of a specialist in a certain type of appliance. It was evident, therefore, that consideration of service work led inevitably to consideration of training for service engineers. Training might be divided under three heads, namely: (1) apprentice training; (2) training of men who had already been engaged in other activities; (3) a refresher course to keep service engineers up to date with the latest developments in design and technique. Hitherto such training facilities as there were had been developed by individual electricity undertakings. There seemed to be a case for organising training on a national basis, probably with regional training centres. It seemed to be a fairly general experience that it paid to specialise in organising servicing work.

Specialisation

Specialisation in servicing tended to mean specialisation in tools and in some cases, even, appliances were made so that they could, in effect, only be adjusted with the aid of specialist tools. With regard to the question of the alternatives of regular servicing and servicing on call, the former was much the preferable. If service was to be given regularly regardless of whether or not the consumer asked for it, the logical deduction was that its cost must be included either in the price of the fuel or in that of the appliance. In the case of public utility undertakings it was probably best included, as at present, in the price of the fuel, provided that the consumer bought or hired his appliances through the undertaking, as in the greater proportion of cases he did. The undertaking then had some control over the type of appliances used and their suitability from the servicing point of view. Attention had been drawn to the danger that if the Government bought in bulk large numbers of "utility" appliances (possibility made to its own design) that important aspect might be neglected, particularly if low first cost was given undue stress. There were a number of exceptions to that generalisation. A substantial proportion of electric refrigerators were purchased through the retail trade either in department stores, specialist electrical shops, or in some cases from manufacturers' retail shops. Those might be serviced by the consumer's local electricity undertaking, but in many cases—probably the majority of cases—the manufacturer or his agent did the servicing and generally charged for it, apart, of course, from any attention which might be given under the terms of a guarantee.

There was every reason for aiming at increased mechanisation in the home. Reliability must, however, accompany mechanisation. Reliability was unattainable without regular servicing. There should be a close relation between design and servicing. Industrial design tended sometimes nowadays to be discussed in terms of æsthetics, which was a fundamental error. Servicing demanded, above all, ease of access. At present the contact between design and servicing was far from good.

In Parliament

Supply Development—Debate on Tummel-Garry Scheme

The following are replies to recent questions in the House of Commons:—

Planning and Developments.—Replying to Mr. McAllister, who asked the Secretary of State for Scotland what steps he was taking to co-ordinate the development of the hydro-electricity, industry, agriculture, housing, the tourist industry and the creation of new towns in the Highlands, and if it was his intention to establish a North or Scotland planning committee to discharge this function, Mr. Buchanan replied that it was the duty of his right hon. Friend, in the exercise of his various statutory responsibilities in planning and other fields to secure the co-ordination of all forms of development; and this responsibility could not be delegated to a committee. He was in continuous touch with the Scottish Council on Industry and arrangements existed for full consultation between him and the other Ministers concerned.

Electricity Supplies.—Mr. D. la Bère asked the Minister of Fuel and Power whether, in view of the fact that certain electricity undertakings in this country are inserting a clause in their forms of agreement for the supply of electricity to the effect that the company shall be entitled to terminate the terms and conditions under which the supply of electricity is provided and taken upon giving seven days' notice to the consumer, he will introduce legislation to render such stipulations and conditions illegal, especially having regard to the interests of men released from the Forces who live in the rural areas. In a written reply, Mr. Shinwell said the clause referred to was intended to enable the electricity supply undertakings to vary the terms and conditions, such as charges for electricity, at seven days' notice, but not to terminate the supply. The clause did not seem to him to be unreasonable.

Electricity Supply (Development).—In a written reply to Mr. De la Bère who asked the Minister of Fuel and Power whether, in view of the willingness now being expressed by the electricity undertakings throughout the country to instal electricity and develop the rural areas, he would consult with the departments concerned, with a view to the provision of labour and the supply of materials, in view of the fact that shortage of both labour and materials was retarding progress, Mr. W. Foster stated that he was satisfied that the industry was receiving a fair share of labour and materials in the present conditions. The Minister was expecting to meet representatives of the industry in the near future to discuss the whole question of development work.

Tummel-Garry Scheme: In the course of a recent debate in the House of Lords, Lord Teviot said it appeared that the Northern Scotland Hydro-Electric Board was entirely in the hands of the Electricity Commissioners. Could not Scotland have electricity commissioners of its own, and do things in its own way? He suggested that the development of atomic energy might have a big effect on schemes, such as this, for generating power. Was it absolutely necessary now to embark on the tremendous expenditure of £6 000 000 to £7 000 000? The scheme had much genuine opposition for various reasons and he hoped those in authority would pause in the matter. Lord Sempill said that if the Tummel-Garry scheme was passed, Scotland would find herself, if we were active in atomic power research and development, in possession of out-of-date equipment in a decade or so. Lord Lovat asked what the Northern Scotland Hydro-Electric Board proposed to do about the Loch Morar scheme and why the Board did not let the people know far in advance about the 102 schemes they proposed to adopt. In the course of the Government reply, Lord Westwood, Lord in Waiting, said that the Secretary of State for Scotland had the most complete confidence in the impartiality and integrity of those who had carried out the inquiries into the schemes, and he was confident that mischievous suggestions of bias which had been made by opponents of the scheme would find no support in any responsible quarter. In the view of the Government, the Hydro-Electric Development (Scotland) Act, 1943, so far as concerned the submission and confirmation of the schemes, had worked well and no ground had been seen for any departure from the procedure laid down. He said that it was not the case, as had been said earlier in the debate, that a credit of £30 000 000 had been placed at the Board's disposal. The Board, in submitting schemes, and the Electricity Commissioners and the Secretary of State in approving them, must have regard to their effect upon the Board's budget, and to the obligation to see that the budget was balanced. On the question of atomic energy, the answer was that its development was a matter for the future, while the need for the production of additional electricity was an urgent and present necessity. A division on the motion for rejection of the Tummel-Garry scheme was challenged, but was not persisted in, and the motion was negatived.

Electricity in Ships

By A. C. HARDY, B.Sc., M.I.N.A.

THIS is the first occasion on which an article on electricity in ships from my pen has appeared for nearly two years and in that time almost staggering developments have taken place. It is true that these are more numerical than technical but the technical aspect has been by no means quiescent. In short the electric ship has now arrived and ranks in importance with the motor ship or vessel with Diesel engines coupled direct to her propelling shafts. It is significant to note that there are nearly as many electric ships afloat at the present time as there were motorships at the end of the 1914/18 war. Just as that conflict gave a tremendous fillip to the production of Diesel engines for marine purposes so the last war has proved a breeding ground for the electric ship. Quirks of manufacturing necessity have been almost as important as any other factor in this phenomenal development. All the same the effect of a probable minimum of 8 million electrical horse-power afloat on the seas of the world is something which is likely to remain for many years and to influence the course of marine engineering as a whole.

Whilst the United States bulks very largely in the matter considerable progress has been made in this country and particularly so in recent years. Furthermore, an indication of the confidence which shipowners in this country have in the electric ship is seen in the recent orders placed by cargo line and tanker operators. Some further generalities may be made before a detailed examination of certain specific cases.

Turbo-Electric Popularity

Turbo-electric drive is becoming popular in Great Britain for cargo vessels of the highest class including some with considerable insulated space. It is also being employed in fast tankers, some of which appear to have been designed with naval use in view. Whilst Diesel-electricity has not moved numerically so far, or as fast as turbo-electric drive in this country, it is nevertheless on order, or under consideration, for several specially interesting ships, including the first ocean-going electric tanker ever built in Great Britain with Diesel engines and a.c. drive. It will be remembered, by the way, that the Diesel-electric tanker as such, is no stranger to this country since three vessels were built for United States owners in a Clydeside shipyard, and fitted with B.T-H. machinery in the late twenties. In this case d.c. was used.

As far as Diesel-electric drive for smaller types of ships, e.g., harbour craft, etc., is concerned it is likely that there will be considerable rivalry with direct-coupled types of power plant. In the United States, electricity has been mainly applied on the propulsive side to tankers, where a vast scheme of standard turbo-electric ships has been constructed, based upon the original Atlantic Refining Co.'s design and evolved by Mr. Lester M. Goldsmith, the doyen of electric shipowners, as he has been called. Diesel-electricity has been employed in powerful ice breakers, in floating power houses to supply the army in its operations in the Pacific, in refrigerator barges and in certain important naval auxiliaries of high power.

Growth of Electric Shipping

The following figures give some indication of the growth of electric shipping in the last few years. The report of Lloyds Register of Shipping operations for the year 1937-38 mentions a total of 110 Diesel and turbo-electric ships, totalling 644 990 gross tons as listed in the society's register book. Of these, 41 of 468 583 gross tons were turbo-electric ships and 69 of 176 407 tons Diesel-electric. The growth in the previous decade had been slow, when the 1928-29 figures were 53 with a total of 187 371 of all types, of which 23, with 130 992 gross tons, were turbo-electric.

At the outbreak of war there was little other than a very specialist interest in electric ships, indeed if anything, the turbo type was declining numerically though the Diesel type was increasing with the application of the electric motor to the propulsion and powering of harbour craft and work boats.

An account of the development of Diesel-electric propulsion in the United States, given by Mr. H. C. Coleman in 1940, called attention to the fact that more than 20 years had elapsed since the first Diesel-electric installation for marine propulsion was constructed in the United States, and at the present time, i.e., 1940 there were altogether 178 such installations completed, or on order, representing over 136 000 H.P. The types included 51 tugs, 34 ferries, 23 tankers, 12 river tugs, 11 yachts, 11 lightships and lighthouse tenders, 9 cargo vessels, 9 coastguard cutters, 8 dredgers, 3 fire floats, 3 survey ships and the rest were miscellaneous craft.

Figures of turbo-electric propulsion are not available for that period, but, again according to Mr. Coleman, it marks the beginning of the avalanche. He, however,

prefers to call it " enormous progress in the application of electric drive in ships," and mentions that even a year ago 870 turbo-electric propulsion sets totalling about 7 600 000 H.P. and nearly a thousand Diesel-electric sets, totalling more than 2 600 000 H.P., had been built or were on order. Even allowing for possible losses, which undoubtedly were heavy, there is no doubt that the wheels of production have been turning so rapidly that this figure is by now considerably exceeded. From all of which the vital fact emerges that the United States alone had built or was constructing nearly 2 000 electric ships of all types, with a total of over 10 million H.P., which, measured in terms of production alone, is a tidy figure. It may be estimated that United States production represents approximately 80 per cent. of the total of the world to-day, she and Great Britain being the only two countries building electric ships.

Of other countries interested in marine engineering, both Sweden and Switzerland are capable of producing electric propulsion equipment, though each does so only on an export basis; Switzerland obviously so, and Sweden because in general neither the Swedish shipowner nor her clients abroad have shown any particular liking for electric drive. Sweden's major contribution to marine electrical engineering incidentally was the electro-magnetic slip coupling, which has now been adopted in a number of other countries and which will probably go down to history as being Swedish, merely because Sweden happened to think of it first. France as a former builder of electric ships may well return to them when her ship-building is reorganised.

Mass Production Possibilities

If then the point is accepted that the electric ship is here to stay and that it is likely to influence the marine engineering trends of the world to a very great extent, it is interesting to inquire into the reasons for this phenomenal growth. Mr. Coleman's opinion is that the rapid expansion is due mainly to the war and partly to the shortage of gear-cutting machinery. In other words, it would seem that marine electrical organisations were able to offer their machinery on a mass production basis under conditions equal to, and in some cases better than, those of other types. This may be due to the fact that considerable improvements have taken place in marine electrical machinery in recent years. For instance, fabrication of plates and welding of structures means a saving in waste and space. Also operating speeds of turbo-generators have increased. There is a more general tendency to accept land practice in the turbo-electrical installations, thereby making it possible for firms to offer standard generator sets.

While this may all be true of war conditions, it would not account for the fact that such cautious companies as the Canadian Pacific Steamship Co., the Union Steamship Co. of New Zealand and the Anglo-Saxon Petroleum Co. will all be taking delivery of electric ships within the next 18 months, while the Union Steamship Co. will be soon accepting an interesting little cross-channel type—virtually a repeat of one constructed some few years before the war. This is a plain indication of the reliability in service of the original equipment, as well as of satisfaction with the initial choice of machinery.

It is, in fact, rather difficult to analyse the reasons for some of the other recent marine electrical orders in this country. Possibly price may have been an important factor, rapidity of delivery another, while the flexibility of electric drive may have appealed to owners. It is a flexibility of space and a flexibility of manœuvring.

Views on Shaft Tunnels

Many naval architects are still of the opinion that the elimination of the shaft tunnel has never been fully exploited, for certain types of cargo and in ships of a complicated 'tween deck nature, the elimination of probably 150 to 200 ft. of shaft tunnel space in a large ship is important. It is also, in these days when rapidity of construction is vital, representative of a saving in material and, of course, in workmanship. Rapidity of manœuvring is another advantage, and although the ability of an electric ship to use full power astern is in some ways theoretical rather than practical, it is nevertheless there. As to which type of machinery should be employed, i.e., turbo-electric or Diesel-electric, or, if the latter, whether a.c. or d.c., are points governed by the service upon which the ship is going to run, the size and type of auxiliary load, the fuel position on the route and, of course, price, individual preference, previous experience, etc. It will be interesting to watch progress with Diesel-electric a.c. drive in the future, and the fact that such an important company as the Anglo Saxon Petroleum Co. has ordered a Diesel-electric a.c. set for one of its standard new tankers, is significant; all the more so when it is recalled that supercharged 4-cycle Diesels are to be employed for driving the generators, and an exhaust gas system with heating boilers is being used for cargo purposes. Alternating current will, it is understood, be used for the cargo pumps. A company of the size, importance and wealth of the Anglo-Saxon

organisation can, of course, afford to experiment, but even so, they would not be likely to experiment with equipment of which they were uncertain.

Electricity a Welcome Guest

It may seem, from what has been said above, that I have written with an air of surprise that so many electric ships are being ordered or built. Nothing could be further from the truth, but the marine electrical industry, no doubt, remembers that it has had to fight for its acceptance by shipowners and their advisers, and that it has been pushed through a semi-open door by the weight of circumstances, rather than pulled through by any sympathetic, welcoming hand. Having entered the house, it appears to be at least a very welcome guest, the warmth of welcome increasing in accordance with the satisfaction of the guest's behaviour.

Whilst the subject of Diesel-electric drive, is still being discussed, it is interesting to recall that the 15 000 S.H.P. Patria—largest and most powerful ship in the world fitted with this kind of propulsion in association with a.c., prior to the outbreak of war, and built for the Hamburg American Line's Hamburg—West Coast of South America trade—is now being operated by a British company. A contemporary who shall be nameless, has commented in interesting fashion upon the operating experience of the new engine room crew, . . . an experience apparently which was not altogether happy.

It is referred to because it is felt that sooner or later such experience may be held up as a reason why electric propulsion should not be employed in future ships. All German electrical ships are infinitely and unnecessarily more complicated than their British opposite numbers; also the selection of engineers for such a ship must be very carefully made. It is not. at this juncture in the development of Diesel-electric a.c. drive for ocean-going ships, sufficient to pull an odd man out of the hat.

Need for Simplicity in Operation

In this particular ship the whole of the six generator sets form a central power station from which auxiliary power is tapped off, and suitably converted. Control of the propeller speed involves control of the main engine, while a considerable amount of the switch gear required for what our contemporary calls, pool operations, is electrically-operated from a central control position equipped only with push-buttons. One complaint made was that without any warning there was a sudden and complete black-out, not only of all lights, but of all machinery throughout the ship, the steering gear being no exception. This dangerous condition lasted for half an hour, terminating in one of the generators burning out. The trouble was traced to a mistake with the controls and was apparently followed by a second similar breakdown.

It is not the object of this article to discuss the reasons for such happenings, but to stress that this should not be regarded as a condemnation of Diesel-electric a.c. drive, or for that matter, of any drive. New crews, even under the guidance of the ship's own experts, operating entirely foreign machinery in every sense of the word, are bound to find difficulties. The happening should be noted, however, by our own marine electrical designers so that British ships of similar type constructed in the future, are not too elaborate.

Welding Research

USEFUL discussions on the applications of research to industry were a feature of the British Welding Research Association's symposium on the "Metallurgy of Steel Welding," held in London, last week.

The president of the association, Sir William J. Larke, said that research was useless if the results obtained did not find practical application and thus make their contribution to the improved efficiency of industrial production. It was only through enlightened interest in the work that they could hope to secure support both personal and financial, from the industries concerned in the development and application of welding.

Undoubtedly one of the most effective means of securing that objective was by the organisation of symposia at which those engaged in research could make authoritative statements on the work and its results, and receive in return comments, suggestions and criticisms which would stimulate further effort and in many cases suggest additional avenues for exploration.

Mr. A. Ramsay Moon, director of research, gave an outline of the association's work in relation to the metallurgy of steel welding.

The next speaker, Mr. J. G. Ball, secretary of the Main Ferrous Metals (Metallurgical) Committee supplemented Mr. Moon's remarks with an analysis of the various papers submitted at the symposium.

The general conclusion from the discussion was that it was in the interest of research and industry to have a series of symposia and the Research Association are planning along these lines.

The papers and discussion will be published in due course by the British Welding Research Association as a volume of proceedings.

Answers to Technical Questions

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

What is meant by the natural load of a transmission line?

The natural load of a transmission line may be defined as the load (at unity power factor) at which the rise in voltage due to the flow of charging current through the line reactance exactly counterbalances the drop in voltage, due to the flow of load current through the line reactance. If the line had no resistance the voltage and the current would then remain constant throughout its length. The magnetising reactive volt-amperes required to set up the magnetic field associated with the current will be exactly balanced by the leading reactive volt-amperes associated with the electrostatic field which obtains as a result of the voltage V. Such conditions are desirable in a transmission line and most long lines are designed so that their full-load rating is near to the natural load.

The value of the natural load may be found by considering a small section of the line as shown in Fig. 1, where L henrys is the inductance per unit length and C farads is the capacitance to neutral per unit length. If the current through the section is I amps. the voltage drop to the inductance will be $I \cdot \omega \cdot L = IX$ and the lagging magnetising volt-amperes necessary to set up the magnetic field associated with this section will be $I^2 \cdot \omega \cdot L$. If V is the voltage to neutral, the charging current of the section will be $V \cdot \omega \cdot C$ amps and the leading reactive volt-amperes will be $V^2 \cdot \omega \cdot C$. If these two are to balance each other—

$$I^2 \omega \cdot L = V^2 \omega C$$

$$\therefore \frac{V^2}{I^2} = \frac{L}{C} \qquad \therefore \frac{V}{I} = \sqrt{\frac{L}{C}} = Z_0$$

This quantity, Z_0, is known as the characteristic impedance of the line. The

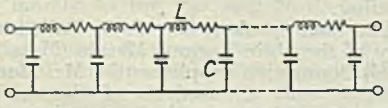

Fig. 1.—Representation of transmission line

power which is being transmitted with the above current I is, for a three-phase line, equal to $3 V_{ph} I = \frac{3 \cdot V^2_{ph}}{Z_0} = \frac{V_L^2}{Z_0}$ where V_L is the line voltage, and this is the natural load of the line.

For a standard 132 kV grid line which has the following constants L = 0.21 × 10^{-3} henry/mile, C = 0.0141 × 10^{-6} farads/mile,

$$Z_0 = \sqrt{\frac{0.21 \times 10^{-3}}{0.0141 \times 10^{-6}}} = 386 \text{ ohms.}$$

$$\therefore \text{Natural load} = \frac{(132\,000)^2}{386} \times 10^{-6} = 45 \text{ MW}$$

The value of Z_0 for any overhead line, whatever the voltage, does not differ much

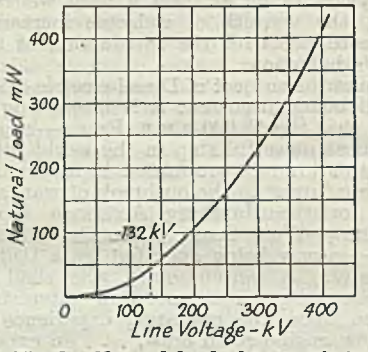

Fig. 2.—Natural load of transmission line for various voltages

from the above value of 386 ohms, so that the natural load of lines of other voltages is shown in Fig. 2. The designed full-load of the grid lines is 50 MW and if any other long lines are investigated it will generally be found that the full-load is not widely different from the natural load. It should, however, be noted that if an actual line is loaded with its natural load the resistance will prevent the voltage along it from remaining constant, and the drop will be approximately that which would be caused by a direct current flowing through the line resistance. E. O. T.

What is the universal decimal classification, and what are its uses?

The universal decimal classification of all knowledge is an attempt to classify by numbers, with decimal extensions and other symbols, the sum total of information available, whether such knowledge is firmly established, experimental or empirical, speculative, or, being on the fringe of ascertained fact, unrelated to existing co-ordinated knowledge. The U.D.C. is the development of the decimal extension scheme devised by Melvil Dewey in U.S.A., and is intended to be used on an international scale. The present standard

version is issued by the Fédération International de Documentation. This arrangement has already been published in French and German; it is in the process of being issued, in English, by the British Standards Institution, and will be known as British Standard 1 000. It will amount to several large volumes. Not only must there be the complete table of numeration, but also indexes and a number of shortened tables to enable users to find their way about the mass of headings and subdivisions provided.

The system is intended to be indefinitely extendable by simple decimalisation; that is, when any particular subject requires sub-division, the desired new divisions are given a number which is added to that of the topic, thus not disturbing any other part of the numeration. Although primarily designed for use in large libraries and catalogues, it is very useful for smaller collections of data, bibliographies, research notes, and the like; by a simple coding system, any number associated with a topic or subject can be associated with a country, language, point of view, or date.

The following main classes give the idea how all knowledge is divided:—Class 0, generalities, bibliography, library science; Class 1, philosophy; Class 2, religion; Class 3, social science, law; Class 4, philology; Class 5, pure science; Class 6, applied science, medicine, technology; Class 7, art; Class 8, literature; Class 9, history, geography, biography.

The Science Museum Library and many others use this classification. Many abstracting organisations, such as Science Abstracts, have gone over entirely to the system, which is a great help since the same numbers apply to the same topic in all languages. For the individual who has to work in some specialised field, the numbers become, however, very cumbersome. For private purposes there is no reason why some simple coding cannot take the place of the main divisions of a subject, while retaining the detail numbers covering the branch of knowledge in hand. From time to time, as knowledge increases in detail, proposed further sub-divisions will be authorised and presumably made official, and published as periodic supplements to the main scheme. L. E. C. H.

Correspondence

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

Changing of Vector References

[To the Editor]

Sir,—In The Electrician of July 27 last an article by Dr. G. L. d'Ombrain appeared, entitled "Changing of Vector Reference."

The derivation below of the final formula given is considered to be simpler and more straightforward.

1. Let the two vectors $\dot{A}$, $\dot{B}$ be expressed as

$$\dot{A} = A\angle\theta \quad = a + jb$$

$$\dot{B} = B\angle\phi \quad = c + jd$$

in terms of some arbitrary reference vector.

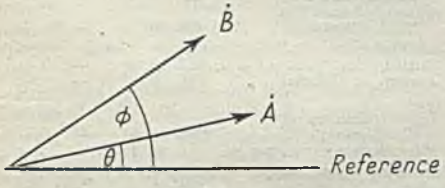

Fig. 1

2. If vector $\dot{A}$ is chosen as reference:

The two vectors $\dot{A}$, $\dot{B}$ then become:—

$$\dot{A} = A\angle 0 \quad = \sqrt{a^2+b^2} + j0$$

$$\dot{B} = B\angle\phi - \theta \quad = x + jy$$

in terms of $\dot{A}$ as reference vector.

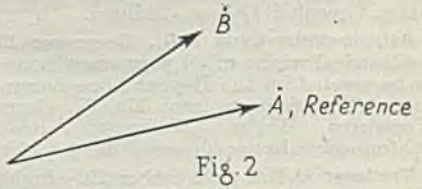

Fig. 2

3. The product $AB\angle\phi - \theta = A\angle -\theta \; B\angle\phi$ is independent of the reference chosen. Hence:

$$(a - jb) \quad (c + jd) = (\sqrt{a^2+b^2} - j0) \quad (x + jy)$$

$$x + jy = (c + jd) \quad (a - jb)$$

$$\sqrt{d^2+b^2}$$

which leads to the rule given by Dr. d'Ombrain.

Yours faithfully,

C. E. Moorhouse,
M.E.E., B.Mech.E., A.M.I.E.(Aust.)
Melbourne.

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 Department of Overseas Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated.

Salford City Council.—Supply and installation of an electrically-operated goods lift at the Bloom Street depot of the gas department. Particulars from the Gas Engineer, Gas Offices, Bloom Street, Salford, 3, Lancs.

North of Scotland Hydro-Electric Board (Distribution Scheme No. 1), December 10. —Supply, delivery and erection of h.t. and l.t. distribution lines. Specification from Mr. T. Lawrie, 16, Rothesay Terrace, Edinburgh, 3; deposit, £2 2s.

Inverness B.C., December 12.—Supply of: (1) 6.6 kV switchgear kiosk complete with switchgear; (2) one 250 kVA kiosk sub-station; and (3) one 500 kVA distribution transformer. Specifications from Mr. N. B. Macarthur, Electricity Offices, Waterloo Place, Inverness; deposit, £1 1s.

Plymouth Electricity Department, December 12.—Supply of (a) time switches (b) underground disconnecting boxes and (c) reinforced concrete lamp columns and brackets. Specifications from the City Electrical Engineer, Armada Street, Plymouth.

Oldham B.C., December 14.—Supply of e.h.t. cable and cast iron frames and covers. Specifications from the Chief Engineer and Manager, Electricity Department, Greenhill Offices, Oldham.

Ashton-under-Lyne B.C., December 17. —Electrical wiring of 50 permanent houses to be erected on the Reyner Lane housing site. Specification from Mr. N. Jones. Electricity Works, Wellington Road, Ashton-under-Lyne; deposit, 5s.

Tredegar U.D.C., December 29.—Supply and delivery of two 250 kVA, 11 kV, 400-230 V transformers and one 500 kVA, 11 kV, 400-230 V transformer. Specification from Mr. W. Davies, Bedwellty House, Tredegar. Mon.

Sutherland C.C., December 29.—Electrical work in connection with the construction of 60 houses in Golspie and Brora. Specification from Mr. E. W. Brannen, County Architect, Dornoch.

Sheffield Electricity Department, December 31.—Supply and delivery of two 600 kVA, 11/440 kV, 3-phase double wound self-cooled transformers. Specification from Mr. John R. Struthers, Commercial Street, Sheffield, 1; deposit, £2 2s.

Maesteg U.D.C., January 1.—Supplying and laying of l.t. mains, services and public lighting at the Caerau housing site, Specification from the Engineer and Manager, Electricity Department, 35, Commercial Street, Maesteg, Glam.

Overseas

State Electricity Commission of Queensland, January 14. — Supply, delivery, erection, and setting to work of 7 500 kW and 750 kW steam turbo-alternators, accessories, and evaporating plant at Wide Bay Regional Electricity Board, Maryborough; Capricornia Regional Electricity Board, Rockhampton; and Townsville Regional Electricity Board. Tender forms from the Agent-General for Queensland, Queensland Government Offices, 409-410, Strand, London, W.C.2.

Eire Electricity Supply Board, January 28.—Supply, delivery and erection of the hydro-electric generating plant at Cathaleen's Fall and Cliff stations on the River Erne. Particulars from the Chief Design Engineer, Electricity Supply Board, 26, Lower Fitzwilliam Street, Dublin, C.18, deposit, £5 5s.

Metal Prices

		Monday, Price.	Dec. 3. Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9 7/16d.	—	—
Sheet	„	11 1/4d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. 0 7/16d.		—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
Wire „	„	11d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£30 0 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ...	„	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G. ...	„	£26 0 0	—	—
Lead Pig—				
English	„	£31 10 0	—	—
Foreign or Colonial	„	£30 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	„	£303 10 0	—	—
Wire, basis... ...	per lb.	3s. 10d.	—	—
Aluminium Ingots ...	per ton	£85 0 0	—	—
Spelter...	„	£31 5 0	—	—
Mercury (spot) Warehouse	per bott.	£31 5 0	—	—

Prices of galvanised steel wire and steel tape supplied by the C.M.A. Other metal prices by B.I. Callender's Cables Ltd.

Electricity Supply

Watford.—The Electricity Committee has obtained sanction to borrow £2 000 for meters.

Bedford.—A net surplus of £18 049 for the year, is reported by the Electricity Committee.

Kent.—The C.C. Offices Committee is to provide fluorescent lighting in the council chamber at a cost of £290.

Maidstone.—The Kent C.C. is to renew the electrical installation at the Judges Lodgings at a cost of £420.

Bexhill.—The Electricity Committee has agreed to the application by the Hastings Corporation for a fringe order to supply Shortwood Farm.

Morecambe.—Sanction is being sought by the Electricity Committee to borrow £5 000 for mains extensions and £1 250 for feeder main and sub-station equipment.

Battersea (London). — The Electricity Committee is to relay mains in the Shaftesbury and Beaufoy estate roads at a cost of £5 105, and increase plant at sub-stations at a cost of £2 916.

Sedgley.—The Housing Committee has received quotations from the gas department and the Midland Electricity Corporation for Power Distribution Ltd. for public lighting on new housing estates, and decided upon electric lighting.

Bedford.—The Electricity Committee is to provide supply to a number of isolated farms, and other premises at Cople, Northill, Willington, Mogerhanger, Beeston and Kempston at a cost of £3 550. The Electricity Committee has arranged terms for the resumption of street lighting in Potton. The P.C. is to pay the corporation the cost, estimated at £411 of converting 32 lamps from gas to electricity.

Croydon.—It is reported that the Central Electricity Board has now issued a formal direction to the Council to construct the further section of the new power station, ready for commercial operation, in September, 1949. The Housing Committee has decided that on the Addington estate 75 per cent. of the houses shall be provided with gas cookers, gas fires, electric light and power plugs, and 25 per cent. with electric cookers, electric fires, electric lighting and power plugs.

Poplar (London).—In the report of the Electricity Committee for the year ended March 31, the total number of units sold is given as 52 514 362. The net income from sale of current and sundry charges was £340 633, working expenses £298 218, gross profit for year £42 415, leaving a net deficiency of £43 351.

Battersea (London).—It is estimated that the London Power Company's plans for extending the Battersea generating station will cost £3 372 436. This extension is a continuation of the proposals for which the station was originally designed, and forms part of the national programme for increasing the available generating capacity for the grid supply.

Stirling.—The electricity undertaking has been advised by the Electricity Commissioners that they will be prepared to permit the T.C. to change from d.c. to a.c. in a limited number of instances in advance of the general change-over. The Council has now decided that it will not effect a general change-over, but will advise individual consumers in advance as is found necessary.

Burnley.—The Electricity Committee has passed a resolution favouring the resumption of hire-purchase facilities for consumers. Meanwhile steps are being considered to secure funds to finance the schemes, and consent is being sought for loans for wiring installations and the provision of consumers' apparatus to the extent of £3 536 and £6 597 respectively, and a loan of £2 000 for the provision of cookers.

Basingstoke.—In connection with the scheme to provide an electricity supply to 316 new houses at the South View housing site the T.C. has decided to apply to the Electricity Commissioners for permission to carry out the work, and for sanction to raise a loan of £14 000 for the extension scheme; and that authority be given the Electricity Committee to purchase all the necessary apparatus and to put the work in hand.

Mansfield.—The Electricity Committee is to provide supply to the Bancroft housing estate at a cost of £2 000 for sub-stations, and plant and £3 057 for cables; extend the 11kV system to Bull Farm and Pleasley at £10 884 for distributors and pillars, and £1 260 for plant; lay mains to the Mansfield Woodhouse housing estate at £618; provide supply to 56 houses on the Racecourse estate at £486 and to Station Street at £1 040; and provide supply to Low Oakham Farm at £410.

Scottish Distribution Scheme No. 3.—The North of Scotland Hydro-Electric Board has been informed by the Electricity Commissioners that they have now approved of the technical and financial details of the Board's distribution scheme for Gairloch and Aultbea in North-West Ross-shire. This is the Board's third distribution scheme; it will now be submitted

to the Secretary of State for confirmation and will shortly be published.

Electricity Expansion Scheme.—At the inauguration of the Caroline Haslett Trust Fund, details of which were given in our last issue, Mr. H. Hobson, chairman of the Central Electricity Board, who was one of the principal speakers, said that the electricity supply industry was embarking on a five year expansion plan, costing £450 millions. Of this sum about £150 millions would be spent on generation and at least double that amount on distribution. Completion of the programme would mean an increase in electricity output of between 8 000 and 10 000 million units per annum, of which probably more than half would be for domestic use.

News in Brief

Lecture Course on X-rays.—A course of lectures on X-rays will commence at the L.C.C. South-East London Technical Institute on January 11, next, at 6.45 p.m. Prospective students are requested to enrol, if possible, on December 12, between 6.15 p.m. and 6.45 p.m. The fee for the single subject will be £1.

Aberdeen Lighting.—The T.C. has approved the resumption of double lighting on the main streets used by buses and trams, subject to Ministry of Fuel authorisation. The decision results from the fact that transport drivers complained of the present one-side-of-the-street method of lighting.

"Thanksgiving Savings Week" Donation.—The staff of the Wessex Electricity Co., Newbury, with a target of £750, raised £1 274 during Newbury's Thanksgiving Savings Week.

I.M.E.A. Scottish Centre.— The Scottish Centre of the Incorporated Municipal Electrical Association recently marked the jubilee of the foundation of the association by a luncheon in Glasgow at which members were guests of Lord Provost M'Neill. The latter paid tribute to the work of Sir Wm. Walker in Manchester, who had been appointed the first lay president.

I.E.E. London Students' Section.—At a meeting of the I.E.E. London Students' Section on November 28, a paper entitled "The Production of X-Rays, and Some Electrical Engineering Aspects" by Mr. R. A. Briggs, Student, was presented in the author's absence by Mr. D. G. Chapman. Various pieces of modern portable equipment were illustrated and reference was made to the many applications of X-rays in electrical engineering for inspection purposes. During the ensuing discussion, much interest was aroused in the problems encountered in safeguarding personnel from exposure to the rays, and from the high voltage at which modern tubes are operated.

Blackburn Exhibition.—The Education Authority has arranged an electrical exhibition at the Technical College to stimulate interest in the industry.

Hospital Installations.—The Glasgow Health Committee is to provide electric heating and plugs for wireless at the nurses' home at Stobhill Hospital at a cost of £8 000. Such provision is proposed later at other hospitals.

"Electricity Looks Forward" Exhibition.—An "Electricity Looks Forward" exhibition, organised by the North Western E.D.A., which is touring the Lancashire and Cheshire areas, is now being held in the Guild Hall, Preston. It will remain open until December 15. Features of the exhibition are three model kitchens, and equipment for farm and factory.

Trolley-bus Scheme.—The Glasgow Transport Committee has considered a report from the manager on the question of making provision for trolley buses for the replacement of rolling stock, and approved in principle of an experiment with trolley buses, with the ultimate possibility of extensions at a cost of £126 000, for 25 vehicles at £75 000, overhead equipment £12 000, two sub-stations £5 000 and cables £34 000.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of December 3, 1920. —In a recent issue we called attention to the vulnerability of large power stations to attack. We suggested that the matter was one for the adoption of some form of protection. Though the possibility of such an occurrence happening in the near future had not escaped us, we did not realise how soon the necessity for some such form of protection would become evident in actual practice. That this is the case, however is shown by the capture of a Sinn Fein document containing plans for the destruction of the Stuart Street power station of the Manchester Corporation.*

Industrial Information

Control of Mica.—Under the Control of Mica (No. 5) (Revocation) Order, 1945, which came into force on December 1, licences will no longer be required for the

Illuminated cross on the spire of Coventry Cathedral

acquisition, treatment, use, or consumption of any categories of mica.

Change of Address.—The Gas and Electricity Division of the Ministry of Fuel and Power is being removed from New Oxford House, Bloomsbury Way, London, W.C.1, to Cromwell House, Dean Stanley Street, Millbank, London, S.W.1.

Change of Title.—The Electrical Machinery Traders' Association (E.M.T.A.) has adopted the title of the Association of Electrical Machinery Traders, by which it will be known in future. The secretary is Mr. J. T. Morgan, and the address is 11, Argyll Street, Oxford Circus, London, W.1 (Telephone Gerrard 6177).

Christmas Festivities.—This month's "Cheerful Rationing" card published by the E.A.W. contains helpful and original tips for giving the home a seasonal festive appearance by making one's own decorations from such common things as empty sardine tins, pine cones, etc. There are also recipes for Christmas fare, including biscuits, jelly, and, of course, puddings.

Electrical Domestic Science School to Re-open.—On January 18 next, the London School of Electrical Domestic Science will re-open by running refresher courses for girls returning to, or wishing to join the electrical industry as demonstrators. For the time being there will be two courses: a three-term course for those with previous knowledge of domestic electricity, and a two-term course for those who have previously had some domestic science training. The school will be under the principalship of Miss H. M. M. Minoprio, from whom full information regarding the school can be obtained at the London School of Electrical Domestic Science, Imperial Court, Basil Street, Knightsbridge, S.W.3.

Disposal of Surplus Stores.—At a conference on Monday, convened by the Board of Trade and also attended by officials of the other Ministries concerned with the disposal of surplus Government stores, Lt.-General Sir Wilfrid Lindsell, chairman of the Disposal Committee, outlined the scheme for disposing of goods which are surplus to the needs of the Services. Ministries who are responsible for the original supply of certain goods will also be responsible for the return of any surplus to the manufacturers for reconditioning, etc. Where no agreement can be reached with the manufacturers concerned, the goods will be sold by public auction. An area of approximately 150 000 000 sq. ft. is at present taken up for storing these goods, but it is hoped to have this completely cleared by the end of 1946; the target for clearance for this year is 36 000 000 sq. ft. No figures of surplus electrical equipment are available.

Lighting Effects at Coventry Cathedral.—The special lighting of parts of the "blitzed" Coventry Cathedral gave an impressive effect to the ceremony of consecration of the Chapel of Unity. A large cross in white fluorescent light, upon a laurel wreath of green light, was mounted at the base of the spire, facing towards the east. Built up with 1 280 W white fluorescent tubes, five feet long, upon a white-painted wooden mount, the cross stood 23 feet high overall and the horizontal arm measured 11 feet. The superimposed laurel wreath comprised 36 green 40 W lamps arranged in a circle five feet in diameter, with five green 200 W lamps at the centre. The completed structure was hauled up the face of the tower to the base of the spire, 150 feet above ground level. Within the ruined shell of

the cathedral, white flood-lighting had been installed by the local authorities, throwing into cold relief the piles of masonry and rubble. In the chancel the high altar was bathed in amber light. Concealed in the rubble on the chancel floor were four 1000 W amber flood-lights, while four 100 W white lamps, in small

The operation of an electric iron being demonstrated to members of the Dynamo football team at the factory of Morphy-Richards, Ltd.

reflectors, added special brilliance to the centre of the altar. In front of the chancel and slightly to each side, was one 1 000 W red flood-light, giving a final touch of warmth to the scene. The illuminated cross and lighting of the altar was presented on behalf of the workers in the Coventry factories of the General Electric Co., Ltd., and the installation was voluntarily undertaken by the company's electricians.

Permitted Prices.—The Central Price Regulation Committee has approved a price of 6s. as the manufacturer's selling price for the accumulators made by the Battery Construction Co., Ltd., Bridgwater, Somerset; and the following prices, exclusive of purchase tax from January 1, 1946, for the cycle accessories manufactured by Joseph Lucas Ltd., Great King Street, Birmingham, 19: No. 166 dynamo set, manufacturers' selling price 13s. 10d., retail 24s.; No. 29 lamp, manufacturers' selling price 2s. 5d. and retail 4s.; No. 59 tail lamp, 2s. 1d. and 4s. respectively.

Trading with the Enemy.—The Foreign Office and Board of Trade announce that a new Order has been made with effect on November 27, which contains the complete statutory list, i.e., a revised list of all persons abroad who are specified as enemy under Section 2 (2) of the Trading with the Enemy Act, 1939, and with whom it is unlawful to have dealings of any kind. Persons owing money to, or holding or managing property of persons included in the statutory list, are reminded that they are under statutory obligation to report particulars to the Custodians of Enemy Property.

Irons for Dynamo Team.—One of the last engagements of the Russian Dynamo football team was to visit the factory of Morphy-Richards, Ltd., at St. Mary Cray, Kent, to see the production of part of a consignment of electric irons for Russia. Each member of the team was presented with an electric iron and was shown how to use it.

New Electric Heaters.—Bescol (Electric), Ltd., of Parkfield Road, Birmingham, 8, have issued a coloured illustrated folder (C.21) dealing with electric heating apparatus now in production, including thermostatically controlled streamline electric kettles, convector heators (including a new de-luxe streamline model) and tubular heaters.

Decca Navigator Contract.—The Decca Navigator Company announces that a contract has been signed with La Société Française Radio Electrique on terms providing for the exploitation of the Decca Navigator, including the erection of the necessary transmitting stations, in France, her colonies and the mandated territories. It is intended to erect transmitting stations to provide a link with the first English chain and chains elsewhere in Europe, including Sweden, where negotiations are at present in progress, and it is expected that this S.F.R. contract will result in the provision of a Decca radio grid covering France, the western Mediterranean, French North, West, and Equitorial Africa and Indo-China, for use by ships, aeroplanes, and the Trans-Sahara automobile services.

Components for Housing Schemes.—The Ministry of Health has issued, in connection with the housing programme, a circular (211/45) which includes the following list of electrical components and their B.S.S. numbers which may be used. Whilst the Government claim to appreciate that under present conditions, it is not possible to make a complete change from non-standard to standard products, it has decided to make it obligatory for all local authorities to conform to these new standards in any future housing schemes, excepting those planned previous to the war, extensions to complete pre-war housing estates, or conversion of existing houses: Ceiling roses, B.S. 67: 1938; C.I. conduit boxes, B.S. 820: 1938; steel conduit fittings B.S. 31: 1940; distribution boards, B.S. 214: 1939; cooker control units, B.S. 438: 1941; switches, B.S. 816: 1938; lampholders, B.S. 52: 1941; fuses, B.S. 88: 1939; P.I. cables, B.S. 48: 1942; v.i.r. and p.v.c. cables and flex', B.S. 7: 1939.

Company News

N. Greening and Sons, Ltd.—Intm. 2½% (same).

Hick Hargreaves and Co., Ltd.—Intm. div. 2% (same).

General Electric Corporation (U.S.).—Qtrly. 40 cts. (same).

John Shaw and Sons.—Fst. and fin. div. 10% (7½%)), less tax.

Wellman Smith Owen Eng. Corp. Ltd.—Intm. on ord. 5% (same).

John Brown and Co., Ltd.—Intm. div. 3⅓% tax free (same), payable on Dec. 19.

Clifford Motor Components Ltd.—Intm. 7½%, less tax (same), payable Jan. 31.

British Columbia Power.—Qtrly. 40c. per "A" sh. payable Jan. 15, to record of Dec. 31.

British Rola Co. Ltd.—Fst. and fin. 15%, less tax (same). Tradg. pft. to Mar. 31, £66 463 (£54 714).

Cape Electric Tramways, Ltd.—Fst. and fin. 6% (same). Pft. for yr. to June 30, 1945, £55 209 (£47 810).

B. E. T. Electricity Supply Co.—Co. is to redeem £144 466 4% deb. stk. at 102 on Mar. 1 next, out of surplus resources.

Lincolnshire and Central Electric.—Rev. to Mar. 31, £83 633 (£81 083), incldg. £2 500 (£441) tax recoverable. Ord. div. 9% £34 875 (same).

Joseph Lucas Ltd.—Tradg. pft. after undisclosed tax, defd. repairs and contings. £370 270 (£340 426), obsolescence £50 000 (same), res. fund £100 000 (same). Carry-fwd. £117 136 (£76 916 after £8 000 instalmt. to University of Birmingham fund).

Heenan and Froude Ltd.—Trdg. etc., pft. to Aug. 31, £64 000 (£58 524). To staff fund, int., fees and w.d.c. £10 177, lvg. pft. £53 823 (£47 368). Taxn. £30 000 (£22 000). Fin. div. 5%, and bonus 5%, both same, payable Dec. 10, mkg. 15%, less tax, again. Fwd. £10 156 (£10 472).

Avon India Rubber Co., Ltd.—Net pft. before taxn. £276 096 (£299 812). To taxn. £231 680 (£263 810), defd. repairs £18 000 (nil), war damage nil (£3 140), pension fund £4 000 (same), pref. divs. £7 500 net (same), intm. ord. div. 3% £4 453 (net) (same), fin. ord. div. 4% and bonus 3% £10 389 net (same), mkg. 10% (same), fwd. £38 184 (£38 110).

Great Northern Telegraph Co., Ltd. (Denmark).—Rept. states for each of yrs. 1940-43, incomplete accts. showed income which barely covered expend. and for each of these yrs. no div. was declared. Rept. now issued for 1944 replaces that issued for mtg. in May last. Receipts (incldg. yrs. 1939-43) were £1 645 661, plus £818 550 brot. in. To exes. £1 418 433, div. 20%, and exchge. loss £400 414, fwd. £645 364.

Albion Drop Forgings.—Tradg. pft. for yr. to Sept. 30, 1945, £14 665 (£60 938). Add E.P.T. repaymnt. £6 846 (nil), tax res. no longer required £6 000 (nil), mkg. £27 511 (£60 938), less taxatn. £3 599 (£43 000), leavg. £23 912 (£17 938). To deprecn. res. £3 000 (same), gen. res. £7 000 (nil), fin. div. 7½% (same), mkg. 12½% (same), plus bonus 5% (nil) £13 125 (£9 375), fwd., £16 221 (£15 434).

R. and J. Dick Ltd.—Trdg. pft. (after E.P.T. and defd repairs) for yr. to Aug. 31, 1945, £33 509 (£32 674), add other income, mkg. £39 732 (£38 882), to inc. tax, and E.P.T. on pfts. of R. and J. Dick, Inc. £20 436 (£22 944), deprecn. £121 (£186), dirs.' fees £1 050 (same). Net pft. £18 125 (£14 702), to pref. div. £7 312 (same), fst. and fin. on ord. 15% (10%), less tax, £7 312 (£4 875), gen. res. £5 000 (nil), fwd. £11 928 (£13 427).

Cape Electric Tramways Ltd.—Prelim. statemnt. yr. to June 30, reports increase in gross rev. of £93 000, but this has bn. accompanied by increase in workg. costs. Cap. expend. ams. to £5 454. Replacemts. res. increased by further £20 000. Net pft. shows increase £7 400, after increasg. reserves by £14 000 in two of subsid. cos. for cost of contemplated improvemts. and gen. renewals. Pfts. for yr. were £55 209, plus £61 769 brot. in. To replacemts. res. £20 000 (same), div. 6% £29 473 (same), fwd. £67 505.

Cable and Wireless Ltd.—In order to correct any erroneous impression that might be formed as a result of a statement reported to have been made by Sir Raymond Birchall, at Bermuda, the company draws attention to the different policies which have been adopted by them and by the General Post Office, of which Sir Raymond Birchall is Director-General, during recent years as regards rate reductions and facilities for the public. Cable and Wireless has continually pursued a progressive policy of rate reductions, with an estimated benefit to the general public which is now approximately £1 250 000 per annum. In the case of the General Post Office, it is pointed out that in recent years the inland postal rate has been raised from 1d. to 2½d., that the inland parcel rate has been increased, that the inland telegram rate has been increased from 6d. for twelve words to 1s. for nine words, that there has been a 15 per cent. surcharge on telephone rentals, and that cheap telegraph and telephone facilities have been suspended.

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.*

ADAM HILGER LTD. London, E.C., optical and astronomical instrument mkrs.—Nov. 9, mort. and charge, to Midland Bank Ltd., securing all moneys due or to become due to the Bank; charged on 77 and 79, Camden Road, 24 and 37a/47 (odd), Rochester Place, 2, Rochester Mews, and 90/100 (even), St. Pancras Way, N.W., together with machinery, etc., also general charge. *£20 000. Oct. 11, 1945.

ELECTRICAL AND INDUSTRIAL INVESTMENT CO. LTD., London, W.C.—Oct. 31, £200 000 debs. with a premium of 2 per cent., secured by a Trust Deed dated Oct. 30, 1945; general charge. *£202 899. Feb. 28, 1945.

ERNEST TURNER AND CO. (SALFORD) LTD., engrs.—Nov. 9, deb., to Mosley Street Nominees Ltd., securing all moneys due or to become due from the co. to Williams Deacon's Bank Ltd., general charge. *Nil. July 4, 1944.

Satisfactions

MITCHELL ELECTRIC LTD., B'ham.—Sat'n. Nov. 8, of mort. reg. Apr. 15, 1942.

R. J. KEMP AND CO. LTD., Coalville, elec. engrs.—Sat'ns. Nov. 9, £4 000 (not ex.) and £6 000 (not ex.), reg. Mar. 30, £6 000 (not ex.), reg. July 16, £2 000 (not ex.), reg. Sept. 6, and £2 000 (not ex.), reg. Dec. 15, 1943.

Applications for Discharge

ELLIOT, George Stanley, 70, Rupert Street, Norwich, electrical engineer. Date of hearing, Dec. 17, 1945. 2.30 p.m., Shirehall, Norwich.

REID, Arthur, Bridge Street, Neston, Chester, and carrying on business at the same address, radio specialist. Date of hearing Jan. 24, 1946, 10.30 a.m., The Court House, Pilgrim Street, Birkenhead.

Notice of Intended Dividend

TOSSWILL, Frank Oliver, 60, Wodeland Avenue, Guildford, and lately carrying on business at 15, Portsmouth Road, Guildford, electrical engineer. Claims to be sent by Dec. 14, 1945, to the Trustee, Mr. Arthur Harold Ward, London (Suburbs) and Southern District, 42, Tavistock Square, W.C.1, Official Receiver.

Coming Events

Friday, December 7 (To-day).

ILLUMINATING ENGINEERING SOCIETY, BIRMINGHAM CENTRE.—Imperial Hotel. Annual dinner. *6 p.m.*

Saturday, December 8.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria Street, S.W.1. Presentation of awards. Presidential address, "Atomic Energy," Sir G. P. Thomson, F.R.S. *3.30 p.m.*

Monday, December 10.

I.E.E., N.E. CENTRE.—Newcastle-on-Tyne. "Factors Influencing the Design of Electric Lighting Installations for Building Interiors," R. O. Ackerley. *6.15 p.m.*

Tuesday, December 11.

I.E.E., RADIO SECTION.—London, W.C.2. Discussion, "The Servicing of Radio and Television Receivers," R. C. G. Williams. *5.30 p.m.*——E. MID. SUB-CENTRE.—Leicester College of Technology. Joint meeting with Leicester Association of Engineers, "A Survey of X-rays in Engineering and Industry," V. E. Pullin. *6.30 p.m.*

I.E.E., N.W. CENTRE, INSTALLATIONS GROUP.—"Excess-Current Protection by H.R.C. Fuses on Medium-Voltage Circuits," R. T. Lythall. *6 p.m.*

ILLUMINATING ENGINEERING SOCIETY.—E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, W.C.2. "Bright Light Sources," Dr. J. N. Aldington. *6 p.m.*

Wednesday, December 12.

I.E.E., TRANSMISSION SECTION.—London, W.C.2. "Mechanical Stresses in Transformer Windings," Dr. Ing. E. Billig. *5.30 p.m.*——SHEFFIELD SUB-CENTRE.—Central Library. Visit of the President, Dr. P. Dunsheath. *7.15 p.m.*——SCOTTISH CENTRE.—Edinburgh. "The Place of Radiant Dielectric and Eddy Current Heating in the Process Heating Field," L. J. C. Connell, O. W. Humphreys and J. L. Rycroft. *6 p.m.*—S. MID. STUDENTS' SECTION.—Birmingham. Students' Lecture, "The Measurement and Reduction of Noise," Dr. A. J. King.

INSTITUTE OF WELDING, E. COUNTIES BRANCH.—Ipswich. "Electric Stud Welding and Welding Transformers," A. H. Bent.

Thursday, December 13.

I.E.E., INSTALLATIONS SECTION.—London, W.C.2. "Mineral-Insulated Metal-Sheathed Conductors," F. W. Tomlinson and H. M. Wright. *5.30 p.m.*

Friday, December 14.

I.E.E., MEASUREMENTS SECTION.—London, W.C.2. "A Precision A.C./D.C. Comparator for Power and Voltage Measurement," G. F. Shotter and H. D. Hawkes. *5.30 p.m.*

ROYAL INSTITUTION.—London, W.1. "The Utilisation of Nuclear Energy," M. L. Oliphant, F.R.S. *5.15 p.m.*

Saturday, December 15.

I.E.E., N. MID. STUDENTS' SECTION.—Leeds. "Power Transformer Maintenance," A. E. Shearer. *2.30 p.m.*

Printed in Great Britain by STRAKER BROTHERS LTD., 194-200, Bishopsgate, E.C.2, and published by BENN BROTHERS, LTD., at Bouverie House, 154, Fleet Street, London, E.C.4.—Friday, December 7, 1945