THE
ELECTRICIAN

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As modern industrial technique meets the demand for faster output, the tendency is towards larger and larger workshop areas, and the efficient lighting of these areas becomes a specialised problem . . . OSIRA high pressure mercury vapour electric discharge lamps provide a good alternative to daylight itself for large areas. They give a steady diffused light that illuminates every detail of the work in progress — nearly three times the light available from tungsten lamps using the same amount of current. Is there a large-scale lighting problem in your plant? Let G.E.C. lighting engineers show you how easily and inexpensively that problem can be solved with OSIRA lamps.

OSIRA H.P.M.V. Electric Discharge Lamp *OSIRA H.P.M.V. Fluorescent Electric Discharge Lamp*

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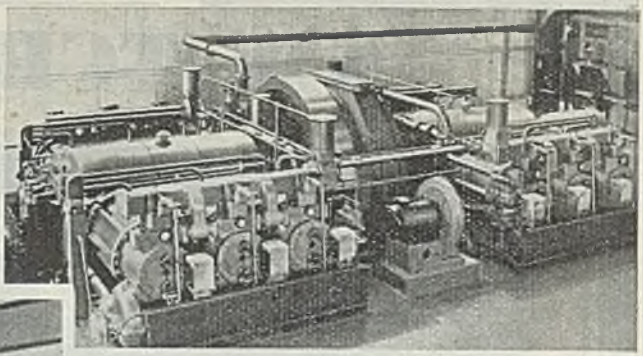
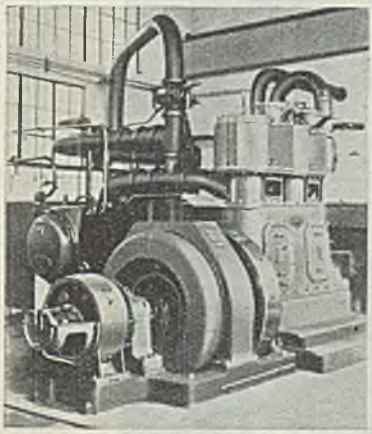
Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2

"Engine Type Generators"

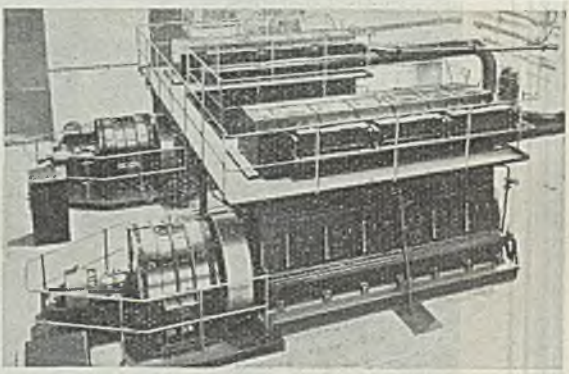
The illustrations on this page show a few installations of Metrovick Engine Type Generators.



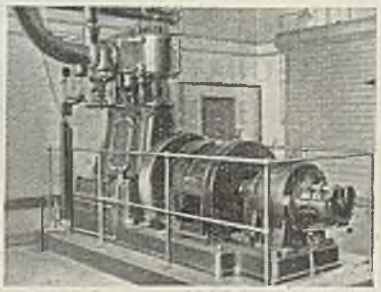
1,000 kW Metrovick Engine Type Alternator with closed circuit ventilation. Installed in the West Indies and driven by a Crossley Premier Vis-a-Vis 212 r.p.m. Gas Engine.



375 B.Hp. 375 r.p.m. Browett Lindley Steam Engine driving a Metrovick 250 kW 4,000 Volt Alternator at a Chinese Coal Mine.



450 kW Metrovick Alternators driven by Belliss & Morcom Diesel Engines in a British Power Station.



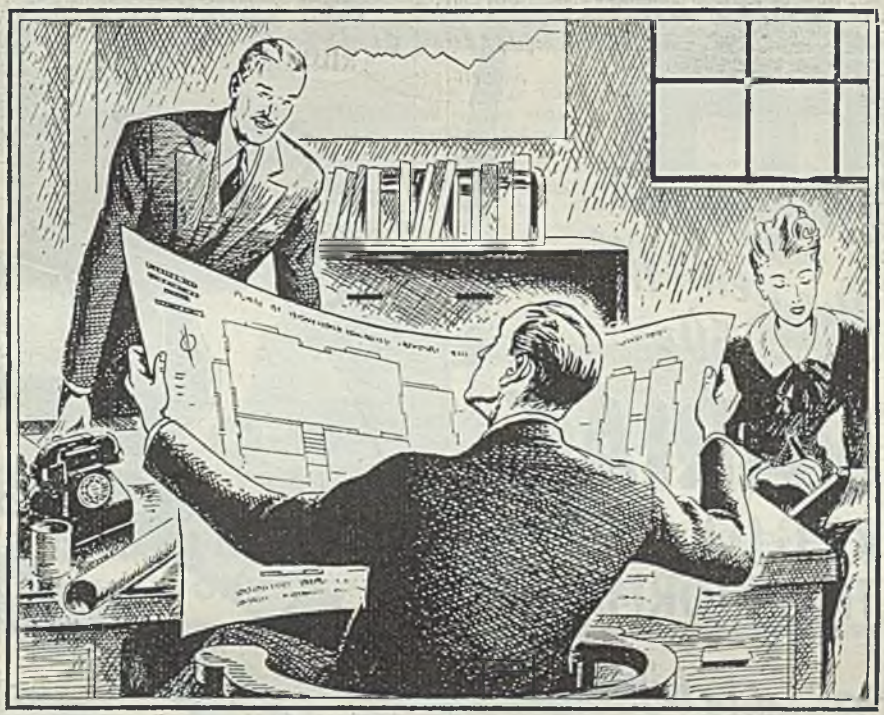
1 of 2 Metrovick 120 kW 500 r.p.m. Alternators driven by a Belliss & Morcom Steam Engine at a Laundry.

For all types of Engine Driven Generators send your enquiries to:

METROPOLITAN Vickers ELECTRICAL CO. LTD.
TRAFFORD PARK · MANCHESTER 17.

C/A/101

Light aids production — IMPROVE YOUR LIGHTING *in consultation with* METROVICK'S ILLUMINATING ENGINEERS



"NOW, REGARDING OUR LIGHTING PLANS—"

LIGHTING ADVISORY SERVICE *All concerned with the installation or renewal of lighting are invited to communicate with our Lighting Advisory Service, Bridle Path, Watford. Phone 5811.*

THE importance of planned lighting cannot be exaggerated. Sufficient light is not enough. Modern practice takes heed of the *psychological* and *æsthetic* aspects as well as the "fitness-for-purpose" of a lighting installation. Appearance, quality, accessibility and economy are other vital considerations ranging far beyond the question of actual light. *All are catered for by the famous Mazda range of lamps and fittings.*

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The British Thomson-Houston Co. Ltd.
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M.4066

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.
HH.McL/MC.

APPLICATIONS are invited from engineers or physicists to undertake research on problems associated mainly with transformer design, manufacture and operation. Previous experience of transformer design is desirable but not essential. Starting salary would depend on qualifications and experience, and would probably be from £450 to £650 per annum, exclusive of cost of living bonus in accordance with the Whitley scale and superannuation under the F.S.S.U.

Applications to be sent by 4th January, 1946, to the Secretary, The British Electrical & Allied Industries Research Association, 15, Savoy Street, London, W.C.2.

The Ministry of Labour and National Service (Technical and Scientific Register) have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

ELECTRICIANS and Electrical Fitters wanted. Installation and maintenance. Permanency.—Box No. 631, Mason-Peacock Ltd., 184, Strand, W.C.2.

SITUATIONS VACANT

LONDON COUNTY COUNCIL.

REQUIRED at the South East London Technical Institute, Lewisham Way, S.E.4, full-time Teachers of Electrical Engineering subjects with experience in Communications, Power Generation, or Distribution Engineering, in January, 1946.

Work includes Ordinary and High National certificate courses for day and evening students. Some teaching in the Secondary Technical School.

Candidates must be graduates, or hold equivalent qualifications, and have had good industrial or professional experience.

Teaching experience an advantage. Salary: Burnham scale, viz., £300-£15-£525, plus London allowance, minimum £36 p.a.

Commencing salary according to qualifications, teaching and industrial experience. Application form from the Education Officer (T.1.), County Hall, S.E.1 (stamped addressed envelope necessary), returnable by 18th January, 1946.

H.M. Forces personnel abroad should apply by letter.

TENDERS

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.

CONTRACT No. 715.

THE Electricity Committee are prepared to receive tenders for the supply and delivery of the under-mentioned equipment:—

ONE fourteen panel 11 kV, 3-phase, 150 MVA Rupturing Capacity Works Auxiliary Switchboard.

Contractors desiring to submit tenders may obtain Specification and Form of Tender at this office on making a deposit of £2 2s. 0d., which sum will be refunded on receipt of a bona-fide tender.

To meet the convenience of Contractors, two copies of the Specification will be furnished; additional copies may be purchased at a cost of £1 1s. 0d. per copy.

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

The tender and accompanying documents, filled up as directed, must be enclosed in the official envelope supplied with the Specification, which shall not bear any name or mark indicating the sender, to be delivered to the Town Clerk, Town Hall, Sheffield, 1, not later than the first post on Monday, 28th January, 1946. Tenders received after the time stipulated herein will not be considered.

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

JOHN R. STRUTHERS,
General Manager and Engineer.
Commercial Street, Sheffield, 1.
December, 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.

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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.

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PLANT FOR SALE.

1 7-kV, 2-phase, 50-cy. Metropolitan-Vickers 1 000-kVA Transformer Control Cubicle, independent mounting, complete with cable sealing box, 3 400-amp. type F s.p. isolating switches, 1 400-amp. B.B.H.5, 2-pole automatic hand-operated oil circuit breaker, 2 current transformers, 2 voltage transformers, 2 ammeters, 2 kilowatt hour meters, type N.E., 1 voltmeter, mounted in non-interlock sheet steel cubicle with doors inter-connections, wiring, fuses, labels and earth bar. **Absolutely new and unused.**

1 5-kV, 3-phase, 50-cy. Metropolitan-Vickers 1 000-kVA Transformer Control Unit, Drawout Truck Cubicle Type, including 1 set 3 main busbars, neutral busbars, neutral link, 1 400-amp. B.B.H.5, 3-pole automatic hand-operated oil circuit breaker, fitted with 3 overcurrent releases, current transformers, voltage transformers, 1 ammeter, 1 voltmeter, 1 power factor meter, 1 kilowatt hour meter, 1 set of synchronising receptacles mounted on drawout truck cubicle, with main meter interconnections, small wiring, fuses, labels and earth wire. **Absolutely new and unused.**

6 125-kVA. 5 000/230-volt, 3-phase, 50-cy. Transformers, Metropolitan-Vickers; also 2 Flat Back Slate Panel Switchboards, 4 panels per board fitted with M.V. hand-operated 300-amp. oil switches, ammeters, voltmeters, current transformers, busbars, isolating links and wiring.

OFFERS INVITED.
METROPOLITAN-CAMMELL CARRIAGE & WAGON CO. LTD., OLD PARK WORKS, WEDNESBURY.
Telephone: Wednesbury 0571.

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.

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.

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.

REPRESENTATIVE, Electrical and Radio, excellent connections. Factors and trade generally, Northern Ireland and Eire; age 44; own car; available post-war developments.—Box 3B, The Arrow, Advertising Agency, 97, Middle Abbey Street, Dublin, Eire.

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Grams: "Patent, London." *'Phone: Holborn 0437 (2 lines)*
And at—NEWCASTLE: 3, St. Nicholas Buildings.

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

THE ELECTRICIAN

Established 1861. *The Oldest Weekly Illustrated Journal of*

Electrical Engineering, Industry, Science and Finance

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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

Export Prospects

SPECIAL attention has been drawn to the export position by the publication last week of a White Paper dealing with the statistical material relating to the Washington conference on the American loan, and by the statement made by Lord WARDINGTON to shareholders of the Bank of London and South America, in which he gave emphasis to the need for a quick restart of the flow of British manufactures to Latin-America. As the electrical industry appears to be the most flourishing of our exporting trades, both the White Paper and the statement warrant consideration.

From an electrical point of view the position is not as discouraging as the general picture, for with electrical exports during the nine months January to September of the current year, valued at £18 626 026, the comparison with 1938 shows an improvement of £2 632 489, as against a decline in general exports of £81 320 000. The reason for this depression of our overseas trade is, of course, a legacy of our war effort, and the consequence of a deliberate act of policy. Any attempt during the war years to maintain our export trade at a high level would have inevitably stood in the way of the full mobilisation of our man-power, production capacity and materials, which operations against Germany and Japan required, and it is only due to the fact that the output of the electrical industry is more adaptable to military needs than many others that the industry has been able to make so quick a recovery in the export field. Accepting that policy to have been necessary at the time, however, is no reason why the industry of this country should continue to sacrifice its export trade, and still less does it justify the control and frustration to which manufacturers are being subjected.

There has been talk in official circles of our exports being stepped up in the next few years to a 50 per cent. increase over our pre-war total, but when the potential production capacity of the country is considered, the possibility of attaining an output of such magnitude is more difficult than may at first be realised. At the moment a high percentage of our industrial plant is due for replacement on account of age or wear, including the plants of those manufacturers whose job it is to make those replacements, while many of the materials needed in the manufacture of new processing equipment are by no means as readily available as industry requires. Mechanisation and electrification of industry, if carried out to an extent hitherto hoped for but never attained, would go a long way to-

wards raising the tempo of production, but, here again, before the supply industry would be able to carry the extra load which such electrification would create, the generating capacity of the country would need to have a greater margin of reserve plant than is now the case. It is true that the Central Board has a five-year plan for power station extensions, but, it should be remembered, of the £150 000 000 programme to be carried out, a fairly high proportion of the expenditure will be absorbed in replacing, for reasons already explained in these pages, generating capacity which is well over age.

Tools for the Job

LORD WARDINGTON has suggested that the Latin-America demand for imported goods is so urgent that any delay in obtaining British manufactures may result in orders being reluctantly diverted elsewhere. British export policy, he urges, should be two-fold—first, to start shipments, even if they are only token shipments, so as to establish a bridgehead and thereafter to expand from that bridgehead. By following in the years to come the example set in the war years, it may be possible for industry to respond to both the appeals of the Government and the demands of Latin-America, but before any serious attempt to do so can be made, it must be afforded the opportunity of overhauling its production capacity, adding modern machines and replacing plant worn out under war-time strain. How soon such an opportunity may present itself is dependent, not upon industry, but upon those Ministries and other Government departments which control the allocation of materials and labour. Industry is over anxious to develop its export trade, but at the moment it is waiting for the tools, which only a more realist point of view on the part of officialdom will put in its hands.

Electrical Exports Still Rising

THE figures given in our last issue with respect to electrical exports during the first nine months of the year are made still more interesting by the fact that improved conditions continued during October, when shipments of electrical goods and apparatus were valued at £1 488 309. This amount is exclusive of machinery exports, which always swell the total, but of which the Board of Trade returns give no details until the end of each quarter. Confining our remarks to electrical goods and apparatus, however, the position is still encouraging, for the October figures compared with a monthly average for 1938 of £1 119 200, represent an increase of £369 100, and an improvement of £435 201 over the same month of 1944. On the import side the figures for October are also encouraging, for at £717 534 acceptances were lower by £1 254 641 when compared with the corresponding month last year, though higher by £458 634 when contrasted with the average monthly figure of £258 900 for 1938. The favourable balance of exports over imports during October was the first for a long time and represents at £770 775, a decline of only £79 525 when comparison is made with the figures obtaining for the same month in the last pre-war year.

A "Coal Electric" Appliance

A NEW application of electricity in the domestic field has been introduced in a two-way "coal-electric" appliance which forms part of a complete prefabricated all-purpose service unit being developed by the Building Component Producers' Association, in conjunction with the British Coal Utilisation Research Association, for small two-storied dwellings. The unit is designed so that the living-room coal fire is the source of heat for the kitchen cooker, the general hot-water supply and the hot-air circulation system, but when the fire gets low, or is not used, electric auxiliary oven heating elements, hot plates and griller, an electric heater in the convection chamber and an immersion heater in the hot-water storage tank, thermostatically and rheostatically controlled, carry on all or any of the functions performed by the fire. The electrical side was, we understand, designed by Mr. James McDonald, a director of G.W.B. Electric Furnaces, Ltd., who has patented it for the company.

"Their Invisible Inheritance"

THIS intriguing title is given to the latest E.D.A. film, a pre-view of which shows it to be concerned with bringing home to local authority housing committees the advantages which electricity has to offer, especially when the wiring installation is designed with some

thought of the future. Besides being of high entertainment value, the film transmits its moral to a watching audience with a force which will leave little doubt in the minds of any anti-electric committeemen, that whatever other fuels there may be, none can approach electricity for overall service, convenience and cleanliness. The now long experience of film production which lies behind the E.D.A. has been put to good use in this latest example, and though we are no more qualified to judge a film than by its ability to tell its story with conviction, with entertainment and with truth, we feel that "Their Invisible Inheritance" should go a long way towards breaking down some of the prejudice which unfortunately many local authority housing committees have themselves inherited from the days when domestic lighting was serviced by a match instead of a switch.

British Association Conference

THE conference of the British Association in London last week was concerned mainly with the relation of scientific research to industry, and though many of the speakers expressed ideas which may be new to some industries, to electrical engineering interests the conference was a useful confirmation of the necessity for the research-mindedness of the industry. The speakers included several well known to electrical engineers, as for instance, Sir ARTHUR FLEMING and Sir EDWARD APPLETON, and all supported the view that generally speaking, industry was slow to put to practical application the new knowledge and ideas which resulted from our outstanding achievements in fundamental research. This is to some extent borne out by comparing the progress of the electrical industry with that made by others less enlightened where research is concerned. In technical matters the industry leads the world, and it is significant that most of the technical achievements which led to the end of the war were electrical in origin or operate electrically. This is no accident, for the industry, quick to adapt itself to the needs of the moment, has at its disposal facilities for industrial research which are an example to every other industry, and is constantly adding to, or improving, those facilities. That it pays the industry to devote part of its labours in this direction goes without saying, but it should not be forgotten that the public and other industries enjoy the results.

Engineers to Discuss the Future

THIS week-end the Institution of Professional Civil Servants, representing some 33 000 professional, scientific and technical personnel, of whom approximately half are engineers, is holding a conference in London to survey the part played by engineers during the war and to discuss the rôle which they can play in peace. It was recognised early on that the war would be an engineer's war, and its progress made this abundantly plain. The full details of the engineer's contribution have not even yet been given to the public, while those developments which are popularly regarded as the province of the scientist are usually in fact the result of a partnership with the engineer. In this connection it may be noted that the most complicated and, at present, most jealously guarded secrets of the atomic bomb are its engineering aspects. Because of these things there will be discussed at the conference ways and means whereby the forces liberated for destruction may now be used for creative purposes.

Lighting History

THIS year marks something of an occasion in the history of electric lighting for the E.L.M.A. Lighting Service Bureau is now in the twenty-first year of its activities. Looking back to 1924 and recalling the conditions which then existed, gives some small appreciation of the enormous strides which have been made in lighting technique since that year. In street lighting particularly, developments have been spectacular, as for instance electric discharge lighting; but in interior lighting advancement has been almost revolutionary. With the introduction of the fluorescent tubular lamp, the lighting of factories, of offices, and soon we hope of homes, has undergone a change which if predicted in 1924 would have been hard to believe. Nor is the present development of fluorescent lighting as we know it to be the end, for next year there will be made available tubular lamps even more attractive than now.

Science and Reconstruction

Sir John Anderson on the Use of Atomic Energy in Industry

IN the course of an address to the Manchester Joint Research Council, on December 6, on the subject of "Science in Relation to Reconstruction," Sir John Anderson, chairman of the Advisory Committee on Atomic Energy, said it was quite certain that nothing had been discovered to justify the expectation that the energy released by an atomic explosion could be used directly as a source of industrial power, as, for example, the explosion of gases was used in an internal combustion engine, or a gas turbine, or in certain forms of rocket. The only method which existing knowledge suggested as practicable depended upon the conversion into heat of the energy released by a controlled process of nuclear fission. There was no difficulty in realising that in principle. But there the practical troubles began to arise. The first problem was to get the heat in a convertible form. That meant a high temperature and involved the necessity for very efficient controls and for special measures to prevent corrosion of the metallic components and the rapid disintegration of the whole system.

Present Limitations of Nuclear Energy

The other major problem arose in connection with the intense and very dangerous radiation by which the nuclear reaction was attended. That meant elaborate shielding devices and a complete system of remote control. It would be absurd to suppose that those and other difficulties would not be overcome in time, and there was always the possibility of some fundamental new discovery completely changing the character of the problem, but the best opinion he could offer—and it was not based on his own conclusion, but on the conclusions of those on whose judgment he could most confidently rely—was that it would be many years before nuclear energy came on the market, for any but the most limited and specialised purposes, in competition with existing sources of power.

Nevertheless, the ultimate possibilities were such that it was clearly incumbent upon us as a nation to devote all the resources we could spare to further researches in this field. The central Government must, for the time being, at any rate, take a leading part in the organisation of such researches. Those recent discoveries opened up an enormous new field of scientific work and should give tremendous impetus to research by physicists, chemists and engineers. Indeed, the matter went much further, for the devices that were employed to produce the new element plutonium, provided a ready means of procuring a vast range of new radio-active substances, including radio-active forms of common elements used in medicine.

Personal Association With Radio-Activity

Sir John Anderson mentioned that his interest in science dated back to the early years of this century, when, having secured a scholarship of sufficient value to enable him to devote a year or two to further study abroad, he went to Germany to engage in post-graduate research in physical chemistry. As it happened, the subject allotted to him was an investigation of the radio-active properties of uranium, a curious coincidence in view of certain activities in which he had been engaged recently.

It was on the quality of our products, said Sir John Anderson, that we must rely to overcome all disadvantages, and to that end we must build up the finest possible bodies of technicians and make the fullest use of all new developments to which science could point the way.

In television we undoubtedly led the world before the war, and we were probably still ahead. In the various applications of radio-location, founded upon investigations originally conducted under the Radio Research Board of the Department of Scientific and Industrial Research, we were in almost every instance well ahead of all competitors. Here was a magnificent example of co-operation between science and industry, resulting in the production of power valves working on wave-lengths of a few centimetres—a development undreamt of a few years before.

He would like to see three changes made in organisation. First, he would have the Lord President formally recognised as the Minister responsible for dealing, on behalf of the Cabinet and subject to reference, where necessary, to the Cabinet, with all general scientific questions, in which the Government were concerned, including problems of organisation, arrangements for Commonwealth or international conferences, and so forth. Secondly, he would continue the Scientific Advisory Committee, which was a special war instrument, on a peace-time footing, with some extension of personnel, as the principal adviser of the Lord President and the Cabinet in scientific matters. Thirdly, he would create a special section of the Cabinet Secretariat, under an officer of appropriate qualifications and seniority, to assist the Lord President in the discharge of his new responsibilities.

Plug and Socket Controversy

By "SUPERVISOR"

THE Post-War Building Study No. 11, Electrical Installations, was published well over a year ago, and contained many interesting recommendations. Some of these represent considerable, and even radical advances beyond existing practice, but apart from one or two, do not seem to have aroused much interest, and the reaction of the installation industry has been almost imperceptible. It is true that a special meeting of the Installations Section of the I.E.E. was called to consider it, but this proved rather abortive, in that another almost equally important report, that of Sub-Committee No. 3, on "Electricity Supply, Distribution and Installation," was discussed at the same meeting.

Need for Co-ordination

In fact, it may be said that the importance of the latter rather overshadowed Study No. 11, judging from the discussion, and that Study No. 11 remains virgin ground to a great extent. The one recommendation that has been dealt with is, of course, that relating to domestic ring mains, with the proposed new standard domestic fused socket and plug, and which has afforded us the brightest firework display of the year. Although much of the controversy that has arisen is all the better for a little ventilation, yet this question is much too important to be handled by isolated sections of the industry, not one of which seems to know just what any other is doing. Is there no way in which these various attempts to settle the problem may be co-ordinated?

As soon as a suggestion for the implementation of the report is made by one body it is immediately decried by another sectional organisation. This, with the necessary time-lag between the various outcries, means that we are getting just nowhere; isolated reports from various interests reach the technical journals from time to time, only to be immediately negatived by others. Much of this undignified controversy could possibly have been avoided had a full and continuous debate on the findings of the report have taken place as soon as practicable, especially on the part of those more intimately concerned, namely, the installation engineers themselves.

And yet we know that the recommendations of this report will receive the close attention of the Sub-Committees and Panels of the Committee on Codes of Practice for the Electrical Equipment of Buildings, which has been convened by the I.E.E. Council, on behalf of the Codes of Practice Committee for Civil Engineering, Building, and Constructional Work. It therefore merits the very closest attention by all installation engineers, and it is rather disconcerting to find that a great many of them have not taken the trouble even to read it. Many of these people will almost certainly be amongst the first to criticise new regulations based upon the report's recommendations, although taking no trouble to mould the new codes into acceptable forms.

Referring again to the piecemeal consideration of sections of the report, one wonders just what is behind the recent tests on plugs and sockets, arranged in conjunction with the National Physical Laboratory. Authoritative information is not easy to come by, but it is understood that nine plugs of representative makes were wired in series, and subjected to a continuous current of 15 A; by continuous current is meant that the current flowed for a certain time, although it is not in fact known if this was a.c. or d.c. Eight of these plugs under test were of 5 A capacity, conforming to B.S.S. 546, whilst the ninth was of a fused pin type; no details of this plug are available—at least, to the writer—but many can probably guess its origin.

Plug Temperature Tests

It is reported that temperature tests were made by means of thermo-couples attached to the plug terminals, and it was found that temperature rises of the order 20° F. to 40° F. were recorded in connection with the eight B.S.S. plugs. No difference was apparent between new and used plugs. This seems to confirm a point that was never in serious doubt, that a 5 A plug and socket to B.S.S. 546 can carry up to 15 A without distress, and is, in fact, suitable for upgrading to that extent. Objections to this step were advanced on quite other grounds, however, so that this demonstration has little value if it is intended to impress the objectors.

It was found that in connection with the fused-pin plug the temperature rise recorded reached 90° F., and we are presumably invited to conclude that with this enormous heating effect the fused pin plug is definitely unsafe. Personally, I am unable to reach this conclusion, as, in the first place, any fuseholder that is fitted with a fuse carrying a considerable overload—as was the fuse in the test, being rated at 13 A only—easily reaches a comparable temperature in time. In addition, we are not afforded any real comparison with other types of fused plugs and it is reasonable to assume that any

plug fused to 13 A carrying a current of 15 A would reach a similar temperature.

Possibly we are invited to reach the conclusion that a fuse mounted in the socket would be much safer than any type of fused plug, but if so, we should prefer to see one such socket fuse included in any test of the nature described. It is thought that compared with a fused pin, a socket fuse might reach even higher temperatures, by reason of the additional contacts necessary. For instance, there must be two contacts between the fuse and fuseholder, if it is to be withdrawable by the consumer for replacement, and these two contacts must again fit into two contacts in the base of the socket. This will give four contacts in series, all carrying 15 A, and it would be very surprising if such an assembly did not easily pass the measured 90°F. placed to the discredit of the fused pin plug.

It is all to the good that such tests are carried out, and as they were made in conjunction with the N.P.L. the recorded results may be accepted without question. What is objected to, however, is the futility of these particular tests, which take us no further towards a solution of our problem —the settlement of the type to be adopted as the new domestic standard. We have waited month to month for someone to make up our minds for us, but inconclusive tests of the kind described can hardly assist in the slightest degree, and merely serve to delay matters.

It is not known by whom the tests were initiated but they were carried out at the I.E.E., possibly in conjunction with the Wiring Rules Committee. However, this is all shrouded in mystery so far as the writer is concerned, but it is to be hoped that a fuller and more conclusive test will be made. Next time, let us have socket fuses and other types of plug fuses in circuit in series with the fused pin plug, and possibly some information of value will be forthcoming.

The installation side of the industry is labouring under a sense of frustration and indecision over this matter of sockets and plugs, and it seems that no progress whatever is being made. Has not the time come when the solution of the problem can be handed over to a special committee—one more cannot matter—charged with the final settlement of the question? It is time that the various interests were informed that they are thanked for their opinions and demonstrations, but that decisions must now be reached on the question of standard sockets and plugs. Very shortly, houses will be waiting the installation of ring mains and fused sockets and/or plugs; are we going to provide a wonderful illustration of the great electrical industry still unable to settle this one little detail?

Although the writer clearly has a preference for the fused pin plug, in view of its simplicity and adequate performance, yet the fused socket will be accepted if only the standard will be fixed and the bickering brought to an end. The forthcoming housing drive is more important than sectional interests, and we must meet it.

Electricity and Post-War Housing

"Their Invisible Inheritance" is the name given to the latest film produced for the E.D.A., and at its introduction at a pre-view in London, on December 6, Mr. V. W. Dale, manager and secretary of the association, said its object was to convince people of the need for more adequate electrical facilities in all new homes. According to the Government claims, about 4 000 000 houses are to be built during the immediate post-war years, and as these would have to last for 50 or so years, it was essential that they be adequately wired.

The film, which lasts about 25 minutes, is to be shown throughout the country to members of housing committees, architects, builders, and all organisations interested in the housing problem; it will not, we understand, be shown in the public cinemas, yet, although, there are several copies of the film available for hire.

The film makes it clear that the invisible inheritance is the public supply of electricity, with its underground network of mains, carrying supplies for lighting, heating and power, to factories and homes alike; at the beginning, one sees shots of power stations, substations, control switchboards, and bombed sites with the invisible inheritance still safe below ground.

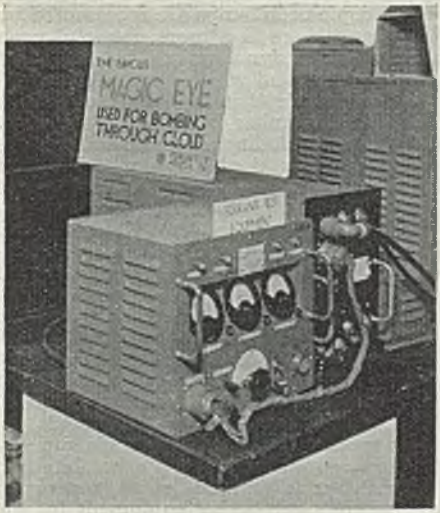
To bring home to audiences the inadequacy of installations in houses built after the last war, the film shows the living room of a typical working-class home, which the tenants share with their daughter and soldier son-in-law, special attention being directed to the one plug point in the room, for serving a table lamp, a standard lamp, and radio. The father enters the room, trips over a mass of twisted flexible, and puts out of action the lamp being used by his wife; his efforts to restore the light annoy his family, and while amusing the audience, demonstrate the total inadequacy of the installation. In order that there should not be a continuance of this bad practice in new housing, there are shown some good illustrations of sensible positions for plug points so that the best use may be made of labour-saving appliances; the elements of good kitchen planning are also introduced, by animated diagrams.

Manufacturer's Radar Display

Special Exhibition Staged by Ferranti, Ltd. at Moston

IN a section of the radio works of Ferranti Ltd., at Moston, near Manchester, there is now being held an exhibition of radar equipment manufactured by the firm. During the war years, the company fulfilled radar contracts to the value of over £7 000 000, and in addition supplied apparatus to the Admiralty who had a building erected adjoining the existing factory.

The exhibition which will remain open until December 22, has already been visited



Device for accurate bombing through fog

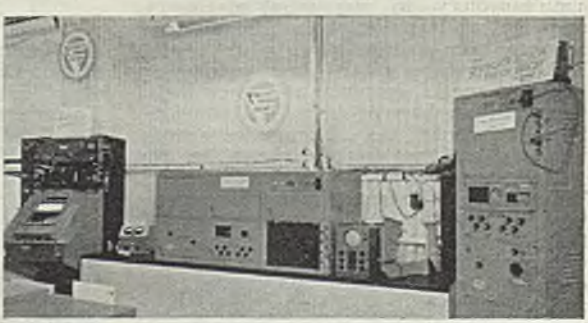
by engineers and by students from technical colleges, universities, etc. The main features of the exhibition include naval low angle gunnery ranging equipment; bombing through cloud units; I.F.F. (identification, friend or foe) transmitter - receivers; gas - filled electronic devices, cathode-ray tubes and radio receiving valves (including service types); test gear, radio receivers and a television set.

Various marks of I.F.F. units, developed and produced by Ferranti Ltd., together with their own test gear, are shown in historical sequence. One of the earliest types used in conjunction with chain stations was employed to give early warning of the approach of enemy aircraft. Then it was adapted for anti-aircraft gunnery control. The next step was to incorporate it into night defences. Soon it became universal at all chain stations.

All these earlier models can be seen, prototypes of the now standard transmitter-receiver. Ninety thousand were produced by the company. The device, which was fitted to every allied ship and 'plane, automatically returned a coded reply to a radar signal, indicating whether approaching aircraft were friendly or hostile. Entirely automatic in operation, I.F.F. derives its power from 12-20V batteries. With I.F.F., bombers could operate freely by night and day without confusing anti-aircraft defences. Demonstrations are given from miniature ground equipment, showing how contact is maintained during flights, how distress signals are registered, and the location of the incident determined.

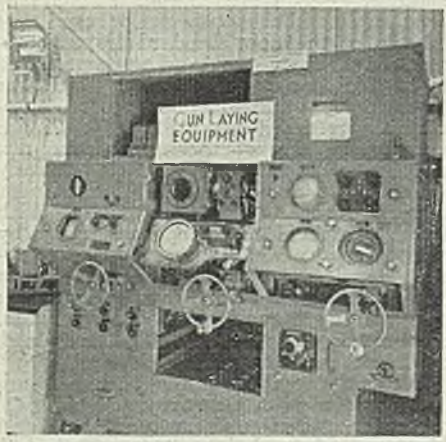
H2S is the bombing through cloud equipment used also as a navigational aid. Of particular interest are the magnetron and klystron valves in the transmitter and indicator units respectively. This device, which incorporates several units—wave form generator, receiver, dual transmitter, modulator, indicator, switch panel, etc.—presents on a screen to the navigator of a 'plane, a map of the ground over which he is flying.

One of the most interesting sections of the exhibition is that devoted to gunnery ranging equipment. The pre-war type of ranging appliance (on view), as used in the battle of Matapan, now superseded by more advanced models, shows two traces in a cathode-ray tube. The lower trace shows the range markers and the upper trace has the target signal on it. By means of gearing, the indicator lines-up the echo or target signal with the range, and the range of the target is measured from left



Gunnery ranging equipment; left to right, pre-war type; standard horizontal presentation; standard vertical design

to right by counting the range markers, each representing a given distance in yards. A later development is a horizontal presentation to permit installation in places where vertical space is not available. There are two cathode-ray tubes in the indicator unit; the large left-hand one has



The gun-laying equipment exhibited at Moston

a single trace with range markers indicated thereon, and gives a course range; the small right-hand tube gives the fired range. Another model is a vertical presentation, and has been made in much larger numbers. Method of indicating the target in the tubes is identical with the horizontal set. An r.f. pulse modulated exhibit is interesting, as it enables the demonstration of one of the methods used in testing radar equipment. It is a general purpose i.f. amplifier. In this case, a rectangular pulse is produced in the test gear. The pulse is fed in one instance directly to one of the plates of the cathode-ray tube indicator in the test gear, and shows as a rectangular pulse. The same pulse is fed simultaneously to the input of the i.f. amplifier, and applied from the output of the amplifier to the other plate of the cathode-ray tube in the test gear. Any defect in the i.f. amplifier will cause a distortion in the shape of the pulse. It follows, therefore, that if the i.f. amplifier is satisfactory, the two pulses shown in the cathode-ray tube will be identical in shape. The gunnery ranging equipment secures accuracy within a few yards at a range of 20 miles.

A range of gas-filled electronic devices is demonstrated by staff physicists. The tubes shown all depend upon some gas or vapour filling in order to give the required electrical characteristics, and so they differ considerably in principle from ordinary radio communication tubes. The Pulsatron is a cold-cathode relay tube designed to give a square wave output—important for high speed morse transmission—when triggered by a signal of irregular formation. In addition to a hot cathode mercury vapour rectifier and a hot cathode mercury vapour grid controlled rectifier, may be seen a miniature cold-cathode triode tube used as a relay device in a photo-cell counter. This tube, it is claimed, has an advantage over the normal thyratron, as it does not require any filament heating supply. A mercury-argon crater lamp is shown in action as a source of photographically-active light which can be modulated. This tube is used for the reception of pictures over a land line. Stroboscopic neon lamps are represented by NSPI, and there is a more powerful neon lamp which is synchronised by means of the Neostron, and which gives a light output many times that of Neostron.

Cathode-ray tubes from 4½ in. to 12 in. in diameter, including magnetic and electrostatic types, a double beam tube, and tubes with "afterglow" screens, are shown. Also, ultra high frequency valves, including a series of reflector Klystrons and gas-filled Rhumbatrons, which were developed specially for radar, and are used as oscillators in such equipment as H2S. Receiving valves are represented by a wide range, including a miniature glass 5 000 V rectifier. It was of interest to learn that a large bomber may have up to 100, and some equipment up to 200 receiving valves.

On other stands may be noted the latest types of high and low angle gunnery ranging equipment; a one hundred millionth of a second pulse measuring oscilloscope; gun laying equipment for the accurate sighting of guns; cathode-ray tube test gear for checking efficiency and duration of the "afterglow" by comparison with the standard tube of this type; post-war radio receivers and television set.

I.E.E. RADIO SECTION

At a meeting of the I.E.E. Radio Section on December 5, a paper, "The Design and Use of Radio-frequency Open Wire Transmission Lines and Switchgear for Broadcasting Systems," prepared by Mr. F. C. McLean and Mr. F. D. Bott was delivered.

The paper describes the various types of transmission lines in use at transmitting stations of the B.B.C., their impedance, attenuation and power-carrying characteristics together with results of various tests, general details of construction, and methods of matching the load to the transmission line. The major part of the work described was carried out before the end of 1943.

Heating the Home

A Combined Solid Fuel and Electric Development

SPEAKING on the subject of "Heating the Family Home" at a lunch-time meeting of the Town and Country Planning Association in London on December 6, Mrs. Gillian Harrison, an architect, said it was no good providing an adequate living area if the space could not be heated.

The question of the provision of adequate heat for warming the house, cooking and supplying hot water, was of vital importance, and it was necessary to consider it from two angles: (1) the proper use of fuel as a national commodity, and (2) the cost of running expense to the tenant.

By comparison with Canada and the United States we got far less comfort for 1 lb. of fuel than they did, and as the heat provided by the average consumption was inadequate we were wasting fuel. Many appliances were inefficient and wasteful. If we considered that a reasonable expenditure by the lower income group tenant was 5s. 6d. to 7s. 6d. a week on all forms of heat, light and hot water, it was of the greatest importance to see that new houses were equipped in such a way that that weekly expenditure would give the maximum degree of comfort. It was of no service to the tenant to provide equipment that for economic reasons he could not use. She had seen recently experimental houses so equipped that a working man could not afford the expenditure entailed.

Many advances had been made since the war started in new domestic heating equipment. Some of the new appliances combined solid fuel as the basic heat source, with electric supplementaries, which was a great advance in economy and efficiency. The type of new equipment to be used should be decided in relation to the type of plan required, before the actual plan of the house was settled, and not afterwards as had so often been the case in the past.

An All-Purpose Service Unit

The all-purpose service unit, produced as a result of research by the British Coal Utilisation Research Association, was a completely prefabricated house unit with an overall size of 5 ft. 3 in. wide, 1 ft. 6 in. deep, and 17 ft. to 18 ft. high. The metal framework, covered with insulated cladding, contained a back-to-back insulated cooker and open fire; a hot water boiler; a hot air exchanger for providing warm air to other rooms; a hot water storage tank; a cold water storage tank; all plumbing, including the soil pipe; all electric mains and meters; and a prefabricated cast-iron flue pipe. There were electric auxiliary heating elements in the top and bottom of the oven, and an electric immersion heater in the hot water storage tank. It answered the problem of giving efficient service to the working man who could spend 10s. a week for light, heat and hot water. The saving on building costs worked out at 35 per cent., and smoke was reduced by 50 per cent.

In reply to a question Mrs. Harrison said the cost of the unit without the electric auxiliaries was, she believed, £105, delivered on the site.

Illuminating Engineers

The annual dinner of the Birmingham Centre of the Illuminating Engineering Society, was held at the Imperial Hotel, Birmingham, on December 7, when over 140 members and their guests were present. Mr. F. F. Middleton, chairman of the Centre, presided, and among the guests were Mr. H. C. Weston, national president of the society, Mr. H. Hooper, secretary, I.E.E., South Midland Centre, Mr. A. Brian Cooper, Birmingham, and Five Counties Architects' Association, and Mr. W. T. Wood, chairman, of the Association of Supervising Electrical Engineers.

Various phases of illuminating engineering were discussed, and it was emphasised that the work of the society could be of great assistance to industry, illumination could be distributed effectively at very little cost and the work of the society had proved of inestimable assistance to workers and employers alike.

In acknowledging a toast to the visitors, Mr. H. Hooper, said that members of their respective organisations need not be alarmed by suggestions of nationalisation.

Mr. A. Brian Cooper, proposing the toast of the society, said he thought it of vital importance that lighting should be considered alike by architects and illuminating engineers. By such joint action many difficulties might be overcome.

Mr. H. C. Weston, who replied, said that the society had grown in responsibility and reputation, and in the coming days its influence would be greatly extended. The Birmingham Centre was the largest in the country, and he congratulated them on their activities.

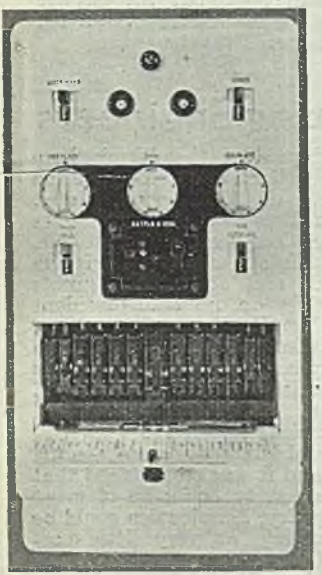
Laboratory Installation.—To bring the new electrical laboratory at Burnley Municipal College to the final B.Sc. standard, equipment costing £3 895 is to be installed.

All-Purpose Service Unit

Electrical Features of New Housing Component

WITH reference to the all-purpose service unit referred to by Mrs. Gilian Harrison and mentioned on page 661, the following particulars have been supplied by Mr. J. McDonald of G. W. B. Electric Furnaces, Ltd., who designed the electrical side and patented it for the company.

The oven heating is provided by a 1 750 W radiant heating element with 3-heat control, and a 2 000 W radiant heating element for grilling, also arranged for 3-heat control. The unit has two bolster hot-plates, each of nickel plated steel, with stainless steel hinged lids; each containing one 900 W red ring of the standard plug-in type.



Typical design of all-purpose service control panel

The electrical connections are taken to a point inside the unit casing, with insulated flexible connections through the main hinges. The bolster lids are spring-assisted and each is fitted with a fully protected mercury switch.

An Autolec control panel is flush-fitted and is for 200/230 V supply; it measures approximately 23 in. by 14 in. by 5 in. deep, is fitted in the tower, and contains one d.p. isolating switch for the oven and bolster heaters; a d.p. switch for water heater control, both switches being fitted with neon indicating lamps. Two simmerstats for the infinitely variable control of the hot plates, are included, together with a 3-heat rotary switch for oven control and another for the grill control. Other fittings are a switch socket to accommodate the fuse plug of a kettle or iron, and a switch for the control of the hob light.

For the complete protection of the household electrical system a compact fuse assembly is included in the main control panel; all fuses are accessible through a flush-fitted hinged door on the front with fuse circuits clearly engraved on the inside of the lid. A suitable insulated screwdriver with three sizes of fuse wire is mounted in the enclosure.

The arrangement of the fuses are generally, one for the control of the ground floor main oven switch, including the switch socket for the kettle and iron; one for the control of the first floor power circuit; one for the protection of the water heater circuit; four for the protection of the cooker electrical circuits; one for the ground floor lighting circuits; one for the first floor lighting circuits; one for the protection of the water heater pilot light; and one for the cooker pilot light.

All the fuses, excluding those protecting the cooker, are connected to a busbar in common with the neutral.

The components are mounted on a steel chassis, suitably hinged to allow for the whole unit being accessible for servicing.

The unit is fitted with pre-wiring with the ends coming off at appropriate levels so that the house electrician can connect up for power points and lighting. The wiring from the ponel is taken through the unit and branches off at different levels.

Correspondence

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

An Appeal from the Army

[To the Editor]

Sir,—You will appreciate, I am sure, that the supplying of vocational information plays a very large part in the Army Education Release Scheme.

Many units have set up vocational information rooms to which the men go, to become conversant and to keep up to date with the current affairs of the particular trade or profession to which they hope to return on leaving the Service.

I am responsible for the upkeep of seven such rooms, which leads me to ask if you could please inquire of your readers if any would be prepared to send to me their copies of The Electrician when they have read them.—Yours faithfully,

C. F. Maylyn,
Bde. Edn. Officer, H.Q.R.A.
3 Brit. Inf. Div., M.E.F.

Supply Authorities and Consumers

(Contributed)

THE economic use of fuel during the war was a national necessity, but in peace-time, efforts will have to be made to advise consumers on the most desirable methods of fuel consumption. Although consumers may not reasonably expect any great relaxation of the restrictions in consumption before the winter of 1946-47, then education on a national scale in the proper use of electricity would serve good purpose. During the ten or so years preceding the outbreak of war, serious attempts were made by electricity, gas and solid-fuel interests and, in a more limited field, oil, to bring their products to the notice of the public. This education took the form of national advertising by individual undertakings; by respective fuel and development associations, and by manufacturers of equipment. Though the value of this form of publicity must not be underrated, of even more value was the information supplied to consumers as the result of personal contact by undertakers' and manufacturers' technical representatives. While all this free education was provided largely for the purpose of developing the respective service or commodity, its effect, too, enabled consumers to more readily appreciate the fundamentals and advantages of each service.

A Misplaced Belief

In some respects competitive load development was overdone in a desire to achieve results, an over-optimistic picture was sometimes painted of the service by the representative, with the result that some consumers were later dissatisfied after discovering certain inherent disadvantages. The fuel "truce" has unfortunately led a large section of the public to believe that upon the return of more normal conditions each type of load should be utilised for a specific purpose only: for instance, in published reports on reconstruction, recommendations have been made to the effect that while electricity is best for lighting and small power, gas, solid fuel and oil are more economic for heating, cooking and large power. Few will deny that as a war-time economy the load should be shared by fuels most suitable to the conditions obtaining at the moment; but it must be remembered such splitting of load is not in war-time necessarily governed by costs. The war-time allocation of certain fuel to certain forms of work is too dependent upon availablity of labour required to produce and supply the fuel; availability of production plant and spares, and of consumers' equipment; availability of raw materials and so on. For instance, electricity consumption is at the moment at a disadvantage in order to conserve our stocks of coal.

These conditions, however, need not hinder the preparation of the public for the development period ahead, for as soon as undertakings are again free to compete with other fuel interests, the time will be opportune for the electrical industry to inaugurate a consumers' consultant service which will surpass all pre-war standards.

Contact With Public

Of first importance is the electricity supply section, for it is this side of the industry which is in a position to make direct contact with a large section of the public. In pre-war days methods of contact and development were as numerous as the individual undertakings; but it is suggested a closer co-ordination of policy would be an advantage. Commercial development was, before the war, in many cases controlled at the head office of the parent company or undertaking, the responsible head of the department being a commercial manager who, in some cases, held a directorship. In view of his influence regarding the administration of a group of companies, where applicable, the commercial manager was able to direct the most favourable policy from both the companies' and the consumers' points of view. Sales development was further co-ordinated throughout the group by the appointment of area and district sales managers who put the main policy into operation. As the requirements of consumers differed between areas and districts, depending upon whether they were rural or urban, head office were able, upon the recommendation of their area sales managers, to vary their main policy to suit individual requirements. It is generally accepted that the larger the organisation the greater the danger of the individual consumers being neglected. The results of the larger groups of company undertakings do not, however, support this theory. Any theoretical disadvantages are further outweighed by the advantages accruing to consumers under a large group. For instance, any suggested concessions, whether a reduction in charges or lower costs of hired apparatus due to bulk purchasing, apply to consumers over such a wide area that each concession is well worth special investigation. The sales development policy of municipal undertakings also varied between individual undertakings. In general the larger

undertakings provided a service to consumers comparable with the large company undertakings. Smaller municipal undertakings were not in all cases, however, in a position to provide this service, while the results achieved by some excelled those of the larger units. In the case of small company undertakings not controlled by any large undertaking or group of undertakings, these were rarely in a position to give as good service as the larger companies. In all instances, where the services to the consumers were above the average, the undertaking employed an efficient outside development staff, augmented rather than led by a system of Press or other indirect consumers' service.

Changes in the structure of undertakings now anticipated would bring each of these problems under close examination; but in the long run it should be the consumer who should first be considered. Service as such must not be compared with intensive or high pressure methods of sales development. It should be the aim of every undertaking and outside representative to provide first a highly efficient service and second to develop the load. It is obviously of little use to attempt to persuade a consumer to increase his load when he is dissatisfied with the operation of his existing equipment; and regular contact with each consumer, irrespective of the magnitude of his existing load, is therefore essential. Only by making regular service calls will the representative win the consumer's confidence, and each time he calls he should have a reason for his visit, otherwise consumers will soon object to his visit for reasons of time wasting. In this connection the visit could be to invite queries, each consumer should, however, be informed beforehand of the proposed visits and where he or she does not approve, this method of contact should not be continued. After a time consumers will learn to associate their particular visiting representative with all things electrical and will seek his advice when the adoption of additional load is considered. On each visit the representative should, if he considers the time opportune, discuss the merits of electricity for other purposes.

Payment of Staff

The amount and method of payment must have a direct bearing upon the quality of service and the rate of development. The right type of personnel cannot be attracted unless salaries are reasonably high, and, in general, a straight salary is preferable to a small salary plus a commission. Where the latter form of remuneration is paid, service usually suffers for sales. A representative on commission will naturally spend more time negotiating the purchase of apparatus, even when that apparatus is of little load value, than he will upon consumers' service. Should periodic sales campaigns during the summer months be desirable, the personnel conducting them should be made up of special representatives who are not concerned with consumers' services; in these circumstances payment of commission is essential, but the service to consumers will not in such cases thereby suffer.

Preparation and Development

All large company-owned and municipal supply authorities should be in a position to employ a number of scales engineers or specialist representatives, whose chief duties should be to contact architects, estate developers, heads of industry and similar individuals. Though obtaining of load should not be the chief aim of these representatives, they should nevertheless be conversant with the application of electricity for all new developments. During their daily contacts they will become conversant with all new buildings, and thus make possible the introduction of electricity schemes in the earliest stages. In the industrial field, frequent calls should be made to all factfactories, firms, quarries, mines, etc., and a short summary should be made of the proceedings at each visit, so that a complete history will be available for future reference.

Sufficient knowledge of each industry to enable the engineer to talk intelligently upon industrial and agricultural engineering questions is only acquired through making an intensive study of each industry, both from technical literature and intelligent observations in the factories and farms during periodic visits. The specialist engineer, in his turn, can provide the industrial and agricultural consumer with a most useful service by analysing the power costs of existing plant. Few owners of plant installed for a number of years are aware of their true operating costs, for in many cases no records are kept of fuel consumption or maintenance charges; in view of this, the estimated costs are much lower than the actual. Many proposals for the change-over to the public supply of such premises have been rejected by their owners in the belief that the comparative figures of existing private plant and public supply have shown the latter to a disadvantage as regards running costs, whereas if the true figures were available the public supply scheme would in all probability be the more favourable. Where periodic visits are paid to all potential industrial and agricultural consumers, the engineer is in a position to put forward a scheme the moment the installation of new plant is first considered.

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

Blackpool Electricity Committee has appointed **Mr. K. C. Coope,** of Leeds, as deputy borough electrical engineer.

Birkenhead Electricity Committee has appointed **Mr. H. D. Offer** as meter superintendent.

Mr. A. G. Milne has been appointed by the Blackburn Electricity Committee as

Group of directors of the Watliff Co., Ltd., taken at a victory luncheon. From left to right are Messrs. M. H. Davies, S. J. Watson, W. Martin Hume, A. O. Hinchliff and A. F. J. Wright

technical superintendent of the electricity undertaking.

The chairman and vice-chairman of the Maidenhead Electricity Committee for the ensuing municipal year are **Alderman H. H. Neve** and **Councillor A. E. Breakspear,** respectively.

Salford Light, Heat and Power Committee has approved the appointment of **Mr. J. B. Thomas,** assistant mains engineer, Central London Electricity, Ltd., as senior mains engineer.

We are pleased to learn from Mr. W. J. Jones, director of the E.L.M.A., that his predecessor, **Mr. C. W. Sully,** is well. May he continue to enjoy his retirement for many years. to come.

We understand that **Mr. W. E. Bush** has returned from the United States and has resumed his lighting activities in Paris.

Southport Town Council has been asked to confirm the appointment of **Mr. Douglas F. Grant,** station superintendent, as deputy electrical engineer.

Mr. H. E. Chastney, deputy chief inspector of factories, will succeed Sir Wilfrid Garrett, chief factory inspector, who retires at the end of the year. Mr. Chastney is a member of council of the Illuminating Engineering Society, and is particularly interested in lighting.

Mr. J. Eccles, Liverpool city electrical engineer, last week addressed the Bootle Rotary Club on " This Mechanical Civilisation." He said the days were looming ahead when oil and coal would peter out and mankind would trust upon atomic fission for power.

Liverpool Passenger Transport Committee has decided to recommend **Mr. Reginald James Heathman,** deputy rolling stock and works engineer to the passenger transport department, for appointment as rolling stock and works engineer. He will succeed Mr. J. S. Ross, who has retired. Mr. Heathman, who is 44 years of age, has been in the service of the department since 1935.

An informal dance organised jointly by the London Graduates' Section of the Institution of Mechanical Engineers and the Students' Section of the Institution of Electrical Engineers, attracted an attendance of about 600 members and others to the Porchester Hall, Bayswater, on December 8. The enjoyment of a popular programme was heightened by the inclusion of a number of Paul Jones and elimination dances. The latter were arranged by Mr. G. Lyon to whom, together with Mr. S. Smith, credit is mainly due for the success of the function. Prizes were awarded in the elimination dances.

Aero Engines, Ltd., Bristol, (incorporating Douglas (Kingswood) Ltd.), have acquired from A. C. Morrison (Engineers) Ltd. of Leicester, a sole manufacturing and selling licence for A.C.M. electric vehicles, and the chairman, **Sir Maurice Bonham-Carter,** and the managing director, **Mr. John R. Phillipson,** have been nominated to join the board of A. C. Morrison (Engineers) Ltd. **Mr. A. C. Morrison** will continue as managing director of A. C. Morrison (Engineers), Ltd., but his services will be at the disposal of Aero Engines, Ltd., for all matters connected with the A.C.M. electric vehicles, which comprise various types and sizes of delivery vans. Production of these vehicles, for which orders have already been received, will be commenced immediately in the works of Aero Engines, Ltd., at Kingswood, Bristol.

For six nights and one matinee the G.E.C. Dramatic Society presented Daphne Du Maurier's popular play " Rebecca " before large and appreciative audiences in the lecture hall at Magnet House, Kingsway, London. " Rebecca " is an ambitious choice of play for amateurs, but with their aptitude and enthusiasm the G.E.C. players overcame all difficulties, including those of the somewhat wordy first scene. The cast was as follows: Horace Haynes (Frith),

Irene Herod (Beatrice Lacy), Douglas Maule-Cole (Giles Lacy), Richard Anson (Frank Crawley), Victor Garland (Robert), Doris Emm (first maid), Evelyn Grey (second maid), Elsie Walbancke (Mrs. Danvers), William Peacock (Maxim de Winter), Phyllis Redman (Mrs. de Winter), Harold Bowman (Jack Favell), Robert Scutt (Col. Julyan), Stanley Wells (Walter Tabb). The producer was Dudley Pearmain, and the excellent setting was by William Peacock. The stage management was in the capable hands of Ella C. Barnett. The proceeds, which exceeded £100, will go to the G.E.C. Well Wishers' Club for the purchase of comforts for members of the Magnet House staff in the Forces overseas.

Scene from the play "Rebecca," produced by the G.E.C. Dramatic Society

Mr. F. W. Cripps, until recently joint managing director of Dowsing Co. (Elec. Mfs.), Ltd., with whom he had been for the last 15 years, has joined Callinan, Giles and Co., Ltd., of Newman Street, London, E.C., proprietors of the Callinan hair waving equipment, in the capacity of managing director. His many friends in the industry will wish him every success in his new enterprise. Meanwhile, he retains his seat on the board of Messrs. Dowsings, leaving Mr. A. J. Gunn as managing director.

Apprentices, their parents and officials of the English Electric Co., Ltd., filled the Association Hall at the Stafford works of the company on the occasion of the annual presentation of indentures to apprentices who had completed their training and merit awards to those apprentices who had earned them by diligent work at technical studies and in the workshops. Among the guests were Sir Hugh Chance, Councillor A. E. Hourd (deputising for the Mayor) and Mrs. Hourd, and Dr. Chapman, principal of the Stafford Technical College. The chair was taken by Mr. F. Caunce, superintendent of the company's technical education department, and other company officials present included Mr. J. W. C. Milligan, manager, Stafford works; Mr. A. H. Wroe, manager, switchgear works; Mr. M. Farrand, superintendent of the personnel department; and Mr. R. C. Cook (chairman of the Apprentices' Association). Mr. Caunce read a message from Sir George Nelson, the chairman and managing director, who was unable to be present. In his address, Sir Hugh Chance congratulated the company on its pioneer work both at Rugby and Stafford in the development of day continuation schools. Mr. Milligan, after distributing 15 indentures and 105 merit awards, handed the Milligan Shield to this year's winner, Kenneth Jameson, who in the opinion of the management, and of the apprentices themselves, was the best all-round apprentice of the year.

Obituary

Mr. Ferrand Agnew Williams, late of the Engineering Department, Port of London Authority, on December 4, aged 74 years.

Mr. Alfred Ernest Bailey, at Truro, aged 68 years. A native of Plymouth, he went in his early days to Borneo as a mining engineer under the Crown Agent for the Colonies. On his return to this country he commenced business at Plymouth as an electrical engineer.

The Rev. Arthur James Stubbs, formerly assistant engineer-in-charge of Postal Telegraphs, on December 8, aged 84 years. After his retirement from the Post Office he acted in the capacity of a consultant civil and electrical engineer. He was ordained in 1931. Mr. Stubbs had been a member of the Council of the I.E.E. He was the author of " Manual of Telephony " and a number of professional papers.

Mr. James McLennan Calder, late manager of the Reading transport undertaking. He joined the undertaking in May, 1905, as power station engineer, and was manager from 1920 until March of this year, when he retired. He was an associate member of the I.E.E. and I.Mech.E., and in 1939 served as president of the Municipal Passenger Transport Association. For some years he was secretary to the employers' side of the district council (Area 1) of the National Joint Industrial Council for the tramways industry.

Mr. Harold Ainsley Cox, formerly chief of the testing department at the English Electric Company's Dick, Kerr works, Preston. Mr. Cox went from Siemens Brothers and Co., Ltd., Woolwich, in 1901, to take charge of the testing department of Dick, Kerr and Co., as the works then were, and continued to hold that position until his retirement in 1931. In those days the principal work comprised tramway motors, controllers and ancillary apparatus; later it embraced d.c. generators and then a.c. machines, including turbo-alternators and water-wheel alternators. Mr. Cox took a keen interest in the studies and recreation of students and apprentices, and many men now well known in the electrical engineering world passed through his department.

Lighting Developments

Work of the E.L.M.A. Reviewed—Future Activities

WE are reminded by the E.L.M.A. that artificial lighting as we know it to-day is a comparatively recent development. The 1914/18 war period provided a major impetus to an industry already showing signs of expansion and not long after the Armistice it became apparent that electric light was to play an ever increasing part in the life of the nation. In 1924, with vision in advance of the time, members of the E.L.M.A. inaugurated the Lighting Service Bureau, a neutral organisation through the medium of which information could be collected and disseminated so that the community in general and the electrical trade in particular could be kept informed of all aspects of electric lighting.

The twenty-first year of its activities coincides with the end of yet another war, and a review of its past record is therefore of interest. In 1932 part of the premises in Savoy Hill, until then occupied by the B.B.C., were taken over and this move made available fifty per cent. more space; all the demonstrations were modernised and reorganised and they have continued to be kept up-to-date ever since. A year earlier the Lighting Service Bureau of Scotland had been moved to enlarged premises in St. Vincent Place, Glasgow, and thus were established comprehensive lighting centres north and south of the Border.

Extensive Scope of the Bureau

Activities were further widened, in 1933, by the addition of the touring demonstration which travelled the country from Cornwall and the Isle of Wight to the Firth of Forth and the Clyde, while the bureau, fully alive to the part played by the written word, produced a series of publications so long and varied that it is impossible to do more than mention some of the more outstanding, namely the orange handbooks covering major lighting applications, of which some have run into nine editions; "Electric Discharge Lamps," one of the first books to cover the subject with any degree of completeness; "Lighting Service," a quarterly house journal which was just getting into its stride when war broke out and is due to be revived as soon as conditions permit; and "Modern Factory Lighting," produced in conjunction with the E.D.A. at the outbreak of war, and of which initially, some 30 000 copies were sent to factories and, of later editions, some thousands were circulated by production departments of the Government to essential factories.

The introduction of fluorescent lighting has made it imperative to revise all the existing literature of the bureau and as time goes on the range of publications will be still further increased. Already since the end of the war, there have been issued brochures entitled "Interior Lighting Design," "Street Lighting by Electricity," "Fluorescent Lamps," "Light—the Sales Builder," and awaiting delivery is "School Lighting."

Popularity of Publications on Lighting

The present demand for lighting information may, in some measure, be gauged by the fact that a five thousand edition of a publication such as "Fluorescent Lamps" which might have lasted about two years in pre-war times, was exhausted within a month.

The popularity of bureau lectures, invariably illustrated by appropriate demonstrations, is such that comment upon them is unnecessary. Suffice it to say that the 41st Illumination Design Course just completed was so overbooked that a duplicate course is to be held in February on a date yet to be determined, and plans are afoot to restart the provincial courses which were proving to be so popular prior to the war. Architects' conferences are again on the programme and it is the bureau's intention to hold the next of these functions in the spring.

Exhibitions have always figured largely in the bureau plans, and since the Faraday Centenary Exhibition in 1932, for which it designed the main lighting features, the bureau has taken part in every nationally important exhibition of appropriate character, either on its own account or in co-operation with other organisations such as the B.E.D.A. and the I.M.E.A.

In addition to the co-operation with all sections of the industry, the bureau has established good relations with Government departments which, recognising it as an authoritative source of lighting information, have called upon it to give evidence before the Departmental Committee on the Lighting of Factories, the Ministry of Transport Departmental Committee on Street Lighting, the Building Studios Lighting Committee, etc. During the war the National Industrial Electrical Lighting Service was set up at the request of the Production Departments, under the chairmanship of the late Sir Duncan Wilson, ex-chief inspector of factories, and played an important part in increasing and maintaining production efficiency.

To-day, the bureau represents the national centre for lighting development

and is a clearing house for lighting information from all over the world. To quote Mr. C. W. Sully, for many years director of E.L.M.A. : " It exemplifies the difference between business for commercial gain and business as a means to an end; in other words, the electrical industry, when dealing with the bureau, can relax that guarded attitude so long considered inseparable from any commercial dealings and can plan the achievement of a common goal on neutral ground."

These brief facts were made prominent at an informal luncheon last week when the technical Press were the guests of Mr. W. J. Jones, director of the E.L.M.A. and Mr. E. B. Sawyer, acting manager of the bureau, and among other topics discussed were the improving effect which the work of the bureau is having upon factory lighting and the lighting of schools; and the development of the fluorescent lamp. With regard to the latter we understand that there will be made available to the industry, in the not too distant future, an 18 in. fluorescent lamp. Another point discussed was the bureau's latest Electric Illumination Handbook, into which have been introduced data concerning tubular fluorescent lighting; a new basis for estimating the illumination required and revised recommended values; a maintenance factor, to take the place of depreciation factor, which caters for the normal soiling and deterioration of reflecting and translucent media; and revised figures of lamp output which cater for any drop in lamp efficiency throughout life.

With a view to assisting in the rehabilitation of members of the Forces, the bureau has in mind the introduction of special courses, either day or evening, which could be made available as part of vocational training programmes if desired; such courses could, of course, be given in premises provided by the industry locally, or in the Services' own centres. In a brochure outlining the design and architects' courses, a typical programme for a rehabilitation course is given. Another new brochure is entitled " Light—The Sales Builder," which presents in convincing manner, the important relation of good lighting to shop sales.

Turbo-Alternator Rotors

Breakdowns Due to Winding Distortion Discussed

THE paper by Mr. R. H. Coates and Mr. B. C. Pyle on " The Operation of Large Turbo-alternators to Reduce Rotor Winding Deformation," an abstract from which was given in our last issue, was read before the members of the I.E.E. on December 6, and discussed at some length.

Details were given of rotor failures experienced by the undertaking with which both authors were associated, and the nature of faults causing outage. Existing theories based on the work-hardening of copper by temperature cycles were expanded and data were given of plastic deformation of copper at working temperatures. Results were given of measurements of both temperatures and the stresses in the windings on alternator rotors in service. An analysis of the phenomena causing the stressed condition indicated means for controlling the stresses. The possibility of reducing stress in rotor windings by pre-heating was referred to, and details of the procedure adopted were given.

Discussion

Mr. C. W. Marshall (C.E.B.) said that a measure of the seriousness of alternator rotor winding troubles might be obtained from the C.E.B. records of plant breakdowns. In July, 1943, 410 MW of plant were out of commission for this reason. This represented about 4 per cent. of the total plant installed in stations connected to the grid. By December, 1944, the loss of capacity due to rotor troubles had dropped to 80 MW. (0.8 per cent.), but at the present time 190 MW (1.9 per cent.) were out of commission because of rotor troubles. A large proportion of such troubles was directly attributable to winding distortion. In addition, 14 alternators with a total capacity of 275 MW, were operating with single earth faults on their return. The great majority of the rotors were wound with copper, but trouble had also been experienced with aluminium-wound rotors of Continental origin. Alternator manufacturers were fully aware of the need for improved performance and energetic action had been taken in modifying design and construction so that machines might be better able to withstand stresses of frequent starting and stopping. Rotor winding distortion was encountered mainly in 3 000 r.p.m. machines of 20 MVA capacity and upwards, but it had also been reported on large 1 500 r.p.m. 100 MVA sets abroad. The authors indicated that operation of plant under grid conditions had accentuated the troubles, but it should be noted that in the case of Sheffield, both the load factor and the power factor on the stations were improved by grid operation. One important contribu-

tory factor in causing the considerable number of rotor failures in the past appeared to be the high maximum temperature of 130°C. permitted under the British turbo-alternator specification, and unless the elastic properties of rotor conductor materials could be improved, this maximum temperature should be reduced by at least 10°C. This would involve reduction of the MVAR rating of the machines which might be made up by the addition of power factor compensating apparatus. The authors had shown how existing machines were being safeguarded by applying pre-heating, and this appeared to be more economical than the addition of power factor compensating equipment, although it involved some complication in operation.

Mr. Marshall concluded by suggesting the following minimum action on the part of all power station engineers to safeguard their plant: (1) Provide reliable means of supervising rotor winding temperature of all machines—and he thought a single high grade shunt with sub-standard ammeter/volt-meter and compensating resistance would give more reliable resistance measurements at considerably less cost than the authors' ohmmeter method. The voltage connection should be taken directly from the main slip-ring brush arms rather than from specially insulated brushes. (2) The cooling circuit component of all alternators should be thoroughly examined and, if necessary, modified to provide maximum air temperature control and heat conservation at standstill. The air-tightness of many cooling circuits was imperfect, with the result that dust accumulated in the machines, particularly in the rotors, and impaired the cooling and aggravated the conditions which gave rise to winding distortion. Emergency doors such as were usually provided to permit operation on an open cooling circuit in emergency, seemed superfluous and should be eliminated. (3) Checking of condition of rotor winding and coil positions by extensometers, should be part of the regular routine maintenance procedure. There was now much evidence in favour of substituting motor-driven exciters for the customary shaft-driven types in all new machines.

Mr. W. D. Horsley (C. A. Parsons and Co., Ltd.), after showing some slides indicating that the authors' experiences were generally very similar to those experienced elsewhere, said it now appeared that the main controlling factor was the temperature gradient down the slot in a radial direction. The copper had been observed to move radially in the slot and in his view the safest approach to the problem at the moment was to rigidly pack the end windings and, what was more important, by various means to reduce the temperature gradient down the slots. Pre-heating on the lines adopted by the authors had been tried for some years in South Africa, but had been found to give negative results; therefore, it would be interesting to have the results of the authors' experience in a few years time. Hard copper had also been tried, but no definite improvement had been observed. Moreover, hard copper had the disadvantage that if contraction occurred the residual stresses due to contraction were very high—a fact confirmed by the authors.

Mr. W. N. Kilner (Metropolitan-Vickers Electrical Co., Ltd.), said that copper shortening in 3 000 r.p.m. rotors had occurred in the stations of only two operating companies where his firm's machines were installed—one in this country and one abroad. In the case of the home station, the machines ran 29 796 hours and were started and stopped 467 times before a short circuit between coils developed. The machine was operated at too high temperature due to inadequate ventilation owing to an error in the erection of the external ventilating ducts which, unfortunately, was not discovered until after the rotor failed. Duplicate machines in the same station operated for longer periods and had not given any trouble. In the case of the overseas station, the machines were operated at overloads for long periods and the practice was to load the machine up until the rotor temperature indicator showed 130° C. These machines, which were in South Africa, had the ventilating slots below the winding points and discharge from these slots was to radial holes which discharged into the air gap of the machines. The first machine that failed had operated for 16 000 hours over a period of two years during which time it had been started and stopped only 86 times. This rotor was returned to the works in England and the trouble was diagnosed as copper shortening. It was believed at that time that hard copper windings would overcome the trouble, but because of lack of experience with this and the urgency of the repair, it was decided to re-wind the rotor with soft copper. This was done and the end turns of the coils were solidly blocked so that if the copper tended to contract it would have to cut through the packing blocks before it could short circuit the various coils. This rotor was installed in 1938 and the operating engineers decided to pre-heat the coils each time they started up, and everything had been satisfactory since. The only change from the original type of winding was the addition of the packing blocks. In the meantime experiments with hard drawn copper coils were made. Two rotors so constructed had been supplied to the same customer, and there had been no trouble. One machine had run for 18 690 hours and the other one 12 840 hours, and

both had been started and stopped 128 times up to the end of 1942 when the rotors were withdrawn for examination and found to be in perfectly good condition. They had been operating in service ever since. These machines were run without pre-heating. It would appear from this evidence that the problem had been solved by the use of hard drawn copper and packing blocks. Unfortunately, there was evidence from other machines in the same station with hard drawn copper windings that there might be trouble, as they were showing signs of deformation. Investigations into the softening of hard copper at temperatures of the order of 130° C., indicated that this varied considerably with the nature of the copper and the two machines that had run satisfactorily in South Africa happened to have a very good type of copper. Later, experiments indicated that copper might soften after two years, and rotors had since been made of silver bearing copper which had similar properties to those of hard drawn copper. However, no rotors made of this material had yet been put into use. Whilst appreciating that pre-heating was a means of overcoming the trouble, he contended that rotors should be made which did not require pre-heating. It was also an obligation on the part of the operating engineer not to operate at higher field currents than the machines were designed for. It was not appreciated that it was the temperature range that mattered so far as thermal deformation was concerned, and not only the temperature rise of the rotor.

Mr. A. J. Gibbons (London Power Co.) said the experience of his company had been relatively fortunate in this matter owing to the fact that practically all their turbine plant at the moment was 1 500 r.p.m. Such 3 000 r.p.m. plant as they had was of limited output, and therefore short length. Moreover, none of the machines was run anywhere near its full rated field current. Nevertheless, the weakest point was the rotors, and most of the trouble had been due to earth faults and not short circuits in the windings which had not been accompanied by an earth fault. It was wise to take steps to have the rotor repaired when the first fault occurred and thus avoid inconvenience and considerable disturbance to supply. He considered that rotors should universally be fitted with some form of continuous insulation resistance tester which would not only ring an alarm when the insulation fell to 1 000 ohms, as the authors suggested, but would also provide a continuous indication of the insulation resistance which could be located near the operators with the other instruments.

Mr. K. R. Hopkirk (B.T-H. Co., Ltd.) suggested that too much emphasis had been placed in the paper and during the discussion on the fact that copper distorted and had viscosity, and that all rotor breakdowns were due to copper distortion. That was not so, and copper distortion was only part of the more general aspect of the matter. A point that did not seem to have been mentioned was the tension in the windings. There was a limit to the tension which was not dictated by the copper in the straight turns, but by the ability to withstand bending, and that was a factor which perhaps the authors had forgotten to take into account. To deal with the problem of the creep of copper, he was using silver bearing hard drawn copper, which had already been mentioned. Another point was the difference of temperature between the top conductors in the slot and the bottom conductors, and there was a very large difference in the Sheffield case. Since 1939 his firm had developed means for evening out that difference, and at the same time reducing the temperature gradient between the copper in the slots and the iron of the rotor. That was a remedy for some of the older rotors, and it also enabled a larger output to be obtained from the same frame size. If it were known that machines were to be operated at two-fifths full load, surely there was some possibility of those responsible for controlling the load to ease these machines as far as possible from rotor current and to relieve them of some reactive kVA. It should be possible to ease the shift working machine as much as possible at the expense of the continuously operated machines. He did not know whether that was done, but it should apply not only to old machines which were suspect, but also to new machines, and he suggested that some examination of that possibility should be made.

Mr. F. A. Youngmark (English Electric Co., Ltd.) said his firm put in their first large machines in 1929 and early in 1930 with rotor lengths of 120 in. and 145 in., and neither of these rotors had broken down yet; perhaps it might have been better if they had. Actually the first breakdown due to copper distortion occurred in 1942, some 12 years after the first machine had been put into operation. At that time they had a considerable number of machines running, all liable to the same trouble, but fortunately a very strong packing had been put in the rear end windings. Since 1929, 15 per cent. of the failures on all the machines his firm had put in, using soft copper, had been due to copper distortion, which could be regarded as comparatively small. As to the future, there were many machines in service which were liable to copper distortion, but he was disposed to think that if we had not passed the peak of our troubles we were very near to it, because before 1942

the manufacturers were alive to the dangers and were beginning to introduce changes which would have an important effect, whilst operating engineers were introducing pre-heating in the case of rotors which were liable to this trouble. The use of semi-hard copper was becoming general, and he was all in favour of the strongest possible packings in the rotor end windings. Silver bearing copper was the next move. His firm had used temperature indicators 25 years ago. They gave misleading readings then, but he definitely recommended that the connections for the instruments should be made from the main brushes.

Mr. C. W. Priest (London Power Co.), said that in the Battersea station was what he believed was the first 30 000 kW 3 000 r.p.m. machine to be installed in this country; it went into service in 1931 and had run for 53 000 hours and had been started up between 4 500 and 5 000 times. No pre-heating was adopted, nor any unusual practices, and so far there had not been any rotor trouble of any description. This machine was designed for a power factor of .8, and although it seldom ran below .9 it gave a good margin on the rotor current.

Mr. J. W. Howard (General Electric Co., Ltd.,) showed a slide illustrating rotor distortion on a 25 000 kVA 3 000 r.p.m. Continental machine installed in this country and which had been sent to his company for repair. He pointed to the fact that in this case the deformation was definitely expansion and not contraction, and also emphasised that the expansion had taken place on the top of the slot, which was generally expected to be the coolest part of the winding. The contraction theories, he said, did not cover this problem as it should be covered. The paper would have been more informative if it had given some indication of the type of blocking used on the machines in question and, in particular, how this varied between one machine and another. His firm had supplied the 30 000 kW machine mentioned by Mr. Priest, which had been in service for 16 years, and had had many thousands of starts without giving any trouble, and other machines of the same make were also going well. It therefore seemed that a 30 000 kW machine could be produced which would not be subject to distortion. In the near future we should have to increase to 50 000 kW, with longer rotors of larger diameter both of which points must necessarily lead to greater danger of distortion. In connection with such machines, the manufacturers would have to ask the supply industry to help formulate a technique involving pre-heating on the lines suggested by the authors. Personally he visualised pre-heating treatment in which for a period of time the copper would be in contraction followed by a period of expansion so that there would be no possibility of cumulative distortion effects which might lead to destructive breakdown.

News in Brief

Electricity for Farmers.—Weardale (Co. Durham) farmers have received a questionnaire from the National Farmers' Union asking their views on a number of matters, including rural electricity and telephones.

School Lighting Installations.—At a meeting of the Bolton Education Committee it was reported that the head teachers of two modern secondary schools had asked for the provision of lighting installations for the school stages, and the Committee agreed to obtain estimates for such provision.

Supply to Factory-made Houses.—The Poplar Housing Committee has considered a reference from the Electricity Committee regarding electricity supplies to emergency factory-made houses, which are temporary structures, and recommends that these should be serviced exclusively by electricity.

Electricity in Council Houses.—It was reported at a meeting of the Barnard Castle U.C. that a questionnaire had been sent to local residents on the question of using electricity in council houses. 122 were in favour of electricity and 13 favoured gas. The Council has, therefore, asked the North-Eastern Housing Association to build " all-electric " houses.

I.E.E. Scottish Centre.—A luncheon has been arranged by the Scottish Centre of the I.E.E. to take place on January 26 at the Grosvenor Restaurant, Glasgow, at 12.15 p.m. The price of the tickets is 12s. 6d. each, not including wines. After the luncheon, Dr. P. Dunsheath will read his presidential address at the Royal Technical College, Glasgow, at 4 p.m.

Belgian Engineers Visit Britain.—A party of ten young Belgian engineers, including one woman, have just concluded a visit to Britain, under the auspices of the British Council, to study mining and engineering practice, particularly developments since 1940. Their visits included the works of Henry Wiggins and Co., Ltd., General Electric Co., Ltd., W. and T. Avery, Ltd., and Hams Hall " B " power station in the Birmingham area; and Mather and Platt, Ltd., and Metropolitan-Vickers Electrical Co., Ltd., in the Manchester area.

Insulation Materials

Types and Processes Discussed by I.E.E. Radio Section

THE necessity for protecting the components of radio and radar equipment used by the Services against the effects of moisture under tropical conditions focused attention on the physics and chemistry of the many substances that could be used, and consequently the discussion by the Radio Section of the I.E.E. on November 27, on " Film-forming Materials used in Insulation " covered a wide field.

Two Main Varieties of Varnish

In opening the discussion, Mr. C. R. Pye pointed out that the two main types of varnish used in the electrical industry were oil-based and synthetic resin-based varnishes, and all insulating varnishes from impregnants to anti-tracking varnishes could be classified under those heads. He went on to deal with the constituents, methods of production and characteristics of both types, and processes of application. Coils, he said, might be coated with insulating varnishes either by simple dipping or by vacuum impregnation. With both complete penetration of varnish to the centre of small coils was obtained, but for large coils it was necessary to use vacuum treatment. In both processes efficient predrying of the coils was absolutely essential. It was advisable when curing the varnish to raise the temperature in the stove step by step. Control of the varnish in either of those methods of impregnation should preferably be by viscosity and not by specific gravity. Enamelling of winding wire was usually done by a type of dipping process in which several coats were applied with a very quick stoving at high temperature (200-300°C.) between coats. Oil-based enamels, vinyl resins and nylon were used for that purpose. Oil varnishes had the best insulation properties, but were not as satisfactory from the standpoint of solvent and abrasion resistance.

Solventless varnishes were the ideal of every engineer connected with coil insulation. Some progress had been made towards their production, but there were still difficulties in the way of a full utilisation of this type of varnish. Probably the type most likely to come into general use was that based on the " Silicone " polymers, which also imparted very excellent heat resistance, in addition to high-frequency insulation. It was essential to realise that every insulation problem involving film-forming materials of that type must have individual consideration, the final choice being governed by the particular function of the finished equipment, and it was here that co-operation between the chemist, engineer and designer was of vital importance.

In the discussion which followed several speakers underlined the necessity for careful stove drying of coils before dipping and the advantage of rapid transfer to the bath while still hot. It was thought that the figures quoted for the degree of vacuum required were conservative and that in general a reduction of pressure to between 1 and 3 mm. of mercury was desirable.

Coils of very fine wire presented special difficulties. The time of impregnation must be closely controlled to avoid solvent action on the thin covering of the wire, and it was equally important to ensure complete curing, otherwise subsequent breakdown would occur under tropical conditions. Metallic catalysts should be used with caution as they were apt to initiate electrolysis; in general, driers with a lead base should be avoided.

Since the function of a varnish was to exclude moisture it was important to realise that this was a matter of degree. The rate of penetration was governed by absorption by the material and diffusion through it. A substance with an intrinsically low water factor might show widely differing degrees of penetrability, depending on whether the molecular structure was ordered or random.

Debye's Theory

It was asked whether the properties of a varnish as a dielectric could be predicted by applying Debye's theory, but the general opinion was that calculations based on the rotation of polar groups were not profitable in substances which were essentially mixtures.

Many of the new wire coverings were more resistant to abrasion than oil-based bituminous enamels, but some were not so good from the point of view of resistance to moisture, though coatings of the polyvinyl/formaldehyde type had, in one speaker's experience, proved satisfactory. Impregnating varnishes of the phenol/formaldehyde type could not always be used owing to the solvent action of free phenol, but oil-modified alkyd varnishes were safe and gave good adhesion to the glossy surface of the covering.

Some speakers thought that the advantages of solventless varnishes might be offset by loss from drainage, resulting from their lower viscosity and the higher temperatures required for curing. Where complete impregnation without voids was required it might be necessary to provide a permanent container for the component.

Stresses in Transformer Windings

Abnormal Conditions Causing Breakdowns

THE forces and stresses set up in transformer windings and their clamping structures, as the result of external or internal short-circuits or of switching operations, were considered in detail in a paper entitled "Mechanical Stresses in Transformer Windings," by Mr. E. Billig, read before the I.E.E. Transmission Section, on Wednesday, December 12.

The author said that although power transformers had attained a high degree of reliability in service, breakdowns nevertheless occurred from time to time under abnormal conditions. Such conditions arose when transformers were subjected to frequent short-circuits at their secondary terminals, with the supply voltage maintained at nearly its full value. In large interconnected supply systems with fault capacities of the order of 1 million kVA or more, the voltage could be maintained even with the largest sizes of power transformers in use to-day. The electromagnetic forces which could be produced under such conditions were formidable. Those forces were applied not only to metallic conductors, but also to insulating materials of greatly inferior mechanical strength, and it would be readily understood that they must be given careful consideration if serious damage were to be avoided.

Axial and Radial Forces

Various arrangements of windings and tappings in large power transformers were described. Points at which particularly high mechanical stresses occurred in concentric windings were discussed in detail. Axial forces between the top and bottom halves of each winding or between different windings were responsible for bending stresses in turns near the ends or adjacent to gaps in the windings, for compressive stresses in the body of the winding, and for tensile and compressive stresses in the clamping gear. Radial forces produced tensile stresses in the outer, and buckling stresses in the inner winding. Such stresses were more pronounced in coils adjacent to the main leakage duct. The excessive mechanical stresses which could be caused by internal electrical breakdowns were discussed. The mechanism of cumulative shrinkage, the loss in clamping pressure due to switching stresses and thermal cycles, and the danger of subsequent movement of the windings causing abrasion of the insulation and final electrical breakdown, were considered in detail. A rule was given for the minimum clamping pressure that should be maintained within the windings.

Some of the gravest dangers, the author stated, arose in windings which were not properly "balanced" magnetically; e.g., if one winding were axially displaced with respect to the other, if the windings were of greatly differing axial lengths, or if a considerable part of one winding were open-circuited by means of tappings. Such unbalance always produced additional stray flux, eddy-current loss, local heating and increase in mechanical stress. The larger the transformer and the greater the tapping range, the more important it became to keep such asymmetries down as far as possible.

Observation on Tapping Coil

Magnetic balance was not, however, the only point of importance. The separate tapping coil, for instance, might adversely affect the distribution of the electric field due to a steep-fronted surge, and would in some cases increase the effective capacitance to earth.

The conclusions arrived at were:—

(a) The clamping structure should keep all the windings continually under a pressure which is strong enough to prevent even the slightest movement under any circumstances which might arise in the operation of the transformer during its life.

(b) All the methods of clamping which had been used up to the present effected a compromise between various factors, and none of them fully solved the problems arising out of shrinkage.

(c) High-voltage windings should preferably be arranged on the outside from the point of view of mechanical strength.

(d) Tapping coils should be removed as far as possible from strong magnetic fields.

(e) There was scope for more detailed investigation of the behaviour of the materials now used as inter-turn, inter-coil, and end insulation of transformer windings, and possibly for the development of a new material better suited to the purpose. The main property required of such a material, apart from the usual electrical and mechanical requirements, would be freedom from appreciable yield even after extended operation over many years when immersed in oil at temperatures up to 100° C. under a high continuous pressure of the order of 1 ton/in^2, on which is superposed a lower pressure pulsating at 100 c/s.

(f) Proper use should be made of the experience to be gained from the performance of transformers under short-circuit. Records should be kept of the frequency and severity of faults in the system and of the state of windings as found by occasional inspection. The development of slackness and signs of movement in the windings should be carefully recorded.

Mineral Insulation

Its Application to Metal-Sheathed Conductors

THE progress made in the application of powdered mineral insulation to metal-sheathed conductors was recorded in a paper by Messrs. F. W. Tomlinson and H. M. Wright read at a meeting of the I.E.E. Installations Section yesterday, Thursday.

Inorganic insulating materials possessed certain advantages, stated the authors, but up to the present such a material, capable of being moulded round a non-rigid conductor, had not been produced. However, when a dielectric such as magnesium oxide or aluminium oxide was compressed in powder form within a tubular sheath, it behaved in many respects as a homogeneous plastic material when the sheath was subjected to deformation or bending.

Most Desirable Dielectric

When used in high-frequency cables, taking all its properties into account, magnesium oxide, when correctly sheathed, probably provided the most desirable dielectric of any materials at present in use. It was consistent in permittivity and characteristic impedance values, and was stable at extremes of temperature and even after considerable mechanical distortion.

For heating elements, the usual type of coiled resistance wire, of the nickel-copper and nickel-chrome alloys, was used. Other grades of resistance wire could be used, according to the heat output required. For cables, high-conductivity copper was required, and single-strand conductors were most suitable for the drawing process at present employed. There were special applications of cables for which other metals might be used, e.g., heating cables and thermocouple cables.

To form the sheath which contained the conductor and powdered insulant assembly, a variety of metals was used according to the intended purpose and operating conditions; for example, a nickel-chrome-iron alloy might be used for operating temperatures of the order of 600-750° C., whilst for the 200-600° C. range an aluminium brass or nickel-copper alloy might be used. For lower temperatures, and when a heater was to be immersed in water, solid-drawn copper tubing was used. Similarly, the metal for the sheath might be selected for its corrosion-resisting properties.

After referring to manufacturing methods, the authors said that for lighting and power supplies, a mineral insulated cable was as near to the ideal as had yet been achieved. It was fire-proof in a very wide sense, could not cause a fire, was permanent, and was sufficiently flexible to enable the most tortuous routes to be followed with comparative ease. Bending or deformation of the cable did not injure the insulating material, and did not affect the relative position of the conductors and sheath.

Whilst it was suitable for all ordinary wiring, the unique properties of the cable had enabled it to be used in many situations where the conditions had been too severe for other types of cable. The advantage of using the cable in situations such as were found in turkish baths, laundries, dyeworks, power stations, gas works, breweries, ships (including tankers), and other hot, wet or oily situations, was evident. There was no condensation within the sheath, and the cable did not deteriorate with heat.

In comparison with other cables such as lead-covered vulcanised-rubber or vulcanised rubber in conduit, the mineral-insulated cables showed a surprising saving in weight and bulk. Furthermore, there was opportunity for design in the mineral-insulated cable having a lighter copper sheath or a sheath of a lighter metal such as aluminium.

This type of cable, having a copper sheath and copper conductors, provided an excellent medium for transmission at high frequencies, losses being largely dependent upon the type of insulant employed. It had been found that magnesium oxide has a dielectric constant of the order of 3.6 and a very low power factor, of the order of 0.0005. The power factor was little altered at high frequencies. Such cables using magnesium oxide had been designed with a characteristic impedance up to 70-75 ohms for concentric cables and 100 ohms for twin-cored cables. These had a low attenuation and were used extensively at frequencies of the order of hundreds of megacycles per second. The optimum design for minimum attenuation, using magnesia as the dielectric, gave a characteristic impedance of 43 ohms for concentric cable and 80 ohms for twin cable.

Wide Field of Application

Copper-constantan and iron-constantan compensating leads could be produced in a suitable sheath. The process enabled comparatively long lengths and small diameters to be produced, and the heat-resisting and non-ageing properties were finding considerable applications. This type of compensating lead was also suitable for use as a thermocouple. There was a wide field of application for the compensating lead for standard commercial temperature-measurement work. As a thermocouple, there were many special applications.

Plastic Materials

By JAMES TAYLOR, B.Sc., F.R.I.C.

DURING the latter part of the war, plastic materials based on polymers of vinyl carbazole were developed in the United States to meet a demand for applications in the field of electronics where high temperatures were encountered in operation, but where the mechanical properties did not require to be particularly high. The trade name of this type of material is Polectron.

Characteristics of Polectron

It is claimed for this material, of which very little has been seen in this country, that it has a high heat distortion temperature, a very low power factor, a high dielectric strength and high volume and surface resistivities. The dielectric constant is said to be uniform up to ultra high frequencies and that any variation is due only to thermal expansion of the material. It is very resistant to water, to alkalis and to dilute alkalis, also to hydrofluoric acid but it is attacked by concentrated mineral acids such as sulphuric or nitric.

It is soluble in aromatic hydrocarbons such as benzene and toluene, and also in chlorinated hydrocarbons, whether aliphatic or aromatic, such as chlorbenzene and trichlorethylene. It is, however, insoluble in aliphatic hydrocarbons, hydrogenated aromatic hydrocarbons, alcohols, ether and many mineral oils.

Like many of the other vinyl derivatives it can be moulded by injection or compression. When injected it develops a sort of fibrous structure and, in consequence, good mechanical properties are obtained in the direction of flow. There is, however, a corresponding weakness in the opposite direction. During moulding, whether by injection or compression, careful control of the temperature must be exercised. Too high a temperature results in break-up of the fibrous structure with consequent loss of mechanical strength. Too low a temperature results in a porous material with low resistance to moisture. Like polyvinyl chloride, varying contents of plasticiser may be used in making up the moulding compounds, and as a result materials softening at varying temperatures can be produced.

Complete data have not yet been published on the material but from the figures available, it has been possible to draw up a table of most of the mechanical and electrical properties so that it may be compared with other plastic materials reviewed in this series of articles: Specific gravity, 1.2; impact strength, 0.5 to 1.0 ft. lb. per in.; volume resistivity, 10^{14} ohm. cms.; dielectric strength (0.1 in. thick) 750-1 000 V per mil.; dielectric strength (0.001 in. thick) 3 000 V per mil. Its main applications have been in dielectric materials for condensers and as insulation against moisture in electrical equipment. It can be used where the working temperature is relatively high and with high voltages. It is worthy of note that the unplasticised material has a power factor which only varies from 0.07 at 50° F. to 0.1 at 300° F.

Polyterpene hydrocarbon resins have also been developed in America during recent years but as they do not find much outlet in the electrical industry, it is not proposed to discuss them in much detail. In the main they find outlet as substitutes for certain alkyd resins in baking enamels. They result in improved colour retention under heat. They are also used to a fair extent in America in the rubber industry. Moulding materials have been produced from them by compounding with fillers but their physical properties are rather poor. The moulding compounds are usually cold moulded like bituminous materials.

Polyvinyl Alcohol

Polyvinyl alcohol has been used quite extensively in America as a plastic material and its applications have raised it into a plastic material of some importance. It is more or less unique in being a water soluble plastic material but despite this it possesses high tensile strength and good flexibility. Its water solubility and consequent water absorption, even at room temperature, prevent it being used as an electrical insulator. It is, however, resistant to most ordinary organic solvents such as hydrocarbons, alcohols, esters, ketones and so on, and it possesses impermeability to nitrogen, oxygen and other gases. When moulded it is rubber-like in its characteristics. It can be made up into emulsions, it can be used as an adhesive or binder and can also be produced in film form.

For purposes of comparison the usual table of mechanical properties is given, but the electrical properties have been omitted because its high water absorption makes any measurements valueless: Specific gravity, 1.25; tensile strength, 1 000-5 000 lb./sq.in.; impact strength, —; water absorption, over 100 per cent.

The initial materials used for its manufacture are acetylene and acetic acid which are used to form vinyl acetate which is then polymerised, as described before, to polyvinyl acetate. The polyvinyl acetate

is hydrolysed to polyvinyl alcohol by the use of acid or alkaline catalysts. Interesting products can be obtained by stopping the hydrolysis before completion and if the degree of hydrolysis is below 70 per cent. the product obtained is insoluble in water. As mentioned above, the completely hydrolysed material is water soluble.

By blending polyvinyl alcohol in powder form with pigments, fillers and plasticisers, a moulding material can be produced which is in sheet form and this can be stamped into finished articles or can be used as preforms for moulding.

The chief interest in this country at the present time is the use of nylon in the manufacture of stockings, although one of its war-time uses was in the manufacture of parachutes and ropes for various Service purposes. Both in America and Germany the use of nylon-like materials for the manufacture of moulding compounds has been developed quite extensively, and these materials possess some interesting and valuable properties. After all, the production of nylon filaments for stockings or ropes is only the extrusion of a plastic material, and it is only a reasonable expectation that the same or a similar material might be moulded by injection or compression. The chemistry of these materials is very complex, and it would be entirely inappropriate to go into details here. Suffice it to say that they are condensation products of certain amines with certain dibasic organic acids, and that these condensation products are subsequently polymerised. For that reason they are usually described generically as polyamide moulding materials.

Polyamide Moulding Materials

In America the Du Pont firm have developed commercially four grades of polyamide moulding material known as Nylon JM 6339, Nylon JM 6337, Nylon JM 6377 and Nylon FM 1. The properties of these four materials are tabulated below, extracted from data published by Du Pont.

	JM 6339	JM 6337	JM 6377	FM 1
Specific gravity ...	1.13	1.09	1.12	1.14
Tensile strength (at 77° F.) ...	4050	7600	9480	10530
Impact strength (at 77° F.) ...	*	1.34	*	0.94
Dielectric strength ...	285	470	420	385
Volume resistivity ...	5.1×10^{9}	4.1×10^{14}	5.1×10^{13}	4.5×10^{13}
Water absorbtion	12.4%	0.44%	2.3%	1.5%

* Specimen did not break.

Of these materials the first to be developed was FM 1. It is an exceptionally tough material, and has a high softening point. Mouldings made from it will not distort at temperatures as high as 400°F if the load applied is low. It can be moulded by injection, and flows readily round complicated inserts, a great advantage in certain pieces of electrical equipment. Its natural colour is a sort of translucent cream, and, owing to the fact that it has no suitable solvents, coloured materials have not been produced commercially. However, in the same way as filments in stockings and ropes can be coated with a dyestuff after manufacture, it is possible to produce coloured mouldings by dyeing them after moulding. It should be pointed out, however, that this process only gives slight penetration of the colour so that it will not withstand too much handling without being rubbed off. For some purposes it is sufficiently durable.

Properties of Nylon

The material is extremely resistant to most chemical reagents. Phenols in the presence of formic acid act as solvents. Plasticisers cannot be worked into it to render it flexible. All alkalis and weak acids are without action on it, whilst strong acids break it down by hydrolysis into its original components, i.e., an amine and a dibasic acid. At low temperatures such as —50°C. the impact strength decreases but not to such an extent as ordinary thermoplastic materials based on cellulose acetate. Owing to the fact that it possesses a certain amount of resilience, it resists abrasion fairly well.

When moulded by injection a specialised technique has to be adopted. Nylon moulding material melts fairly sharply to a fluid state at a high temperature, and hardens fairly quickly on cooling. It is this fluidity which makes it specially suitable for moulding round complicated inserts, even if they are fragile they are not distorted. Specially designed nozzles have been developed to handle the material. Screens have to be provided to allow for the removal of unmelted particles of material, and vertical machines are usually used instead of the more common horizontal ones. Moulds have to be designed to prevent oozing of the liquid material around ejector pins and closing faces. Lower moulding pressures than the normal are used owing to the fluidity of the material.

Nylon JM 6337 was only developed last year. It can be moulded by injection, and is also suitable for moulding by extrusion, and is used as a wire covering material being extruded over the wire. Nylon JM 6339 is designed for compression moulding, and, in solution, it can be used for coating fabrics for proofing purposes. Nylon JM 6377 may also be extruded, compression moulded, or used in solution is of interest because of its specially good resistance to petrol.

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,

In what way do large audio-frequency transformers differ from small audio-frequency transformers or power transformers ?

The large transformers required for large public-address systems or for radio-relay networks may have to carry up to a kilowatt of electrical power. They are similar to power transformers in that they have to achieve the highest tranformation efficiency which is economically possible; that is, they must have sufficient iron and copper to keep the losses down to make them an economic proposition in terms of paying for the power wasted in them. Usually the size is determined by such considerations rather than disposing of the heat generated by the losses. The rating is, of course, the maximum rating which does not introduce appreciable amplitude distortion into the transmission in the system; the r.m.s. value of the currents or voltages may be anything down to 6 or 8 decibels below the occasional peak-power, which determines the rating of the system. With full continuous modulation, the rating for determining the loss of power to be disposed of is correspondingly lower.

An overall efficiency has therefore to be specified, and this is taken at the medium frequency of 1 000 c/s. For example, it may be 90 per cent. Accordingly, wattmeters operating with the requisite accuracy at this frequency must be available. The only way to avoid errors arising from residual inductance in the swamping resistances of the voltage circuit is to use the same wattmeter on the primary and secondary windings of the transformer. To a high approximation, phase-shift errors tend to cancel out. The wattmeter is used in the ordinary way, with the current coil in series with primary or secondary winding as the case may be, and the potential winding across the line, the transformer being terminated with and supplying the requisite power to the specified loan resistance, usually specified non-inductive, although the transformer may be used to supply a feeder which is highly capacitative. Since the measurements on apparatus to see whether they conform to a specification must be of high accuracy, much higher than ordinary works-test measurements, not only must the measurements be made with instruments which give adequate observational accuracy but the instruments. load resistances, etc., must in themselves be accurately known as to magnitude; in particular, the resistances must be sufficiently generous in dimension so as to dissipate their losses without undue rise of temperature.

So far these large audio-transformers should be dealt with as power transformers. In addition to the above tests there are response-curve tests over the whole of the frequency-range, and these correspond to any other audio-type of transformer.

L. E. C. H.

Physical Exhibition

THE thirtieth exhibition of scientific instruments and apparatus, arranged by the Physical Society, will be held at the Imperial College of Science and Technology, on January 1, 2 and 3 next. Amongst the exhibitors in the Research Section will be:

Metalisation, Ltd.; Barr and Stroud; Salford Electrical Instruments, Ltd.; G.E.C. Research Laboratories, Wembley; Metropolitan-Vickers Electric Co., Ltd.; Ferranti, Ltd.; British Electrical and Allied Industries Research Association; A. C. Cossor, Ltd.; British Insulated and Callender's Cables, Ltd.; British Thomson-Houston Co., Ltd.

Exhibitors in the Trade Section include: A.E.W., Ltd.; Aldis Bros., Ltd.; the Automatic Coil Winder and Electrical Equipment Co., Ltd.; Bakelite, Ltd.; Blackie and Son, Ltd.; the Bristol Instrument Co., Ltd.; the British Electric Resistance Co., Ltd.; British Rototherm Co.; the Cambridge Instrument Co., Ltd.; C. F. Casella and Co., Ltd.; R. M. Catterson-Smith; E. K. Cole, Ltd.; A. C. Cossor, Ltd.; the Decca Navigator Co., Ltd.; the Drayton Regulator and Instrument Co., Ltd.; Ebonestos Industries, Ltd.; Electro Methods, Ltd.; Elliott Bros. (London), Ltd.; Erie Resistor, Ltd.; Everett, Edgcumbe and Co., Ltd.; Evershed and Vignoles, Ltd.; Ferranti, Ltd.; the Foster Instrument Co., Ltd.; Gambrell Bros. and Co., Ltd.; Gresham Transformers, Ltd.; Griffin and Tatlock, Ltd.; Hendrey Relays, Ltd.; Jackson Automatic Electric Controls, Ltd.; Johnson Matthey and Co., Ltd.; George Kent, Ltd.; the London Instrument Co., Ltd.; Marconi Instruments, Ltd.; Marconi's Wireless Telegraph Co., Ltd.; Measuring Instruments (Pullin), Ltd.; the Mercury Switch Manufacturing Co., Ltd.; the Metropolitan-Vickers Electrical Co., Ltd.; the M.O. Valve Co., Ltd.; the Morgan Crucible Co., Ltd.; the Mullard Wireless Service Co., Ltd.; the Multitone Electric Co., Ltd.; Nalder Bros. and Thompson, Ltd.; Philips Lamps, Ltd.; the Record Electrical Co., Ltd.; Salford Electrical Instruments, Ltd.; Sangamo Western, Ltd.; Standard Telephones and Cables, Ltd.; H. W. Sullivan, Ltd.; Sunvic Controls, Ltd.; the Telegraph Condenser Co., Ltd.; the Telegraph Construction and Maintenance Co., Ltd.; the Telephone Manufacturing Co.; H. Tinsley and Co., Ltd.; Ernest Turner, Ltd.; the Westinghouse Brake and Signal Co.; Wild-Barfield Electric Furnaces, Ltd.; Zenith Electric Co., Ltd.

In Parliament

Disposal of Surplus Radio Valves—Shop window Lighting

The following are replies to recent questions which have been asked in the House of Commons:—

Government Departments (Research Work).—Replying to Mr. Cobb, who asked the Lord President of the Council the number of Government establishments, excluding the Post Office, which carried out research; and the total number of physicists or qualified engineers employed by these on pure research and applied research respectively, Mr. Herbert Morrison, stated that practically every Government department was concerned to some extent, either directly or indirectly, with research work. Complete figures were not available, but, excluding the Post Office, there were upwards of 9 000 qualified engineers and over 1 300 physicists in Government service. It was impossible to answer the last part of the question. The duty of many research workers involved both fundamental and applied research at the same time.

Coal Stocks (Gas and Electricity).—In a written reply to Mr. Raikes, who asked what were the stocks of coal at gas and electricity works in England and Wales on November 1, 1943, 1944 and 1945 respectively, Mr. Shinwell said the stocks of coal at gas and electricity works in England and Wales at the nearest convenient date to November 1 in the three years referred to were as follows: October 29, 1943: Gas 2 397 879 tons, electricity 3 860 861 tons; October 27, 1944: gas 2 716 168 tons, electricity 3 586 126 tons; October 26, 1945: gas 1 657 110 tons, electricity 3 206 694 tons.

Surplus Radio Valves.—In a written answer to Major C. Poole, Mr. Wilmot stated that general discussions had taken place with the Radio Industry Council, on which the British Valve Association is represented, about the disposal of radio surpluses. Approximately 3 000 000 radio valves had so far been declared surplus to Service requirements, but not all of these were of types suitable for civil use. Surplus valves released for the home market would be disposed of through trade channels, including the valve manufacturers, and invitations to tender in this respect had been issued.

Electric Power Plugs.—Replying to Major John White, who asked the President of the Board of Trade if he was aware that there is a shortage of electric power plugs in East Kent; that this shortage is holding up the completion of housing construction and repairs, while causing hardship to householders without alternative means of cooking and heating; and if he would take steps to make supplies available, Mr. Ellis Smith said his information was that the production of electric power plugs is sufficient in quantity to meet present essential demands.

Assistant Electrical Wiremen.—Sir H. Webbe asked the Minister of Works on what grounds assistant electrical wiremen employed by his department were barred from qualifying for employment as full craftsmen. In a written reply, Mr. Tomlinson said the Departmental Joint Industrial Council had been able to formulate a satisfactory scheme to enable assistant electrical wiremen to qualify for employment as full craftsmen in his Ministry.

Cable and Wireless, Ltd.—Capt. Cammans asked the Secretary of State for Foreign Affairs whether any negotiations have yet been opened with the Governments of Egypt, Portugal and other countries at present served by Cable and Wireless, Ltd., as to the terms under which these countries are prepared to transfer the properties of Cable and Wireless stations to the jurisdiction of His Majesty's Government. Mr. Bevin replied in the negative.

Shop window Lighting.—In written replies to Mr. Hurd, Flight-Lieut. Beswick, Air-Commodore Harvey and Mr. Walkden, Mr. Shinwell said he regretted that the present fuel situation did not justify any relaxation of the restrictions on shop window lighting during the Christmas period.

Merioneth Electricity Supplies (Water Power).—In a written reply to Squadron-Leader E. Roberts, who asked the Minister of Fuel and Power the total amount of units of electricity produced per annum by water power in the county of Merioneth; and how much of such electricity was consumed in the county, Mr. Shinwell said the number of units generated by authorised undertakers in 1944 was 34.5 million. Of this, about eight million units were sold in the county of Merioneth, the remainder being sent to other parts of North Wales. No figures were available of units generated or sold by non-statutory undertakers.

Oxford.—The City Council has reversed their decision that no further increase in the standard of efficiency of street lighting be made during the financial year 1945-46, and 150 W lamps are to be substituted, at an estimated cost of approximately £100, for the existing 40 W and 25 W lamps on the main roads. All lighting, however, is to be extinguished at midnight, except at danger spots.

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.

Cromarty B.C.—Electrical work in connection with the erection of 24 permanent houses. Names of contractors wishing to tender, to Messrs. D. Matheson and Sons. Dingwall.

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.

Manchester City Council, December 21.—Supply and delivery of 660 V and 250 V cables. Specification from the General Manager, Transport Department, Picadilly, Manchester, 1.

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.

Manchester City Council, December 31.—Supply, delivery and erection of 6.6 kV switchgear (feeds No. 4), Spec. No. 842, and one 20-ton weighbridge and frame, Spec. No. B.149. Specifications from Mr. R. A. S. Thwaites, Electricity Department, Town Hall, Manchester, 2; deposit, £1 1s.

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.

Sheffield Electricity Department, January 28.—Supply and delivery of one 14-panel 11 kV, 3-phase, 150 MVA rupturing capacity, works auxiliary switchboard. Specification from Mr. John R. Struthers. Commercial Street, Sheffield, 1.

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 and other particulars 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.

Eire Electricity Supply Board, February 28.—Supply, delivery and erection of transformers and switchgear at the Cathaleen's Fall and Cliff Stations on the River Erne. Specifications from the Chief Design Engineer, Electricity Supply Board, 26, Lower Fitzwilliam Street, Dublin, C.18; deposit, £5 5s.

Metal Prices

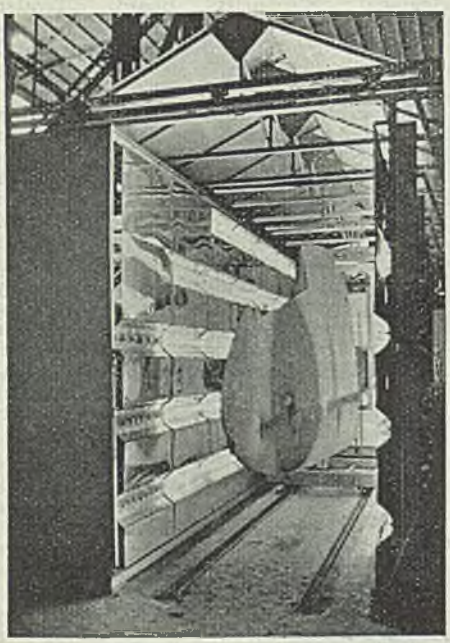
		Monday, Price.	Dec. 10. Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9 7/16d.	—	—
Sheet	„	11 7/16d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. 0 7/8d.		—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
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 supplied by B.I. Callender's Cables Ltd.

Infra-Red Heating

Some Examples of Equipment Used in the Aircraft Industry

DURING the war the G.E.C. supplied a large number of plants for accelerating paint drying. As restrictions have now been relaxed it is possible to describe some installations of exceptional interest, with reference to their technical details. The



Stoving a "Seafire" wing in an infra-red heating plant

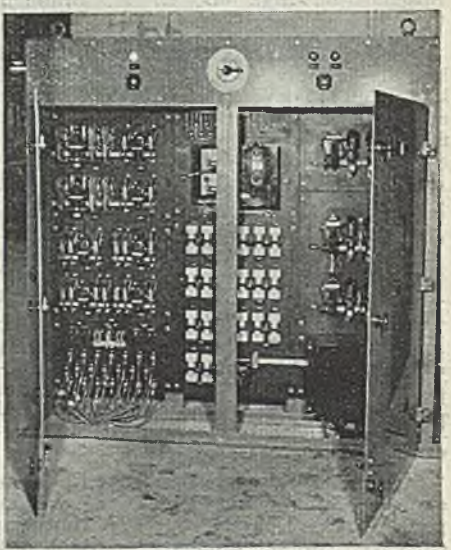
performance of high speed aircraft is materially affected by skin friction and drag, and elaborate methods of treatment were developed to obtain the highly finished smooth surfaces required. To reduce drying time and thus accelerate production an infra-red lamp heating plant designed by the G.E.C. was installed by Folland Aircraft, Ltd., Hamble, for components of the Seafire.

The plant comprised an enclosed oven with sliding doors at both ends, the two sides being 18 ft. long and 9 ft. 4 in. high. There were five rows of steel troughs fitted with rhodium plated reflectors, the two upper rows being somewhat shorter at one end so as to conform to the shape of the wing. There was a maximum temperature stipulation of 80° C., so as to avoid damage to built-in components. A further requirement was that the maximum temperature should be attained as rapidly as possible and that it should be maintained for a definite time.

To ensure reliable operation with unskilled operators, fully automatic control was provided, the appropriate contactors and timing devices being housed in a steel cubicle. The plant contained 432 clear infra-red industrial lamps, and had a maximum connected load of 108 kW.

Rubery Owen, Ltd., Darlaston, installed a plant for stoving paint on aircraft jettison steel tanks. To avoid damage to the paint it was necessary that the temperature should not exceed 325°F., so that it was impracticable to employ maximum intensity of irradiation. The plant contained six rows of lamps in steel troughs fitted with rhodium plated reflectors spaced at different distances. All controls were mounted on one side and opposing units were connected together.

Another interesting installation was carried out for British Overseas Airways Corporation, Ltd., Pontypridd. It was designed to dry stove paint on radial engine components during overhaul and repair. The plant, which was 6 ft. long with four rows per side of infra-red industrial lamps in rhodium plated trough reflectors, was loaded at 36 kW.



Control cubicle for the plant illustrated above

Electricity Supply

Sheffield.—The Electricity Committee is to extend mains at a cost of £6 730.

Blackburn.—The T.C. has approved a supply of electricity to Prospect Mill, involving an expenditure of £2 700.

Manchester.—The Electricity Committee has voted £29 304 for the reinstatement of the normal standard of street lighting.

Rawtenstall. — The Electricity Committee is seeking sanction to borrow £2 500 for services and £600 for unspecified work.

Barrow-in-Furness. — The Electricity Committee has obtained sanction to borrow £5 000 for mains and services.

Ilkeston.—The Housing Committee has granted permission to the Council House Tenants Association to instal electricity in council houses.

Birkenhead. — The Electricity Committee is seeking sanction to borrow £20 000 for mains, services, and change-over.

Barrow-in-Furness. — The Electricity Committee is to effect the change-over in the Vickerstown and Ferry Road areas at a cost of £1 629.

Salford.—The Electricity Committee is seeking sanction to borrow £5 000 for domestic electrical appliances, and £4 017 026 for extensions at the Agecroft power station.

Cheltenham. — The Electricity Committee recommends the resumption of hire and hire purchasing schemes, and an estimate of £10 000 for the purchase of apparatus.

York.—Sanction to borrow £7 734 for mains, £4 050 for transformers and switchgear and £5 595 for supply to temporary bungalows, has been obtained by the Electricity Committee.

Wallasey.—The Electricity Committee has obtained sanction to borrow £2 307 for supply to temporary houses, and £15 206 for supply to the Mariners' Home and Manor Road areas.

Barrow-in-Furness.—Supply is to be provided to Boon Crag and four cottages at Monk Coniston at a cost of £253; to Briar Dene, Urswick, at £90; to Pennybridge at £62; and modify the network in Blawith at a cost of £1 780.

Cardiff.—At a meeting of the Electricity Committee, the City Electrical Engineer submitted a sample of a new standard service unit suitable for small dwelling houses, and he was authorised to fix it in all new houses where suitable, and also use such units as replacements.

Supplies in Islay.—An agreement has been reached between the Air Ministry and the North of Scotland Hydro-Electric Board for the latter to purchase the whole of the Bowmore generating plant on the Island of Islay. A scheme for local distribution has already been prepared. Ultimately this will become part of a wider scheme covering most of the Island. Subject to availability of labour and materials, it is hoped to start erection of the distribution lines early next year.

Maidenhead.—The Housing Committee has decided that the heating and lighting of the first fifty temporary bungalows shall be by means of electricity. The figures of estimated gas and electricity consumption have been supplied by the respective undertakings. The Committee has decided that in order that comparisons may be made between the relative advantages and disadvantages of gas and electricity, the heating of the second fifty bungalows shall be by gas and the lighting by electricity.

Bray (Berks).—A sub-committee has been appointed by the Parish Council to consider the merits of street lighting by electricity or gas. The Maidenhead electricity department has quoted for installation and maintenance an annual payment of £4 16s. 8d. per lamp for ten years, thereafter reduced to £2 5s. per year. The gas company has quoted £2 19s. per lamp for the lighting season with an additional charge for the overhaul of the equipment.

Portland.—At a meeting of the Electricity Committee it was reported that numerous requests had been received from tenants taking over empty houses for electric cookers. In several instances the houses had facilities for both gas and electric cooking, but owing to the shortage of electric cookers these applicants had to continue the use of the existing gas cookers, and had asked for their names to be placed on the waiting list. The Committee decided that such requests be granted at the discretion of the Electrical Engineer when electric cookers are available.

Northern Ireland.—Moving the second reading of the Electricity (Supply) Bill which increases the existing borrowing powers of the E.S.B. by £300 000, at Stormont, Belfast, on November 29, Major Perceval-Maxwell, Parliamentary Secretary, Ministry of Commerce, said it was the desire of the Government of Northern Ireland to see further developments conducted with great speed and efficiency. The Ministry was considering a post-war policy, and legislation would be introduced to enable the Ministry to finance the installation of a 31 000 kW capacity at the Ballylumford power station.

Mansfield.—At a meeting of the Housing

Committee, the Borough Engineer submitted a letter from the Electrical Engineer pointing out that an effort was being made to design a complete consumer's service unit in which the whole of the consumer's fuses would be housed in a single component, and a prototype sample was laid before the Committee. The Electrical Engineer pointed out that if this unit were used, the installation would be designed for metering through a single meter only, and suggested that this unit be adopted for the electrical installations in council houses now being built. The Committee agreed.

Poplar (London).—At a meeting of the Electricity Committee, with regard to fuel economy, it was reported that in order to avoid the necessity for carrying out any form of "load shedding" with its resultant inconvenience to consumers, the Borough Electrical Engineer had circularised all industrial consumers urging collaboration in this matter by reducing their consumption at peak load periods, namely, 11 a.m. to 12 noon and 4 p.m. to 5 p.m. and also during foggy weather when the plant of the undertaking will be taxed to the utmost. Already a considerable number of such promises had been received, and would materially assist the undertaking over a very difficult period.

Good Trading Practice

Annual Report of the Electrical Fair Trading Council

THE annual report of the Electrical Fair Trading Council, of which Mr. V. Watlington is chairman, and Mr. T. W. Heather, vice-chairman, states that the membership of the Council had been augmented by the addition of the British Refrigeration Association (Sub-section A(i) —Manufacturers of Domestic Type Refrigerators) and by the Electric Discharge Lamp Auxiliaries Council, representing the makers of electric discharge lamp auxiliaries. Eleven associations of manufacturers, in addition to the organisations representing wholesale distributing, contracting and retailing, were now represented.

It was with the deepest regret that the Council recorded the recent death of Mr. J. Y. Fletcher, of the G.E.C., one of the representatives of the E.L.M.A., on the Council. Mr. Fletcher was a great pioneer of fair trading in the industry, having taken a very active part in the deliberations of Committee 'D' of which he was the first chairman and which preceded the setting up of the Electrical Fair Trading Council in 1933.

The following changes in representation had occurred during the last 12 months: Accessories Section of B.E.A.M.A.: Mr. F. C. Fuke in place of Mr. E. D. Ruddle; C.M.A., Mr. W. Lewis Smith in place of Mr. A. E. Tanner; E.L.M.A., Mr. H. A. Lingard in place of Mr. W. H. Williams; E.W.F., Mr. W. H. Swain in place of Mr. A. G. Beaver.

The Council acknowledged with thanks the valuable assistance of the electrical Press in giving publicity to its policy, which had brought the matter to the attention of all those interested. The Council had endeavoured to get everybody to believe in the idea of fair trading as a basis for the prosperity of the industry, and a considerable measure of success had been achieved.

As a result of experience and the admission to the Council of new member-associations, a revision of the current constitution Rules of Procedure had been found to be desirable, and the General Purposes Committee was dealing with the detail work.

Since the second edition of the "Fair Trading Policy" was issued in July, 1939, certain clarifications and additions had become necessary as a result of experience. These had been incorporated in the third edition (October, 1945), with additional schedules for synchronous clocks and electric discharge lamp auxiliaries.

The member-associations and their representatives are as follows:—

Manufacturing: Accumulator Makers' Association (Messrs. C. H. Branton, David Eccles and F. C. Vine); British Electrical and Allied Manufacturers' Association (Messrs. T. W. Heather and C. Rodgers); Accessories Section of the B.E.A.M.A. (Messrs. F. G. Allen, F. C. Fuke and A. E. Mills); Domestic Electrical Appliances Section of the B.E.A.M.A. (Messrs. E. G. Batt, R. Berry and J. A. Fraser); British Refrigeration Association, Section A, Sub-section (i) (Messrs. E. G. Batt, W. F. Edwards and A. E. Lever); British Synchronous Clock Conference (Messrs. D. W. Barrett, H. M. Harris and A. Middleton); Cable Makers' Association (Col. Sir Thomas F. Purves, Messrs. H. D. Roberts and W. Lewis Smith); Electric Discharge Lamp Auxiliaries Council (Messrs. W. E. J. Drake, R. P. Sayers and H. Wigston); Electric Lamp Manufacturers' Association (Messrs. W. J. Jones and H. A. Lingard); Electric Light Fittings Association (Messrs. A. J. Burbidge, A. E. Iliffe and K. Scott Adie); Electric Water Heater Manufacturers' Association (Messrs. E. G. Batt, O. H. Buckingham and D. G. Rodger).

Wholesale Distributing: Electrical Wholesalers' Federation (Messrs. A. Albrecht, W. H. Swain and A. B. Wildsmith).

Contracting and Retailing: Electrical Contractors' Association of Scotland (Messrs. W. Finlay, H. M. Fulton and R. Smith); The National Electrical Contractors' Trading Association, Ltd. (Messrs. T. E. Alger, L. C. Penwill and W. H. Walton).

The secretary is Mr. Felix A. Rogers.

Industrial Information

Change of Address.—Refrigerator Distributors, Ltd., of 9, Cateaton Street, Manchester, have moved into new premises at 56, Victoria Street, Manchester, 1.

New Factory.—Globe and Simpson, Ltd., electrical equipment engineers, of Sheffield, are to build a factory in William Street, Sunderland, on a site of 1 274 square yards.

Electric Motors.—Higgs Motors, Ltd., of Witton, Birmingham, have recently issued an abridged list, giving particulars and prices of most types of electric motors, from fractional H.P. up to 100 H.P. for a.c. and up to 30 H.P. for d.c.

Electric Vehicles.—A factory for making electric vans and lorries is being established at Sunderland by the Crown Works Co., and it is expected that production will start early next year. Lorries of 2½ tons, and 20 cwt. vans, will shortly be built.

Londex Publications.—Londex Ltd., 207, Anerley Road, London, S.E.20, have issued two new leaflets (Nos. 104, 105). One describes a system of remote control of street lighting, using a master switch and their special relay; the other a new type of high speed contactor for control of a.c. or d.c. circuits.

E.D.A. Bulletin.—The current number gives details of the First Women's Electrical Exhibition, held recently in Dorland Hall, London, which received four Royal visitors during the fortnight it was open. Also included in the issue, are some interesting views on post-war housing, which tend to show the preference of service men and women for electric homes.

Education in Engineering. — The Regional Advisory Council for Technical Education in Manchester and district have recently published a booklet, " A Student's Guide," which contains particulars of facilities for courses of study in engineering in and around Manchester. Further information may be obtained from the Director of Education, Manchester, 3.

I.E.E. Radio Section.—In THE ELECTRICIAN of November 23, p. 583, reference was made to the paper read before the I.E.E. Radio Section by Mr. J. R. Brinkley on November 21, but unfortunately the title of the paper was wrongly printed. The correct title is " A method of Increasing the Range of V.H.F. Communication Systems by Multi-carrier Amplitude Modulation."

British Irons for U.S.A. — Morphy-Richards, Ltd., who have recently shipped considerable quantities of their auto-control safety electric irons to Russia, report that they are now receiving instructions to send appreciable consignments to the United States of America. In spite of heavy tariffs certain of the big departmental stores are finding this line attractive, and feel that it can stand up to the severest American competition.

Trading with Yugoslavia.—Those provisions of the Trading with the Enemy Act, 1939, and the Custodian Order, 1939, which remained in force after the liberation of Yugoslavia, now cease to apply in respect of money and property accruing on or after December 3, 1945, to persons resident in that territory. The effect of new orders is to lift certain restrictions on trading with Yugoslavia arising out of the trading with the enemy legislation, but traders should note that the resumption of commercial relations with Yugoslavia presents difficulties since banking channels between the two countries have not yet been restored.

Production Control.—The British Standards Institution has just issued B.S. 1 100 : Part 3—" Application of Production Control." This booklet is the third and last of the series dealing with production control. The other parts have referred to the " Principles of Production Control " (Part 1) and " Production Control in the Small Factory " (Part 2). The present booklet is written from the general viewpoint of a concern dealing with batch production, i.e., where repetition orders occur, but not with sufficient regularity, certainty and quantity to call for mass production. Both machining and assembly are envisaged.

Watliff War Effort Celebrated.—At a recent luncheon at the Waldorf Hotel, London, Mr. W. Martin Hume, chairman of the Watliff Co., Ltd., told the shareholders and guests something of the part which Watliff commmutators had played in the successful prosecution of the war. He mentioned that the company, whose commutators grew to over one million yearly before the end of the war, had contributed to the success of the attack by midget submarines on the German battleship " Tirpitz " at Alten Fiord on September 22, 1943. They had supplied special commutators for the main motors of the midget submarines, and these motors stood up so well to the strain of the arduous journey that a special letter of commendation was sent to the manufacturers by the Admiralty.

Paper Insulated Cables.—Tastefully bound in a blue and gold cover, " Catalogue C " just published by W. T. Henley's Telegraph Works Co., Ltd., covers the range of Henley paper insulated cables standardised in accordance with B.S. 480—1942. These comprise single-core, twin-core (belted), three-core (belted), four-

core (belted), and five-core (belted) cables for 660 V; single-core cables for 1 500 V, for d.c. railway electrification systems; single-core and three-core (belted) cables for 3 300 V; single-core and three-core (belted) cables for 6 600 V; single-core, three-core (belted) and three-core (screened) cables for 11 000 V; single-core, three-core (belted), three-core (screened) and three-core (unscreened) cables for 22 000 V.

Resettlement Schemes.—This month's Production and Engineering Bulletin, issued by the Ministry of Labour and National Service, contains notes on what firms in various industries are doing to help employees whose wage-earning capacity has been impaired by wounds, illness, or accident. There is also an article on finishing fine bores in aircraft components.

British Cast Iron Research Association.—The November issue of the B.C.I.R.A. bulletin contains, in addition to news of association activities, reports and so on, patent specifications and abstracts from foundry literature. The annual meeting of the association took place in London on December 12. The annual report states that during the year 1944 the major part of the research done comprised either experimental work directly undertaken for various official departments, or the continuation of such parts of the general programme as were of direct use in connection with war requirements. The application of the photoelectric absorbtiometer to the analyses of cast iron had been studied and two reports had been issued. Among reports issued relating to improved methods of testing, one covered an immersion thermocouple for direct determination of molten metal temperatures.

Newage Products.—An admirably produced and attractively bound brochure containing a large number of illustrations on art paper has been published by Newage (Manchester), Ltd., of 282, Bury New Road, Manchester, 7. It gives descriptive details of a comprehensive range of their products including power take-off units, mobile and stationary alternator sets, generating sets, welding sets, battery charging sets, and compressors. Chiefly produced for the war effort and supplied to all Government departments these sets have given good service in the war theatres all over the world. Most of the designs are suitable for both arctic and tropical conditions.

Scientific Man-Power and Resources.—A proposal for a national committee of scientists to co-ordinate and direct research, and to have high authority in industrial planning, was made recently in the House of Commons by Captain Blackburn, who urged higher expenditure on research, in which he asserted Britain was behind America and the Soviet Union. The new organisation he suggested, should be called the Central Research and Development Council, or the Central Scientific Manpower and Research Committee. Replying, Mr. Herbert Morrison, Lord President of the Council, said that the major need in scientific activities at present was man-power, which would be the concern of the committee the composition of which he had recently announced. He agreed that scientists had a great and growing part to play in our national life, including possibly the sphere of administration.

A Warning.—In a circular letter to chief engineers and managers of undertakings, the Electricity Commissioners state that their attention has been drawn to the fact that as the result of the disposal of stocks surplus to Government requirements, quantities of low voltage cables used for radio-relay work and for the wiring of aeroplanes have become available, and cases have been brought to the notice of the Commissioners where such cables were being installed for wiring lighting circuits in domestic premises. Cable of this type is not suitable for use on circuits carrying 200/250 volts, and the Commissioners suggest that all electricity undertakers should arrange for their installation inspectors to keep a look-out for this class of work, and that undertakers should also issue a warning to all electrical contractors against the use of cables of this type for wiring domestic premises where the conductor and/or the thickness of dielectric is less than the recognised standard required by the I.E.E. Regulations.

Atmospheric Pollution in Leicester.—The Department of Scientific and Industrial Research has published the first technical paper by the Atmospheric Pollution Research Committee. It is entitled, "Atmospheric Pollution in Leicester—A Scientific Survey" (Stationery Office, 3s. net). The paper states that from January, 1937, until December, 1939, regular measurements were made of atmospheric pollution at each hour of day and night at 15 different points in and near Leicester, the total number of readings of all kinds being about 200 000. At ten of the posts daily measurements were also made of ultra-violet radiation. For this purpose an instrument was specially designed for the survey. This was the ultra-violet daylight integrator, for measuring the number of units of ultra-violet radiation received each day from the sun and sky. The results of these measurements showed that if all smoke were eliminated, at least 30 per cent. more ultra-violet radiation would reach the central region of the town in the critical winter months.

Company News

MARCO REFRIGERATORS, LTD.—Fst. and fin. 5% (2½%).

DERITEND STAMPING CO., LTD.—Intm. div. 5% (same).

W. AND T. AVERY LTD.—Intm. on ord. 5%, less tax (same).

MADRAS ELECTRIC SUPPLY. — Intm. div. 2% (6% for yr.).

WHESSOE FOUNDRY CO., LTD.—Intm. div. 10% on ord. (same).

LISBON ELECTRIC TRAMWAYS.—Intm. div. 2½%, tax free (same).

AVELING-BARFORD LTD.—Intm. div. 5% tax free (same), payable Jan. 1.

EDMUNDSONS ELECTRICITY CORPORATION. —Intm. div. 2½% on ord. (same).

MANN EGERTON AND CO., LTD.—Div. 15% (10%) for yr. ended Sept. 30, 1945.

HEAD WRIGHTSON AND CO., LTD.—Intm. on ord. 2½% (same), payable Feb. 6.

UNITED RIVER PLATE TELEPHONE CO., LTD.—Intm. on ord. 5% less tax (same).

KENDALL AND GENT LTD.—Fin div. 10% (same), plus bonus 5% (same), mkg. 20% (same).

ELECTRIC AND GENERAL INVESTMENT.— Intm. 3% (same), less tax, payable Jan. 1, to holders reg. Dec. 17.

CLEVELAND BRIDGE AND ENGINEERING CO., LTD.—Fin. on ord. 3½% (3%) tax free, mkg. 5% (4½%), tax free.

WELLWORTHY PISTON RINGS, LTD.—Fin. div. 10%, payable Dec. 22, mkg. 15% (same) for yr. ended July 31, 1945.

CRYSTALATE LTD.—Div. on ord. 6%, less tax for yr. ended Sept. 30 last. This is fst. paymt. on ord. since the 12½% for 1932/33.

WAILES DOVE BITUMASTIC CO., LTD.— Fin. div. 10%, mkg. 15% (same) for yr. ended Sept. 30, 1945. Net pft. £21 083 (£21 221).

MOSS GEAR CO., LTD.—Fin. on ord. 12½% (same), and bonus 5% (2½%), mkg. 25% (22½%). Net pft. to Aug. 31, £39 952 (£36 685).

VICTORIA FALLS AND TRANSVAAL POWER CO., LTD.—Intm. on ord. 4% (same), less tax. Partg. div. on pref. 4% (same), less tax, payable Jan. 31.

NOTTINGHILL ELECTRIC LIGHTING CO., LTD.—Div. for 2 yrs. to Dec. 31, 1945, on 6% cum. pref. (Prev. div. paymt. for 1 yr. to Dec. 31, 1943).

BRITISH ELECTRIC TRANSFORMER CO., LTD.—Fin. div. 10%, mkg. 20% (15%) for yr. ended Sept. 30, 1945, payable Dec. 31. Pft. £29 674 (£24 569). Fwd. £323 (£180).

TUBE INVESTMENTS LTD.—Tradg. pft. for yr. ended Oct. 31, £2 254 723 (£2 354 038). Net blce. available for appropriatn. £808 195 (£824 048). Carry fwd. £290 145 (£274 166).

BROWN BAYLEY'S STEEL WORKS LTD.— Fin. on ord. for yr. ended July 31, 1945, 5% (8%). Tradg. pft. for yr. is £280 486, includg. £200 000 estimated E.P.T. refund, and net pft. £131 717 (£136 077).

AMAL LTD.—Pft. to July 31, after taxes, plus int. and divs., £19 063 (£18 835). Div. 10% (same) and bonus 5% (same), fwd. £12 640 (£12 224). Contingencies res. of £4 000 and £5 967 from pft. and loss transferred to res. for future taxatn.

JOHN I. THORNYCROFT, LTD.—Net pft. to July 31, 1945, after taxn. was £127 989, agst. £128 685. Fin. div. on ord. 12½% (8%), mkg. 17½% (13%). Dirs. propose to trans. £50 000 to gen. res. (same), to provide £46 434 for defd. repairs (£50 000), fwd. £101 707 (£110 718).

Company Meetings

AERONAUTICAL AND GENERAL INSTRUMENTS, LTD.—The annual meeting was held in London on November 22. In the course of his address the chairman, Mr. W. McClelland, chairman, said the war had greatly increased the size of the company's buildings and plant and consequently the scope of its activities and the managing directors were now engaged in adapting its production facilities to peace-time requirements. The general policy was to provide the unique and specialised article, possibly in limited quantities, rather than the article of universal demand manufactured on mass production lines. The whole history of the company had been based on this conception and it was the board's considered opinion that future products should represent a continuance and extension of this policy. The break-up of mid-European scientific instrument production gave additional reasons for the necessity to provide such products for the home and export markets.

CARRIER ENGINEERING CO., LTD.—The annual meeting was held in London on November 30. In the course of his address the chairman, Mr. S. L. Groom, said the company were able to report that this year's turnover would be a record. A large part of their orders were for direct export, and also for the equipment of factories now preparing for the export market. They were now preparing plans and estimates for refrigerated air conditioning plant for several new British liners. The company was examining the possibilities of the quick freezing process for foods and its application in this country. They looked forward to the expansion of their business with France, Holland, Belgium and the Scandinavian countries, from which countries they had already received many inquiries for export.

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.*

CLAYTELEC LTD., London N., electrical engrs.—Nov. 20, assignment securing to Midland Bank Ltd. all moneys due or to become due to the Bank; charged on contract moneys.

FELGATE RADIO LTD., London, W.—Nov. 8, deed of amendment securing an increase from 5% to 10% in rate of interest payable upon moneys secured by a deb. dated June 12, 1939, to F. J. Benzimra, London and ors.; general charge. *£3 500. Nov. 28, 1944.

ELECTRONS LTD., London, W., neon advertising and lighting.—Oct. 31, deb., to Olds Discount Co., Ltd., as tr. for itself and other cos. securing all moneys now due or to become due from the co. to the holders; general charge. *Nil. July 19, 1945.

G. W. RUSHWORTH LTD., Colne (Lancs.), engrs.—Nov. 5, charge, to Burnley Bldg. Soc. securing £10 000 and any other moneys etc.; charged on Savoy Garage, Bull Street, Burnley. *Nil. Aug. 19, 1944.

PETTERS LTD, Loughborough, engr.—Nov. 9, deb. to Lloyds Bank Ltd., and Hambros Bank Ltd., securing all moneys due or to become due to the Bank; general charge. Nil. Sept. 4, 1945.

County Court Judgments

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

HOWLETT AND SONS, 51, St. Leonards Road, Windsor, electrical contractors. £11 0s. 8d. Oct. 23.

FAIRCLOUGH, Thos., 1, Victoria Road, Bunny, Notts., electrical engineer. £21 19s. 8d. Sept. 19.

CHADWICK, K. C. (male), 30, Holland Road, Sutton Coldfield, electrician. £31 17s. 9d. Sept. 11.

LYONS, Christopher J., 78, Stratford Road, Sparkbrook, electrical engineer. £15 4s. 10d. Sept. 11.

WILLIAMS, Milton B., 6, Well Street, Holywell, Flint, electrician. £26 19s. 3d. Sept. 28.

MYERS, Fredk., J. R. 36, Auberon Street, North Woolwich, arc welder. £26 9s. 3d. Oct. 12.

TOWNSEND, Fredk., The Bungalow, Dundrey Lane, Bristol, electrician. £36 10s. Sept. 26.

JONES, Fredk., 61, Oxley Road, Bradford, Manchester, electrical cable tester. £12 16s. 8d. Oct 4.

Satisfactions

ELECTRICAL AND RADIOLOGICAL INSTRUMENTS CO., LTD., London, W.—Sat'n. Nov. 22, £500, reg. Apr. 26, 1945.

FOWEY RADIO CO., LTD.—Sat'n. Nov. 24, £1 100, reg. Oct. 18, 1937.

Coming Events

Friday, December 14 (To-day).

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.*

Sunday, December 16.

BRITISH KINEMATOGRAPH SOCIETY.—Film House, Wardour Street, London, W.1. "Electronics and the Kinema," IV. G. Parr. *11 a.m.*

Monday, December 17.

BIRMINGHAM ELECTRIC CLUB.—Grand Hotel. "Electrical Plant Breakdowns," J. Ashmore *5 p.m.*

SHEFFIELD SOCIETY OF ENGINEERS AND METALLURGISTS.—Royal Victoria Hotel. "Colour Television," L. C. Jesty. *6.15 p.m.*

Tuesday, December 18.

I.E.E., SCOTTISH CENTRE.—Glasgow. "The Design and Installation of Electrical Accessories for Domestic Purposes," F. C. Fuke. (Joint meeting with the Scottish E.C.A. and the Electrical Society of Glasgow.) *6.15 p.m.*

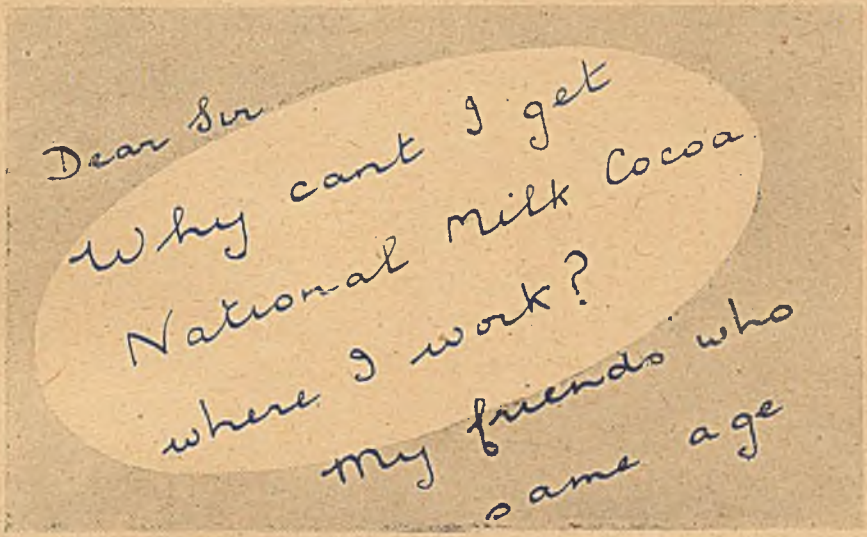
——N. MID. CENTRE.—Metropole Hotel, Leeds. "Mineral-Insulated Metal-Sheathed Conductors," F. W. Tomlinson and H. M. Wright. *6 p.m.*——LONDON STUDENTS' SECTION.—London, W.C.2. "Atmospherics and Their Location."

INSTITUTE OF WELDING.—Liverpool. "Metallurgy for Welders," D. Lewellyn.

Wednesday, December 19.

I.E.E., MERSEY AND N. WALES CENTRE.—Municipal Annexe, Dale Street, Liverpool. "High Frequency Heating," L. Hartshorn and E. Rushton. *6 p.m.*

BRITISH INSTITUTION OF RADIO ENGINEERS.—11, Upper Belgrave Street, London, W.C.1. "U.H.F. Aerial systems," S. G. Button. *6.15 p.m.*



THIS is typical of many enquiries that come in the Ministry's post-bag. There are still numbers of young workers under 21 who are unable to get their daily allowance of *extra* food in the form of National Milk-Cocoa.

Employers are asked to co-operate with the Ministry of Food to ensure that their young workers do, in fact, get this first class protein every day, for it is essential to their physical development and activity.

If you already hold a permit for National Milk-Cocoa, do please see that *all* your employees, under 21, have their daily ration. Encourage them to take it, and see that it is properly mixed—it is quite simple.

If you have not got a permit and employ young workers under 21, enquire at your local Food Office where you will be given all the information necessary for you to apply for one.

National Milk-Cocoa is supplied in 6 lb. and 20 lb. containers, sufficient to make 96 and 320 cups respectively. Nothing could be simpler to make and serve — just add hot water and stir well. A maximum charge of 1d. a cup is permitted.

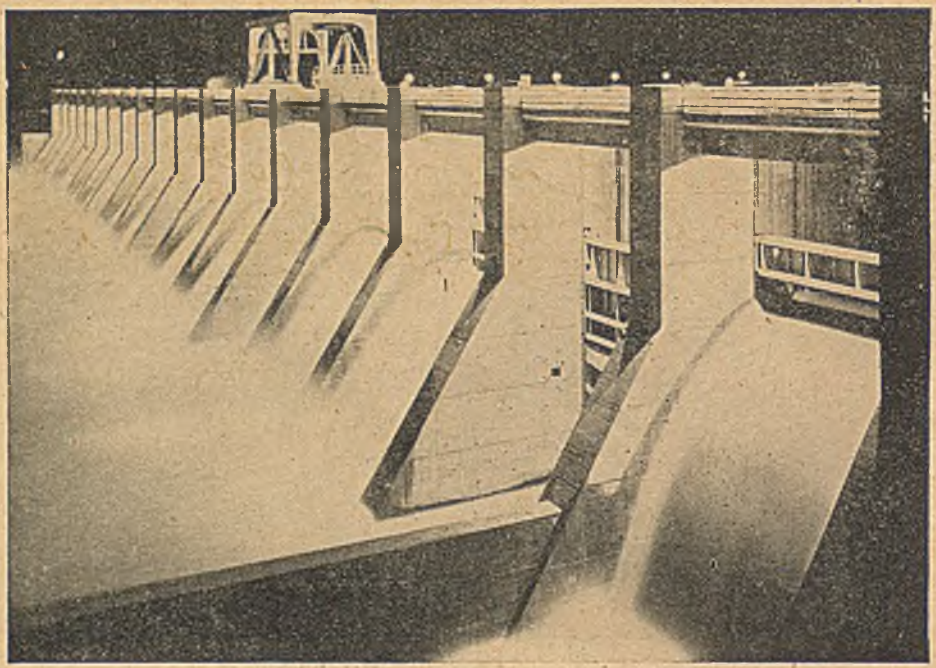
NATIONAL

Milk-Cocoa

in 6 lb & 20 lb containers

Apply at your local Food Office

Issued by The Ministry of Food, London, W.1.



FAMOUS HYDRO-ELECTRIC STATIONS.

The Chickamauga Dam U.S.A., is one of those on the controlled Tennessee River System. This imposing dam was completed in 1941 and is 129 ft. high, 5794 ft. long. Designed for power generation and to assist navigation and flood regulation, the Chickamauga has a power installation of 144,720 H.P. ultimate capacity.

CM24

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