THE
ELECTRICIAN

Vol. CXXXV. No. 3514. Friday, October 5, 1945. Sixpence

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PLAN FOR BETTER LIGHT

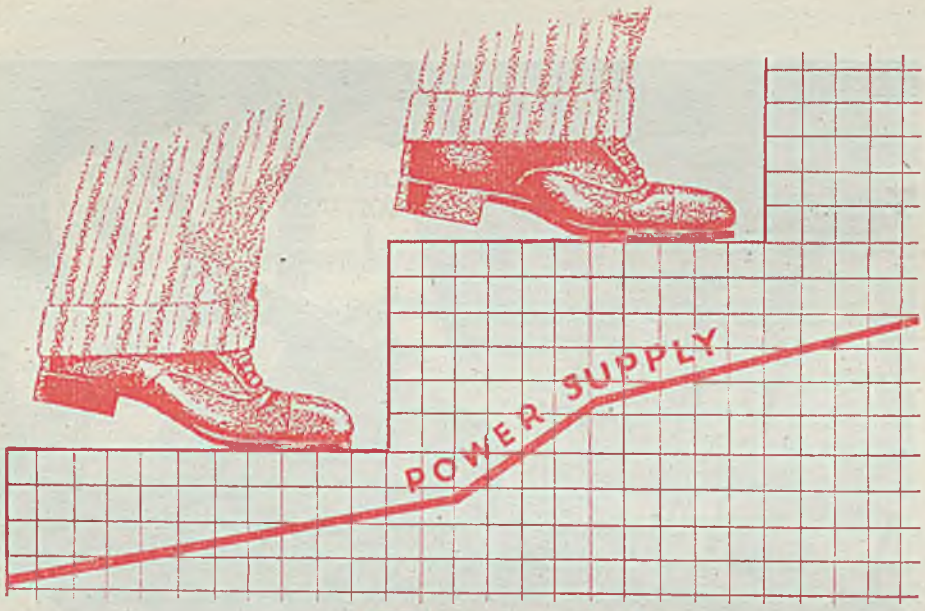
As modern industrial technique meets the demand for faster output, the tendency is towards larger and larger workshop areas, and the efficient lighting of these areas becomes a specialised problem . . . OSIRA high pressure mercury vapour electric discharge lamps provide a good alternative to daylight 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*

OSIRA LAMPS

A G.E.C. PRODUCT FOR A.C. CIRCUITS ONLY

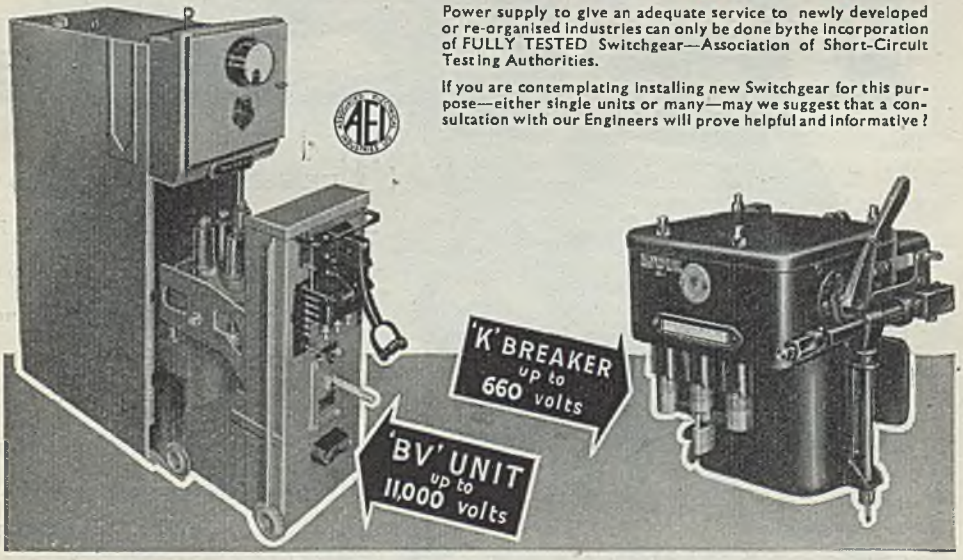
Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2



Stepping up

Power supply to give an adequate service to newly developed or re-organised industries can only be done bythe incorporation of FULLY TESTED Switchgear—Association of Short-Circuit Testing Authorities.

If you are contemplating installing new Switchgear for this purpose—either single units or many—may we suggest that a consultation with our Engineers will prove helpful and informative!



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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

COUNTY BOROUGH OF CROYDON. ELECTRICITY DEPARTMENT.

APPOINTMENT OF ENGINEERING ASSISTANT.

APPLICATIONS are invited for the appointment of an Engineering Assistant to assist the Chief Engineering Assistant during the construction of a new Power Station. Applicants must have a wide experience in the design, construction and layout of large modern Power Stations and be Corporate Members of the Institution of Electrical Engineers and/or Mechanical Engineers.

The salary will be £750 per annum, rising by annual increments of £25 to £850 per annum, plus war bonus (at present £59 16s. 0d. per annum).

The selected candidate will be required to pass a medical examination and reside within the Borough.

Applications, giving particulars of age, training and experience, and accompanied by copies of recent testimonials, should be sent to the Chief Engineer and General Manager, Electricity Department, Electric House, Croydon, endorsed "Engineering Assistant," not later than 15th October, 1945.

The Ministry of Labour and National Service have authorised this advertisement.

E. TABERNER,
Town Clerk.

September, 1945.

B.E.A.I.R.A.

THE Council of the above Association seek applications for the position of Director from those who have had experience in electrical research, preferably from those who in addition have had some contact with the electrical supply and manufacturing industries. Age preferably not exceeding 50 years. Commencing salary £2,500 per annum with Superannuation (F.S.S.U.). It is desirable that the successful candidate should be able to take over early in the new year or sooner if possible. Applications with supporting particulars, which should be received not later than Friday, 16th November, 1945, should be sent under personal cover to the Chairman of the Council, The British Electrical and Allied Industries Research Association, 15, Savoy Street, London, W.C.2.

FIRM of electrical engineers and contractors shortly opening business in the South Scottish area invite applications from electricians and wire-men experienced in the highest grade domestic and industrial installations. Permanent positions with good prospects and conditions are offered to suitable applicants over 51 years of age or Class "A" Servicemen. Men expecting release from the Services in the near future are particularly invited to apply. All applications will be considered and acknowledged.—Reply, giving full particulars of age, training and experience, and when disengaged, to Box No. 144, Phillips Advertising Ltd., 15, Wilton Road, London, S.W.1.

MANAGER required, with general experience in the manufacture of lead storage batteries. State experience and salary required.—Write Box L.P.O., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

ROYAL TECHNICAL COLLEGE, SALFORD.

Principal: J. E. RICHARDSON, Ph.D., B.Eng., M.I.E.E., A.M.I.Mech.E.

APPLICATIONS are invited for the post of full-time Lecturer in Electrical Engineering, to commence duties on 1st December, 1945.

Applicants must have had industrial experience and be capable of teaching Design of Electrical Machinery up to the Higher National and London University Final B.Sc. degree standard, together with at least one other advanced electrical subject. Salary in accordance with the new Burnham Technical Scale.

Application forms and further particulars may be obtained from the Principal, Royal Technical College, Salford 5, to whom applications should be returned not later than 15th October, 1945.

H. H. TOMSON,
Clerk to the Governors.

TECHNICAL SALES ENGINEERS.—Applications are invited for a number of appointments covering areas of the U.K. as Technical Sales Engineers, Thermovent Electrical Heating. Experience of Space Heating technique and electrical knowledge essential. Applications with full details to Technical Sales Manager, Thermovent Heating (E.K. Cole Ltd.), Rembrandt House, 5, Virgo Street, London, W.1.

TENDER

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.

CONTRACT NO. 706.

TRANSFORMER.

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

One 20 MVA 33/11 kV 3-phase Double Wound Self-Cooled.

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. 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, 5th November, 1945. 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.
September, 1945.

FOR SALE

COUNTY BOROUGH OF BRIGHTON.

ELECTRICITY UNDERTAKING.

THREE SETS OF 3 SINGLE PHASE, CONCRETE FRAME REACTORS designed for 11 kV operation, capable of carrying 400 amperes continuously and giving a reactive drop of 5.5 per cent. on that current.

The plant may be inspected on application to Mr. H. Pryce-Jones, Engineer and Manager, "Electric House," Castle Square, Brighton, 1. Tenders, addressed to the undersigned, must be delivered not later than 12 noon on Monday, 22nd October, 1945.

No tender will be considered unless received in a plain sealed envelope, not bearing any name or mark indicating the sender, and endorsed "Tender for Reactors."

J. G. DREW,
Town Clerk.

Town Hall, Brighton.
24th September, 1945.

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.

WANTED

COPIES of "THE ELECTRICIAN" from May, 1940, to December, 1944, are urgently required to meet enquiries from European readers who have been cut off from supplies during those years. Back number price will be paid by "THE ELECTRICIAN," Bouverie House, Fleet Street, London, E.C.4.

AGENCIES

ADVERTISER, shortly visiting Europe, wishes to contact manufacturer desirous of opening or extending Export Trade.—Box L.Q.D., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

BUSINESS PROPOSITIONS

FUNDS available for builders, manufacturers and others with sound, well-established businesses capable of profitable expansion.—Write, Box ZL. 734, Deacons Advertising, 36, Leadenhall Street, E.C.3.

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: Old Whittington 50.

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.

PATENT AGENTS

MEWBURN, ELLIS & CO.,
PATENTS, DESIGNS AND TRADE MARKS,
70 & 72, Chancery Lane, London, W.C.2.
Grams: "Patent, London." *'Phone: Holborn 0437 (2 lines)*
And at—NEWCASTLE: 3, St. Nicholas Buildings.

THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance

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

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

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

No. 3514. [Vol. No. 14 CXXXV] October 5, 1945 Annual Subscription 25s Overseas 30s.

CHIEF CONTENTS OF THIS ISSUE

Twenty-One Years

NEXT Thursday and Friday the Electrical Association for Women will celebrate its coming-of age after twenty-one years' valuable service in the promotion of the electrical idea. The fact that the anniversary falls at a time when the minds of most are being exercised by reconstruction problems is a happy arrangement of dates, for the programme which has been prepared to mark this important event in the history of the association will not only promote the goodwill of the organisation, but will, too, publicise some of the important work which women have done with electricity during the war, and draw attention to some of the hopes which the association entertains with respect to the future.

The first meeting of the association took place on November 12, 1924, and was held at the London residence of the late Sir CHARLES PARSONS, with Lady PARSONS, the then president of the Women's Engineering Society in the chair. Since then the association has, under the able guidance and enthusiasm of its director, MISS C. HASLETT, grown from strength to strength, until it is to-day the accepted platform for the expression of the woman's point of view on all matters relating to electricity, and is the training ground for the many women who, because of the anticipated progress in domestic electrification, will enter the ranks of the electrical industry in ever-increasing numbers.

For the fifteen years prior to the outbreak of war, the association carried out extensive educational work in electrical development until in 1939, there had been built up an organisation of some 9 000 women in 80 branches throughout the country, consisting mainly of housewives, teachers and demonstrators, with wide contacts with schools, women's organisations, adult education groups and so on. In the war years, the work of the association proved a valuable contribution to the national effort and the exhibition which is to be opened by the DUCHESS OF KENT, on Thursday, will depict some of the work which women have done. It is a proud record, in the establishment of which every member of the E.A.W. has played a part, in the establishment of which the goodwill of the electrical industry has been furthered and its potential prosperity assisted.

To appreciate more fully the value of the association, attempts should be made to conjure in one's mind a picture of the industry unaided by its drive, lacking the publicity efforts of its meetings and the personal persuasion brought to bear by its individual members, for in that way it is quickly realised how much and how great a part of the industry has the organisation become; what opportunities would be lost without it. No other industry enjoys advantages equal to those

offered by the E.A.W. and it is indeed a good thing that those who conceived it in 1924 were of an electrical turn of mind. Its activities and achievements have been followed by every civilised country in the world, its constitution has formed the basis for the establishment of like bodies in many countries overseas; it is the envy of our competitors, and the spokesman for that most important of all electricity consumers, the housewife—the woman upon whom the destiny of the supply industry so largely depends.

The E.A.W. and Progress

TWENTY-ONE years is a long time in the life of the electrical industry as at present constituted, and in the progress which has been made during that period, the E.A.W. has been an important contributing factor in directing the thoughts of the public along channels which have led to wider domestic electrification, and in attracting to the industry women whose educational standard, character and bearing have done so much to advance the causes of electricity supply in the home. To Miss C. HASLETT who has directed the affairs of the association since its inception this must be a proud year, for not only has the association a past which is exemplary in the extreme, but its machinery and membership have been built up in such a way that it is well fitted to tackle the many problems of domestic electrification which will emerge from the reconstruction programmes.

The Imperial College Centenary

ORIGINATING in 1845 in the foundation of the Royal College of Chemistry, the Imperial College of Science and Technology at South Kensington is holding a centenary celebration at the Albert Hall, on October 25, to be attended by the KING and QUEEN. On the two succeeding days, every department of the college will be open to visitors, while later, probably in April next year, it is hoped to arrange an exhibition indicating the scientific development that has taken place in the last 100 years. The Imperial College of Science and Technology, constituted by Royal Charter in 1907, is a federation of three institutions—the Royal College of Science, the Royal School of Mines, and the City and Guilds College. Its association with the electrical industry makes the centenary celebrations of special interest, particularly when it is recalled that it is only three years ago since Prof. C. L. FORTESCUE, who occupies the electrical chair at the City and Guilds (Engineering) College, was elected President of the I.E.E. It is hoped that the celebrations will result in the institution receiving wider and fuller appreciation both in this country and in the Empire.

Mica Supplies

IN view of the heavy consumption of mica in the electrical industry it is interesting to note that Mr. CHAND MUL, a leading Indian producer of the material, is engaged in negotiations with the India Office and the Ministry of Supply with a view to increasing his export business. During the war the whole of the output of mica was acquired by the Allied Governments, but as it is expected that by the end of the year the export of mica from India will be decontrolled, private buyers will have to be found. In view of the shortage of supplies and the anticipated development of the electrical industries, there is, however, no likelihood of difficulties in that direction. The major problem is apparently, in connection with machinery, for that now used has inevitably deteriorated to a large degree during the war, and Mr. CHAND MUL is understood to be anxious to place substantial orders for new plant. Because British industry is unable to make early delivery, however, he is contemplating placing orders in the United States on some form of barter arrangement. This leads us once again to the old questions of how soon will the industry of this country be free to put its house in order, and how long must we watch unchallenged, orders being negotiated with our commercial rivals?

Electricity in Schools

THE Committee appointed by the Secretary of State for Scotland, to consider and make recommendations as to the planning of schools and similar buildings, has published its report as No. 21 in the Post-War Building Study Series, and though pressure upon space prevents us from giving more than this brief mention until next week, it may be said that the Committee has approached the problem with commendable understanding. With respect to the heating and ventilating of schools, the Committee

received the advice of a number of well-known personalities in the industry, and this no doubt assisted them in arriving at the common-sense conclusions published. The observations given contain nothing new to the industry, but they offer food for thought among those less familiar with the versatility of electrical service, including architects, education committees and so on. The wiring of schools for broadcasting is also dealt with in the report and in an age when this form of education is likely to extend, this side of the electrical installation is no less important than that concerned with other services. The report is, for obvious reasons, mostly devoted to building problems, but it is a healthy sign that electrical matters occupy a substantial number of its pages.

Post-War Equipment and Safety

THE current issue of the E.D.A. Bulletin draws attention to the fact that the pent-up demand for domestic electrical appliances may lead to firms entering the electrical industry, whose knowledge is not all that it should be, and in consequence there is a distinct possibility of appliances being made without due regard to the importance of avoiding danger of shock. Even in the products of reputable manufacturers, says the E.D.A., there may be risk of assembly or inspection departments quickly reverted to peace-time production, overlooking some comparatively minor point, which may make a lot of difference from the safety point of view. It seems advisable, says the E.D.A., that supply authorities selling appliances should take even more care than in pre-war days to ensure, by rigorous inspection and test that new models are properly designed, particularly in regard to internal earth-continuity. As far as cookers are concerned pre-war recommendations for the reliable earthing of all parts are under review by the E.D.A. Electric Cooking Committee and will be issued as soon as possible.

Appliance-Saturation

A REPORT just issued by the E.R.A. deals with the measurement of appliance-saturation factors by means of sampling, and from the shortened version given in this issue it will be appreciated that the subject matter is of special interest both now and in the future. At the moment, application of the suggestions made would give some useful guide as to how the general public is faring in these days of scarcity, what appliances are in use, what are out of commission due to age or fault, while the information might, too, lead to some estimate of potential domestic load. As to the future, the most obvious use to be made of appliance statistics is that of comparison between what has been and what can be achieved. Comparisons can cover a wide field—such as one undertaking, one district, or one development policy or sales technique with another, while the statistics may be used for directing a sales campaign, setting targets or quotas and locating personnel and material, and the purchasing of the latter in advance and in correct quantities. The figures, too, when combined with scientific load analysis and cost analysis may be useful in the formation of economic tariffs, and may, in general, have an appreciable bearing upon domestic tariff policy.

I.E.E. Resumes Its Meetings

THIS week marks a resumption of the activities of the I.E.E. in so far as meetings are concerned and the session opened on Monday with Mr. J. O. KNOWLES'S chairman's address before the Liverpool Centre. Yesterday, Thursday, Dr. P. DUNSHEATH, delivered his inaugural address as president, while the meetings which have so far been arranged, all suggest a most interesting session. The subjects selected for the informal meetings should prove most provocative and that for discussion on October 20, with respect to whether engineering concerns should be managed by engineers, is likely to be most enlightening. The authors of papers this session will, by the withdrawing of censorship restrictions, enjoy a freedom of expression which has not been accorded I.E.E. speakers since 1939, and the subject matters chosen may, in some cases, therefore, include details which have hitherto been withheld. This condition, no doubt, had some effect upon the papers read during the war years, but it is to the credit of their authors that there was no obvious trace of it. The speakers this session will be in no way required to think of the effect of their words upon an enemy and for the first time in six years, therefore, the conditions obtaining in 1938/39 will be enjoyed.

Manufacturers' War Work

Switchgear and Circuit Breakers in the National Effort

THE firm of J. G. Statter and Co., Ltd., of 82, Victoria Street, London, S.W.1, and whose works are at Amersham Common, Buckinghamshire, are specialists in the manufacture of l.v. and h.v. switchgear; they have, in common with all other engineering firms, been engaged to their maximum capacity during the last six years in the production of all kinds of standard and special apparatus required for the prosecution of the war. The bulk of their output has been for the Admiralty, but other Government departments have also been supplied with appreciable quantities of equipment.

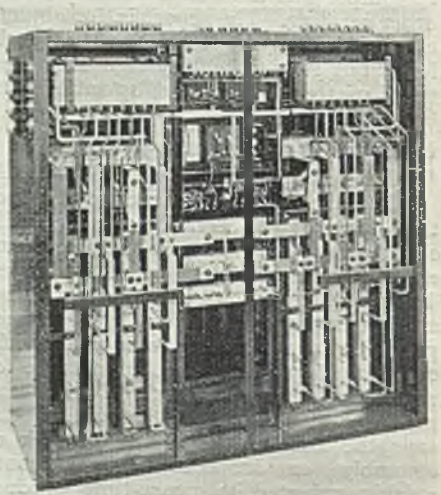
Peace-time Products Applied to War

As switchgear in various forms is used so widely for war purposes, Statter and Co. have been fortunate in maintaining to a large extent the peace-time nature of their products under war conditions, and no great change-over in methods of production has been necessary. In the early days of the war, when magnetic mines were menacing our shipping, the company supplied many thousands of knife switches at very short notice for use with the degaussing equipment then being fitted to ships. Many hundreds of circuit breakers and special switchboards were also supplied for degaussing and wiping purposes; the company were entrusted with the contract for the supply of many large switchboards for floating docks, which contributed so largely to the quick repair of vessels damaged by enemy action. Many hundreds of special switchboards were also manufactured for the Admiralty for installation aboard frigates, corvettes, minesweepers, landing craft vessels of various types, and small floating docks.

The company's non-ferrous foundry was considerably extended to cope with the large quantities of non-ferrous castings required and tens of thousands of brass, gunmetal, and similar castings were supplied. Thousands of special water-tight switches were manufactured to the special requirements of the Admiralty. A particularly praiseworthy achievement to note is that in spite of all the difficulties of supplies and shortage of labour, the company always produced the switchgear or articles required by the time they were wanted.

Important contracts were executed to help the U.S.S.R. and large numbers of alternator control switchboards were supplied for use with Diesel-alternator sets for establishing supplies to devastated and reoccupied areas. In addition, many thousands of airbreak circuit breakers were supplied for shipment to the U.S.S.R. and complete maintenance instruction booklets were printed in the Russian language and forwarded with the gear supplied, to ensure the correct functioning of the equipment when installed.

Switchboards of all types both l.v. and h.v. were supplied for the equipment of



Rear view of totally-enclosed switchboard, one of a large number supplied to the Admiralty. These switchboards are fitted with sliding front access doors permitting two-thirds of the unit to be exposed, and have wired glass inspection windows. The view above, with back sheet removed, shows the bus-bars and connections

numerous large munition factories which were established, and here again speed in delivery of the switchgear supplied contributed in getting such factories into production at the earliest possible moment.

The company also undertook the manufacture of many special items of equipment such as gun mountings, firing grips, etc., when production of such items was urgently needed, and demand exceeded the available supply.

Change of Address.—Craig and Derricott, Ltd., manufacturers of control devices and the Diacam rotary switch have moved into a new factory, the address of which is Royal Works, Sutton Coldfield, Nr. Birmingham. Telephone: Sutton Coldfield 2547.

Public Address at Holiday Camp

Comprehensive Loud-speaker Distribution System at Filey

THE public address equipment installed at Butlin's holiday camp at Filey, Yorks, which covers some 275 acres, has been planned to provide a comprehensive and flexible system for entertaining the visitors and for administrative purposes. After the camp was surveyed it was decided that approximately 1 kW would be needed to cover all the parts—chalets, swimming pool, boating lake, skating rink, tennis courts, theatre, etc.—at least 12 separate programmes would be required during the peak entertainment hours, and that loud-speakers should be installed on as many circuits as possible. Accordingly a total of 60 independent groups was adopted. This includes provision for future extensions, without modifications to the layout. In view of the size of the equipment and complex facilities needed, a control consol was designed, from which immediate control of the entire system and programme selection could be under the care of a single operator.

The main equipment consists of two assemblies, as follows:—1.—Seven steel channel racks with: (a) Sixteen power amplifiers, each capable of developing over 60 W., so that with all channels in operation approximately 1 000 W. of audio power is radiated. (b) Remote relay panels

Control consol of the public address system at Butlin's holiday camp at Filey

for automatically controlling the loud-speaker circuits, selecting power amplifiers and completing their h.t. circuits. Illuminated indicators immediately show when the appropriate amplifiers and circuits have been made alive by the operator. (c) Monitor test, output meter and valve test meters are provided in duplicate, for routine checking, fault diagnosis, etc., whilst monitor loud-speakers are mounted on the same panels for listening to the speech or music output of the apparatus under test. (d) Two independent high quality radio units have been provided so that, at all times, it is possible for two separate radio broadcasts to be relayed to the predetermined sections of the camp.

Oral Warning Device

Time clock panel (e). An electric clock with large dial has been installed for use of the operator so that he can synchronise the programmes and arrangements to fit in with the camp routine. (f) Fuse alarm panel. A device has been installed in this unit which, in the event of certain troubles, immediately gives oral and visible warning of certain faults; for instance, should a cable be broken or damaged a spring-loaded fuse will be released, sounding an alarm, and also indicating in which section the cable fault has occurred. (g) Alarm signal generator. This unit is an electronic oscillator which generates three distinctive warning notes without employing any mechanical mixing parts, these signals being controlled by relays from the consol, and used for sounding calls mainly for administrative purposes. (h) Monitor amplifier. This is a small high quality low-output amplifier which is normally connected to the loud-speakers fitted in the control room. This amplifier enables the operator at the consol to check and listen to all broadcasts before radiating them to the various sections of the camp. The loud-speaker is connected *via* an automatic relay, so that it becomes inoperative when microphone announcements are made from the consol, thus there is no possibility of microphone howl. The output of this amplifier is also connected to a special peak reading indicator mounted on the consol which enables the operator to measure and maintain the signals available for the inputs of the twelve individual channels.

In addition to the above units, mounted on the main rack assembly, there are a number of multi-termination units, main switches and fuses for controlling the supply to the separate units. For operating the relay, indicator lamps and signalling circuits, two heavy current medium voltage rectifier units are used, so that the installation is entirely mains operated, no batteries or accumulators as used in telephone exchanges, being necessary.

2.—Control consol. From here the in-

coming programmes are selected, monitored, and distributed, as and when required, to the various sections of the camp. The main units of this consol are: (3) Illuminated loud-speaker group indicator panel. This shows the schematic layout of the camp and indicator lamps are illuminated automatically to show the operator which loud-speaker groups are in operation at any one time. (b) Loud-speaker group selector panel. This is fitted with sixty group selector switches for controlling the same number of loud-speaker groups. In addition, six other switches labelled " sub-masters " are provided.

Allocating 36 Programmes

These group the loud-speaker circuits into six sections. These sub-masters are in turn connected to one special master switch which, when depressed, automatically connects all loud-speaker groups,. The operator is able to listen to the programme being transmitted to any of the loud-speaker lines by depressing a small push-button mounted immediately above the loud-speaker group switches. Similar switches are provided for the sub-master and master switches. For simultaneously operation with these monitor switches a special peak reading output indicator meter is fitted so that the operator can measure electrically the power being radiated and can adjust the volume controls situate in this panel to the point to ensure that each channel is being injected with the input signal at the correct level. The monitor loud-speaker used for these tests is automatically disconnected when the control consol microphones are in use, but the indicator meter is left connected in the circuit. (c) Channel selector panel. This is provided with over 200 jacks and cord plugs which enables the operator to arrange and set up the various plugs for the loud-speaker circuits. (d) Input selector panel. This panel receives and allocates the 36 input programmes that can be connected to the 12 operational channels. (e) Gramophone. Two independent electric gramophone motors with corrected pick-ups, treble and base controls, are provided. These are so connected to the input selector switches that both may be in use simultaneously to provide two separate programmes from gramophone records, or, alternatively, by operating separate selector switches, both gramophone units may be connected to one channel where " fading " is required, or continuity from one record to another.

Other units are mounted inside the consol, being readily accessible by opening doors at the rear. The most important items here are the line amplifiers. There is one for each channel. They are mounted in pairs per unit and are operated by a.c. mains supplies. These line amplifiers are fitted with an automatic volume control system, making it impossible for distortion to occur. For obtaining balance the line amplifier has been provided with an electronic " mixer " unit. This enables up to six separate microphones to be used for any one orchestra or band, and by adjusting controls on the " mixer " unit the required musical balance can be obtained.

For an installation of this character a large variety of types of speakers is necessary, each chosen to suit the varying acoustic and the changing functional purposes of the buildings. For external use there are weatherproof re-entrant horn-type speakers of unique design, which are able to radiate both musical and speech frequencies over considerable areas of the camp.

War Damage

In a letter to electricity supply undertakers the Electricity Commissioners state that with the termination of hostilities, the Government are giving further consideration to the question of compensation for war damage sustained by public utility undertakings as defined in Section 70 of the War Damage Act, 1943. The Commissioners have been consulted by the Treasury as regards certain aspects of the problem affecting electricity undertakings and it is necessary that the Commissioners should be in possession of up-to-date information showing in close approximation (a) the expenditure already incurred by electricity undertakers in repairing and/or reinstating property which has suffered war damage; (b) the estimated further expenditure still to be incurred either to complete existing commitments or to carry through repairs or reinstatement not yet commenced; (c) the amount of value payments claimable as distinct from " cost of works " payments. It is contemplated that the principles by reference to which the amount payable in respect of war damage to electricity undertakings would be determined, would be those outlined in Section D (paragraphs 24—36) of the White Paper on " War Damage to Public Utility Undertakings, Etc." dated November, 1942 (Cmd. 6403). It is important that the above-mentioned information should be available to the Commissioners without delay, and that the best possible estimates should be furnished, but the Commissioners are prepared, for the present purpose, to accept figures subject to adjustment at a later stage if necessary. Where no damage has been suffered a " nil " return should be submitted.

Progress in South Africa

Supply Commission's Twenty-Second Annual Report

THE twenty-second annual report of the Electricity Supply Commission for South Africa states that, while the prices of most commodities had increased very considerably during the war period, the Commission had not increased its charges. Tariff increases might, however, be unavoidable in the next year or two.

Rural Area Schemes

The establishment by the Commission of regional electricity supply schemes in certain rural areas had been urged by interested public bodies with the laudable objects of enabling the natural resources to be developed and attracting new industries which were expected to be established after the war. Such regional schemes, involving relatively small loads and lengthy transmission lines between supply points, were, however, not economically practicable at the present high prices of plant and materials, and must, therefore, be left in abeyance. When the Railway Administration proceeded with the Cape main line electrification scheme, new possibilities would be opened up for electrical development in certain rural areas now remote from an economical source of supply.

The aggregate of installed plant capacity in the main power stations owned by the Commission as at December 31, 1944, was 806 650 kW. Plant under construction or on order would increase the total to 1 084 150 kW.

Area of Supply

The Commission now owns approximately 2 643 route miles of transmission lines and cables, and its licensed area of supply throughout the Union covers approximately 34 369 square miles.

The output of electrical energy from the Commission's power stations in 1944 reached the record total of 4 543 758 253 kWh. This exceeded the previous year's total by 123 107 144 units, or 2.78 per cent. The increase since 1939 had been 781 949 908 units, or 20.79 per cent. of the 1939 output. Sales of electricity generated in power stations owned by the Commission and purchased from other sources for consumers supplied by the Commission in 1944, amounted to 4 415 802 727 units, which was 140 172 873 units, or 3.278 per cent. more than the sales in 1943.

The total consumption of electricity on the Reef by the gold mining and other industries and municipalities, etc., exceeded 5 713 000 000 units in 1944.

At the date of the balance sheet the Commission's loan capital totalled £24 250 000, all of which had been publicly subscribed in South Africa. Capital expenditure during the year amounted to £731 269, which brought the total capital expenditure at December 31, 1944, to £24 018 023. Expenditure on capital account would amount to approximately £27 815 000 on completion of all the works to which the Commission was at present committed. The Commission's total assets on December 31, 1944, amounted to £33 105 634, and its total liabilities to £25 373 807, the excess of assets over liabilities being £7 731 827. The revenue for the year was £3 353 508 (£3 189 782), and the total production costs (including interest, redemption and reserve fund charges) £3 345 681, the excess of revenue over production costs being £7 827 (£4 636).

Plant Extensions

It has been decided to extend the Colenso power station by the installation of an additional 25 000 kW set and two 180 000 lbs. per hr. boilers to be ready for service by June, 1947, and to make provision in the new buildings for two further duplicate sets and four more similar boilers.

Orders have been placed in Great Britain for the manufacture of one 40 000 kW generating set and two 230 000 lbs. per hr. boilers for the Table Bay power station. It is hoped that this plant will be in operation in time for the 1947 winter load.

Parliamentary approval having been obtained of proposals of the South African Railways and Harbours Administration for the electrification of the Cape main line between Cape Town and Touws river, a distance of 160 miles, the Administration, in April, 1944, asked the Commission for revised estimates for the electrification of a further 179 miles of track as far as Beaufort West. Estimates had been submitted for supplying the whole load from the pooled generating stations at Cape Town via 132 kV lines, or, alternatively, for a partial supply from that source and the balance of the energy from a proposed new power station, transmitted at 88 kV.

The Congella power station of the Durban undertaking is being further extended by the installation of a second 40 000 kW turbo-alternator set and two additional 200 000 lbs. per hr. boilers to supply steam at 625 lbs. per sq. in. and 825° F., to be ready for service in 1947.

Sciences in Electrical Engineering

Address of the I.E.E. North-Western Centre Chairman

IN his Chairman's Address before the I.E.E. North-Western Centre on Tuesday, Dr. J. L. Miller spoke of the merging of sciences in electrical engineering, with special reference to the physical side. He pointed out that while the blending of physics and electrical engineering was not new there had been an acceleration of the process during the past 20 years, so that to-day electrical engineering research had become more physical in colour and the designer was utilising, more frequently and with less delay than formerly, the results of such research.

Dr. Miller then considered the probable reasons for this state of affairs, with particular reference to heavy engineering. One reason was no doubt, due to the paramount necessity he said, of obtaining solutions to problems arising from the increases which took place since the last war in the ratings and voltages of plant. In the main these solutions required the help of the physicist and this in turn brought research departments into greater prominence, so adding further impetus to progress. Then, too, the effect on advance of nation-wide electrical schemes, like the grid, must not be forgotten, and in addition there was little doubt that the influence of physical research during the 1914-18 war, just as in the case of the last war, gave rise to further prompting. Additionally, developments in radio and electronic technique, which had powerful repercussions in all branches of electrical engineering, must not be forgotten.

Physics and Engineering

The Chairman then examined the position in regard to wire telephony and radio, pointing out that in radio particularly, engineering and physics were so inextricably interwoven, that it really was an industry of applied physics. Dr. Miller then went on to deal with two specific branches of electrical engineering in which the physicist was very directly concerned, namely, electronics and insulation. Electronics had found its most obvious application in telecommunications, but nevertheless it had also had a profound influence, sometimes almost as an industrialised branch of applied physics, in other fields.

Measurement was a case in point. Apparatus for the measurement of small quantities, the X-ray tube, X-ray diffraction equipment and the electron microscope were all instruments having a marked effect on engineering progress, while the cathode-ray oscillograph had become the indispensable electronic measuring device. Without it, progress in many fields, like power transmission, switchgear, radio and television would at least have been long delayed. On the industrial side proper, the electronic control of resistance welders must not be forgotten. In the forefront of such a discussion, too, must be the use of h.f. currents for the drying, curing and processing of materials.

Progress of Mercury Arc Rectifier

Any dissertation on electronics must not omit the mercury arc rectifier. The ignition type of rectifier, first finding its application in traction, had now advanced into other fields and up to 1942, in the U.S.A., over 2 000 000 kW were installed. The electronic physicist had certainly played a full part in progress in heavy and industrial electrical engineering.

As regards insulation, the physicist had not at first sight played such a direct role. In the main his practical contribution in this field had not extended much beyond the development of measurement techniques and the provision of data about phenomena. Such work nevertheless had enabled the engineer as progress continued more adroitly to choose the most suitable material, more consistently to process it and more accurately to incorporate it in the overall design of the equipment.

The cable industry formed a good illustration. Mass impregnated cables to-day looked rather like those made many years ago, but full advantage had been taken of the work referred to, to make many beneficial changes, including the increasing of stresses and the reducing of diameters, while maintaining full reliability. In high-voltage cable design, the influence of the physicist could perhaps be more directly seen. It was due to information originally provided by him often indirectly, that the oil and gas-pressure cables existed to-day. They formed at a moment the only possibility of transmitting power underground at the higher voltages and until new synthetic materials, possibly utilised in novel ways, were available they must continue to do so. If high-voltage d.c. transmission came to the front, this also would have effects on future cable technique.

But if the physicist had not played a direct practical role in insulation, the position might drastically change in the future. As a result of work beginning with Debye and extended by many others, it was to-day possible to calculate, using the latest theories of molecular structure,

without recourse to a single electrical measurement and from thermal data alone, the permittivity, loss factor, temperature and frequency relationships for a group of simple dipolar substances. Further, for a large group of crystalline substances the breakdown voltage could be calculated from optical data alone.

This physical research could not yet be extended to include synthetic polymeric substances. Nor could it have important repercussions on existing insulating materials like paper, cotton, varnish and the like, but having regard to the advances which were being made towards an understanding from the chemical point of view of the influence of the molecular structure on the electrical behaviour of existing synthetic materials, it was possible that in time the molecular physicist and the chemist would have so far advanced their techniques, that they would be able to present materials which had a molecular structure specifically designed to satisfy, at least, some of the requirements called for by the engineer.

The physicist and the chemist had already proved their worth as important specialists in electrical insulation. If and when they attained the ultimate goal, they would become an essential part of that branch of electrical engineering. No one could guess where such progress would lead, but certainly great benefits would accrue.

In concluding, Dr. Miller reviewed some of the administrative, research and educational difficulties which arose out of the growing number and wide range of sciences and techniques that were to-day included in electrical engineering.

Among the points raised were that the universities should be assisted to increase their volume of fundamental work, that industry should increase its own quota of such work, that many of the university courses in electrical engineering and physics needed overhauling and, an increasingly difficult problem, that industry itself must ensure a full flow of individuals, with the necessary breadth of view and capable of appreciating the impact of science on industry, to fill the higher technical posts in the future.

Electricity in Tank Culture

By Our Horticultural Correspondent

AMONG the experimental aspects of horticulture, the process known as tank culture or nutrient solution culture has been successfully applied to the growing of a variety of plants, independent of the soil. This activity dates from the 1930's when the methods used by the plant physiologist were examined to find out commercial possibilities.

The raising of plants in solution instead of in earth is not intended to supersede this normal, commonsense method. But solution has valuable characteristics for certain purposes. It gives freedom from soil-borne disease and avoids the need for soil sterilising. It is thus a method of securing greater control over conditions of growth. Considered commercially, it would be justified only in raising relatively high-priced crops as in glasshouse cultivation where a big return is required from a comparatively small area.

The pioneer work in nutrient solution methods was undertaken at California University and at Purdue University in the U.S.A., while in Great Britain valuable experimental work has been carried out by the Imperial Chemical Industries' Research Station at Jealott's Hill and by Captain Mullard at Englefield Green Nurseries. More recently, Reading University horticultural department has co-operated with the E.R.A. in an experiment on the control of growing conditions in tanks.

There are nature's growing conditions in which the plant has to survive the attacks of many enemies as well as the variations of uncertain climates. In these conditions, some authorities maintain that a strong, healthy plant is likely to be produced, capable of resisting diseases. The exponents of " controlled conditions " argue differently. They wish to find out the effect of different circumstances on plant growth and characteristics. Ideally, there would be a greenhouse of special design in which all the conditions which affect plant growth would be varied and regulated. Air and its movement, humidity, light and heat and water—these are the items which could be controlled. In addition, the small quantities of chemicals needed by the plant for food, could be fed into the water and the solution kept at normal strength.

Light could be adjusted by means of special blinds or shutters to regulate sunlight while artificial, electrical illumination of varying intensity could be used to supplement sunlight in summer and to act as main source during the sunless months. In this way, crops could be raised away from their normal season. Further, the amounts of light and of heat which a plant needs appear to be related. There may be for each class of plant, a critical temperature, calling for a certain minimum of lighting. Humidity and air movement may affect one class of plant more than another under

glass. Temperature is most significant, and this refers not only to air temperature but to the temperature gradient along the plant and to the temperature of the root system.

It is in connection with the last point that recent experiments at Reading have been developed, using electrical heating of the solution tanks to secure different temperatures, with thermostatic control, so that the effect on growth and on the root systems may be studied.

Experimental work of this type requires much time before it is practicable to state definite conclusions about the effect of a particular variable upon an over-all result, but when it is possible to state a conclusion about the effects of solution temperature on growth and yield, it is then possible to take another factor, such as light irradiation, and ascertain the effects of different intensities and sources of light upon growth and yield.

Tomato Cultivation

The work at Reading has been concerned with tomato cultivation although it is possible to raise a variety of plants in soil-less methods. Gericke at California University, produced potatoes and bananas as well as tomatoes through these methods. Captain Mullard raised various vegetables as well as carnations in tanks, using the sub-irrigation system.

Soil-less cultivation covers three kinds of method: sub-irrigation culture which is the most practicable, liquid culture and sand culture. Chemicals are mixed into solution for the roots to obtain this part of their food, but it must be remembered that the plant procures its basic food from the carbon dioxide in the air. The sub-irrigation system is used at Reading, and is best adaptable to large-scale growth. The main tank is filled with gravel or cinders (sterilised) and nutrient solution is pumped in at intervals from another tank at a lower level. The solution flows back after flooding the main tank, and draws down air as it drains off. In this way, plant roots are adequately aerated. The roots are firmly held in position by the small cinders or gravel and the flow of solution can be regulated.

The gravel used should be fine, washed silica gravel and the solution should give the proper chemical reaction before inserting the young plant roots. The elements required for growth have been listed by Professor Stoughton of Reading University as: " primarily nitrogen, potassium, phosphorus, calcium, magnesium, sulphur and iron. In addition, plants require relatively minute quantities of a number of other elements, especially boron, manganese, copper and possibly zinc."

The preparation of the solution for use requires certain precautions, for the chief elements have to be provided in correct proportions considering the class of plant to be grown and the seasonal conditions of sunshine and temperature. Most plants thrive best in a slightly acid solution. Since the balance of a solution is altered by the various rates of absorption of chemicals by the plants, care has to be taken to restore this balance promptly. For instance, an ammonium sulphate solution becomes more and more acid as the ammonia is more quickly absorbed than the acid radical. One method of meeting this point is to make up a solution which changes slowly, using a combination of salts which are known as physiologically alkaline with those which are physiologically acid. Such a solution, applied with success to the cultivation of tomatoes and lettuces, consists of sodium nitrate, potassium chloride, magnesium sulphate, superphosphate of lime, ammonium sulphate and water. This main solution needs the addition of a supplementary solution containing very small amounts of manganese, boron, copper and zinc salts.

The results obtained so far by experimenters are similar in kind. They show that this sub-irrigation system is effective in the raising of tomatoes. Crops are almost invariably heavy, with a high proportion of first grade tomatoes. In comparison with plants raised in the normal way from soil cultivation there appears to be a slight advantage with the tank grown plants, in such matters as size of crop, quality of fruit and general appearance. Good results might be secured from the combination of electric light irradiation with heating of the root systems by means of immersion heaters in the tanks.

Questions Awaiting Answers

A number of questions remain to be answered satisfactorily in this largely experimental field of horticulture. Critics have alleged that plants grown in this way may be less disease-resistant than those which are grown in soil and subject to natural conditions, and that the stock bred from artificially grown plants will be a weaker strain. On the other hand, enthusiasts suggest that it may be possible to breed disease-free plants through solution culture. There is not sufficient evidence to confirm either view-point. Results obtained with tomatoes show no differences between the product of soil growing and of tank growing in size, yield, quality, vitamin content, etc., which would encourage the critics.

Future experimental work will show the effects of root area temperature and light irradiation on growth. These developments of research must use electrical methods since they are the only methods capable of providing the exact regulation and control needed to establish scientific data.

Appliance-Saturation Factors

E.R.A. Communication on Measurement by Means of Sampling

THE use of the part as an indication of the whole has increased enormously in recent years, techniques such as "quality control" in the field of production, or "gallup polls" in the field of human behaviour, being topical examples. The sampling-tests described in a report* issued by the E.R.A. are designed to give an indication of certain electrical statistics of a large body of consumers by examination of a relatively small sample.

Application of Surveys

Surveys of this kind may be used to ascertain either matters of fact or opinion—e.g. to find out either how many consumers have electric water-heating or how many would like to have it. The examples here described are of the former kind, but similar methods can be used for the latter. The report indicates what degree of confidence can be attached to the results of such a survey, and how it can be carried out so as to give the maximum accuracy for the least labour. The theory is checked by applying it to a case in which the correct values are known.

In any kind of measurement there is no such thing as absolute accuracy, and in this the process of measuring differs from straightforward counting. One can never say that a certain length is exactly two feet, but only that it differs from two feet by not more than a specified amount. Where the accuracy of a sampling-survey differs (in kind) from the accuracy of, say, an ammeter reading is that the former is of a statistical character and must be stated in the form of a probability. If a 0/100 ammeter has an accuracy at half-scale reading of ± 1 per cent., this means that when the true current is 50 A the instrument will read between 49.5 and 50.5. Compare this with a large body of consumers (say 100 000 or more) from whom a true random sample of 500 is taken. If the actual cooker saturation of the whole bulk is 50 per cent. there will be a 90 per cent. chance that the sample reading will lie between 46.3 per cent. and 53.7 per cent. (i.e., ± 3.7 per cent.). That is to say, if for test purposes a large number of samples of this size were taken, the results of nine out of ten could be expected to lie inside this range.

A larger sample will increase the accuracy, though not in proportion, and the increase could be expressed either as a greater than 90 per cent. chance or as a smaller range of probable error. But however great the sample, the expression would always be of this statistical character, although of course, when the sample equalled the total, the "chance" would be 100 per cent. and the error zero. It is suggested that a 90 per cent. probability is a reasonable level on which to work when measuring saturation factors.

The accuracy obtainable depends on a number of factors, the chief of which are size of sample, selection of sample, and size of quantity being measured. (The word "sample" is used to denote the selection and the word "bulk" to denote the total from which the sample is selected.) Accuracy depends chiefly upon the absolute size of the sample, not upon its size relative to the bulk, thus a 500-sample will give a certain accuracy for a bulk of 100 000 and almost equally good accuracy for a bulk of 1 000 000. There is, therefore, no need to increase the sample size for large bulks, but when the bulk size is quite small a somewhat smaller sample will suffice. The following table shows some equivalent sample sizes which give equal accuracies:—

Bulk Size.	Sample Size.
Well over 20 000	500
10 000	475
1 000	335

It is suggested that for large bulks (20 000 and over) 500 is a suitable sample size.

Sample Consumers

Generally, considerations on sampling are based on "random" selection, i.e., the picking out of chance individuals from the bulk by a system which avoids any bias. The scientifically correct way of ensuring this is the use of random numbers taken from tables which are available for this purpose. In the case of electricity supply undertakings, however, where the sample will generally be selected from the record of domestic consumers (arranged in street order or on another geographical basis), a method at least equally good is to pick out one in every so many cards, the ratio corresponding to that of the chosen size of the sample to the bulk. It is important that in doing so an actual count be made and the cards extracted strictly according to the calculated interval. This method is of particular advantage where the total area of supply is of a heterogeneous character; for it is thus made certain that each stratum contributes to the sample in proportion to its size. The report also recommends that,

* Ref. K/T113: "Measurement of Appliance-Saturation Factors by Means of Sampling." By J. R. Isaac, B.A., and G. O. McLean, M.Eng. Price 15s. 6d.

where possible, the bulk be split up in groups, for instance, rural, suburban, and urban, and that where justified by the sizes of the group, a full-size sample be drawn from each group.

With given conditions of sampling and size of sample, the accuracy also depends on the magnitude being measured. The report deals with the measurement of the saturation of electrical consumers for certain services, e.g., the proportion of consumers using electric cooking. This is described as a saturation factor and it is obvious that if the latter is very low the results of sampling will be inaccurate, unless the sample is made very large. Thus, if the actual saturation factor, say, for refrigerators, were only 0.2 per cent., the average number in a sample of 500 would be 1. But any given sample might well include none, or two, or more, thus giving an entirely false result.

It is suggested that saturation factors below 3 per cent. should be neglected in the sampling-survey, since these low values would require a much larger sample for accurate results.

Statistical theory shows that the relative accuracy goes up steadily with the saturation factor, but that the range of probable error is a maximum when the saturation is 50 per cent., and decreases on either side of this point.

In order to demonstrate the practicability of the recommendations and illustrate the effect of chance on sampling results, application has been made to the records of an actual undertaking where a recent complete survey had been carried out.

Samples were drawn by mechanical means from a bulk of 20 000 records, both on the basis of " random numbers " and by selecting " one in every so many," and the results are tabulated in the report. They prove the theories outlined there, especially, that the second sampling-method appears superior.

On the whole, the report contains sufficient information to enable individual undertakings to plan and execute a sampling-survey in respect of appliances, and in this way to obtain information which has hitherto been lacking. It may be added that the E.R.A. is considering a scheme under which members who are authorised undertakers will be asked to carry out such surveys simultaneously at a time still to be fixed and to make available the results for circulation among members.

Magnetism Indication

Simple Device for Use with Closed Magnetic Circuits

THOSE relying upon residual magnetism for revealing cracks and other defects in ferro-magnetic materials, or who use any form of impulse magnetation, will be interested to know of a simple indicating device used with success by the Metropolitan-Vickers Electrical Co., Ltd. It is known that when magnetising articles by the through-current impulse method, a closed magnetic field is established in the component, the final value of which depends upon the magnetising current conditions preceding the moment of interruption. Occurring sufficiently often to be troublesome, when using a heavy a.c. from a transformer secondary as the magnetising force, it has been found that some of the components so magnetised have in fact no residual magnetism. Consequently, any subsequently crack-testing operation done on such articles is useless. Owing to the closed nature of the field established, even in the magnetised components, it is impossible to distinguish between them and the unmagnetised articles unless some surface discontinuity—such as a crack—is present. Hence there arises the doubt whether accepted articles so tested are magnetised and found free from cracks, or are cracked and found free from magnetism.

Example of crack detection by residual magnetism, using a captive fluid detector

For this reason the " Electroflux " and " Metroflux " crack detectors made by the Metropolitan-Vickers Electrical Co., Ltd. have been designed for the simultaneous application of the detecting agent and the magnetising current where a.c. is used. In

those cases where special considerations demand the use of residual magnetism, this has usually been ensured by employing undirectional magnetising current. Occasionally circumstances have arisen when a.c. must be used, and the doubt regarding the switch-off point has been removed by the device to be described.

This consists of a U-shaped magnetic yoke embracing the heavy conductor carrying the magnetising current to the article. Attracted to this yoke against the action of a calibrated pull-off spring, is a steel armature carrying signal lamp contacts, which close when the armature is released so as to light the warning lamp. It will be obvious that this will only take place when the residual flux in the indicator is insufficient to hold in the armature. Since the components under magnetisation are in the same series circuit, their magnetic condition is also indicated. Hence should the warning lamp light upon switching off the magnetising current, other magnetising "shots" should be given until the switch-off occurs at the right moment, resulting in the holding in of the indicator armature by the residual field.

A similar effect can be obtained by employing a current indicator in the heavy current circuit such as a repulsion type ammeter fitted with high hysteresis elements, so as to maintain a reduced deflection on the instrument when the current switch-off leaves the elements magnetised. Conversely a zero reading is obtained when the current switch-off is such as to leave the elements—and hence the components in the same series circuit—unmagnetised.

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.

Plugs and Sockets

[To the Editor]

Sir,—A statement has been issued to the Press by the B.S.I. dealing with plugs and sockets for post-war housing. This statement claims to be the final settlement of the question, whereas in fact, all that has happened is that the B.S.I. have not acceded to the request of the I.E.E. to standardise an entirely new plug and socket with a fuse in the plug and not interchangeable with any existing standard.

The request of the I.E.E. followed the report of a Special Committee convened by the I.E.E. at the instance of the Ministry of Works, which was fully representative of every section of the industry, including consumers. This Committee sat for approximately two years to consider the electrical installation of new houses from every angle, and the question of plugs and sockets was recognised as one of the most important matters. Finally, a unanimous conclusion was reached which appears in the Appendix at the end of No. 11 Post-war Building Study issued by the Ministry of Works, and after further discussion at other committees, the I.E.E. put forward the above mentioned request to the B.S.I. in April this year.

This request was considered and agreed to by the B.S.I., who set in motion the procedure for producing the required specification. . A section of the manufacturing side of the industry had in the meantime developed strong antagonism to any new standard plug and socket and asked the B.S.I. for the matter to be reconsidered; in July of this year the B.S.I. passed a rescinding resolution to the effect that no new standard should be prepared and that the existing 5 A plug and socket to B.S.S. 546 should be rated at 13 A instead of 5 A and that a fuse be provided in the socket, instead of in the plug.

The decision of the B.S.I. not to proceed with the new specification cannot be regarded as finally disposing of the situation; it means only that there will be no B.S. Specification to cover the new plug and socket, the need for which has been expressed by an overwhelming majority of installation and supply interests.

The B.S.I. cannot be accepted as the arbiter on a matter of principle affecting any section of the industry, as their primary function is to produce specifications to meet the needs of industry as ascertained and required by responsible and representative committees of all appropriate sections of industry.

Yours faithfully,

L. C. Penwill,

Director and Secretary

The Electrical Contractors' Association.

Fuel Economy—Date or Temperature ?

[To the Editor]

Sir,—Within little more than a few days the fuel economy drive will be intensified by the banning of industrial and domestic heating determined by dates published in the Press or broadcast by radio; but this year and in future it seems that a much more efficient method could be employed by regulating the initiation of fuel economy with an observed temperature as a fundamental instead of the date as a basis.

A great deal can in general be learned from those engaged in the branches of the

electrical industry specialising in the use of thermostats, time-switches, heating and air-conditioning equipment; and it is certain that the future offers enormous opportunities for the installation and utilisation of automatic control gear, both in industry and in domestic life.

It is opportune, therefore, that a new scheme for fuel economy operation, at least for heating, should be launched at the earliest possible moment, and it would be interesting to hear in this connection what the opinion of others, who have specialised experience, has been during the war years, coupled with their future outlook.

I am, Sir, Yours faithfully,

S. H. PARSONAGE.

Wembley Park, Middlesex.

From Sir Frank Gill, K.C.M.G., O.B.E.

Capitalisation of Losses

[TO THE EDITOR]

Sir,—Mr. C. H. Lackey, in THE ELECTRICIAN of September 21 last, asks a proper question.

The term "capitalisation" merely means converting recurring annual charges into a single sum which if spent *now* is the present value of all the annual charges for the full period. It is a bad term because the conversion may be made as at *now* when it is the present value or *then* when it is the amount at the end of the term, but users of the word do not distinguish between these two, and seem generally to use "capitalisation" when they mean present value.

Since the dates of expenditure vary, e.g., first cost applies *now* while annual charges involve different dates of spending, these must be brought to a common time line before they can be added together. We can represent a recurring annual charge as one sum now or then; and a fixed sum spent at any date as may be represented as an annual charge. Either language is correct, but one is sometimes more convenient than the other.

In the case of the two transformers we can obviously say:

As in "The Electrician" August 10.	Present Value. £	As in "The Electrician" September 21	Present Value. £
A. 250 F.C.		20 C.C	
362 A.C.		28.93 L.	
	612		48.93
B. 200 F.C.		16.00 C.C.	
424 A.C		33.85 L.	
	624		49.85
Relative diff.:			
B. is 1.96% more.		B. is 1.88% more	

When the times and periods are the same and the first cost difference not very great, the sum of the annual charges (as in September 21) is the simpler and it would not be worth while to emphasise the difference in the first cost. But if the first costs were much greater, say multiplied by 1 000, it might be well to pose the situation thus:

The first cost of A will be £50 000 more than for B, but the annual charges for A (after paying all the charges on the additional £50 000) will be £920 yearly less than for B. Therefore, A is the more economical, always provided that the additional capital is available.

Yours faithfully,

London. F. GILL.

Motion Study

A WORKING exhibition of some results of motion study in industry has been arranged by the Ministry of Aircraft Production at the Carlton Hotel, Pall Mall. It is an effort to interest industry generally in a science which, though by no means new, has hitherto had only a limited application in Great Britain. As Sir Stafford Cripps pointed out in opening the exhibition on Tuesday, excellent work has been done by certain pioneering firms, notable among which is the Metropolitan Vickers Electrical Co., Ltd., yet motion study remains an unknown science to by far the greater part of British industry.

Mr. F. E. Chappell, chairman of the Production Efficiency Board of the M.A.P., presided at the opening ceremony, and was accompanied by Miss Anne Shaw, whom Sir Stafford Cripps described as our greatest expert on motion study.

The demonstrations are being given by workpeople of some 30 industrial firms that are putting motion study methods into practice, with results which are often remarkable.

Overseas Trade Statistics.—Publication of the detailed monthly trade accounts will be resumed in the normal form beginning with the issue for January, 1946. These will give particulars of all our principal imports, exports and re-exports, with a considerable amount of information on trade with individual countries. The Board of Trade will publish detailed trade accounts for the first nine months of 1945 and further accounts for the whole year. In addition, a monthly summary (on the lines of those issued during 1940) will be published showing the July and August figures for each group distinguished in the oversea trade statistics; further summaries will be published for October and for November.

Shop and Store Lighting

Advantages of Fluorescent Lamps in Relation to Colour

THE special features of fluorescent lamps—colour, large area, low brightness, low radiant heat output, high efficiency and long life—make them particularly suitable for various aspects of shop

A colour display at D. H. Evans Ltd., London, enhanced by the light from Osram fluorescent lamps

and store lighting. The possibilities in the field of colour rendering are among the most important from the shop lighting point of view. Both daylight and warm white types, at present obtainable, will find uses, but the former is of special interest. While its similarity to daylight is not sufficiently close for very accurate colour grading processes, for such purposes as matching stockings or ribbons, selecting cloth, or displaying furs and a multitude of similar applications in shops. it provides a perfectly satisfactory light at high efficiency.

How far daylight lamps and how far warm white lamps should be used in shops will depend upon taste and the type of goods displayed. Undoubtedly under the daylight colour, goods are given a more natural and vital appearance, but it is arguable that so long as warmer tones of light remain popular for the lighting of places such as restaurants, hotels and homes, goods which are to be seen mainly in these warmer lights, such as evening dresses and curtains, should be displayed in the light in which they are to be used. Apart from this, there will be many who prefer to sacrifice the natural colour and vitality of display for a warmth of atmosphere, but it is well to remember that any impression of coldness which the daylight lamp introduces is mainly due to insufficient illumination.

Because of the large area and low brightness of fluorescent lamps, shadows are soft and risks of either direct or reflected glare are greatly reduced. Under a localised system of lighting the extra brightness on display areas will import that emphasis due to contrast which is so desirable in shop display. Fittings employed for lighting in this way should allow sufficient upward light to keep ceilings bright and avoid any appearance of "tunnel" effect. It is very undesirable to use unshielded fluorescent lamps, except at relatively high mounting heights. The large area of the source introduces one limitation, namely, that the light cannot be concentrated into narrow beams to give a spot-lighting effect. Where such an effect is desired some supplementary system must

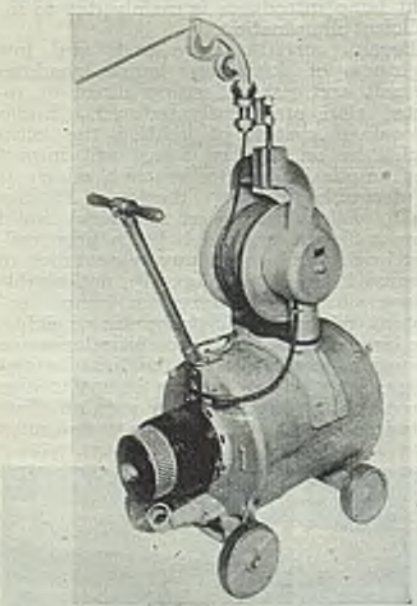
Effective use of a fluorescent lamp for counter and background lighting (G.E.C. picture)

be employed, and, fortunately, tests have shown that tungsten floods and spotlights blend satisfactorily with fluorescent lighting.

New Equipment and Appliances

Self-Winding Cable Reel—A Quick Heating Iron

WITH the use of most electrically-driven machinery and equipment involving position movement, a great reduction in the wear and tear of the trailing cable is achieved by the use of the Wayne self-winding cable reel, a production of **Power House Components, Ltd.,** which embodies a compact metal rotating wheel



Wayne self-winding electric cable reel mounted on a swivelling head on a vacuum cleaner

with a spring mechanism, on which the cable winds or unwinds automatically, always maintaining a suitable tension without any slack or sag.

Industrial vacuum cleaners, such as the one illustrated, are now being supplied with what is known as the " Major 12/5 " type of Wayne reel, fixed on the top of the casing and provided also with a universal swivelling head fitted to a crossbar. If desired this head may be made adjustable to suit operators of tall or short stature. This reel takes ⅝ in. diameter 4-core cable, approximately 70 ft. in length. Reels are available in a considerable range of sizes, from the Baby, taking twin lighting flex, to the Mammoth, able to deal with the very largest cables, 2½-3 in. in diameter, although in this case, because of the very great weight involved, operation is sometimes by hand instead of a spring. All the other sizes, including the next largest, the Goliath, are entirely spring operated.

The Craft rustless Quickheat iron of totally die-cast construction, streamlined design and with one-stud fixing device, is the answer of **Craft Electrical Industries, Ltd.,** to the demand for a breakaway from orthodox smoothing iron construction. Features claimed for it are that it is quick heating because it is made of a brass alloy, and is ready for use in half the time taken by most irons, yet consumes no more current and is thus more economical; it is rustless and cannot discolour or soil linen; there is no plating to peel off; its design is simplified and effective, and there are no loose connections or pins to give trouble; it can be used by right or left hand and heat is prevented from travelling to the upper parts of the iron by an asbestos deflector plate; a standard element, procurable from electrical dealers in any country, is fitted; the iron is shock-proof. The weight is approximately 5 lb.

A Craft sprinkler iron has the same specifications as the Quickheat but with the inclusion of a reservoir for water, which discharges under pressure in a fine spray from the base of the iron. In a Craft steamer iron the reservoir is substituted by a boiler, heated by the iron element, and a safety valve is incorporated in the filler cap.

Other electric irons in production by the company are the Roxy, the Dixy, the Laxy and the Texy (the last-named being for export only).

A new pocket dual Testoscope has been produced by **Runbaken Electrical Products.** The combining in one instrument of two indicating tubes enables tests to be made on circuits of from 2 to 30 V, and also on 100 to 750 V a.c. or d.c. It can be used, it is claimed, to indicate switches, live conductors, earth neutral wire, continuity, open circuits, leakages, insulation values, polarity; and for testing transformers, armatures, neon signs, fuses, condensers and electrical apparatus, including radio sets. The improved test prod is designed to make contact with conductors without stripping, the needle point piercing insulation without damage. The size of a fountain pen, the Testoscope is made of high-grade ebonite to safeguard the user from shock. The screw-driver blade is magnetised and can be used for retrieving small parts and for detecting ferrous metal.

Electrical Personalities

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

Mr. Oliver Lyttelton, M.P., has been appointed chairman of Associated Electrical Industries Ltd., in succession to **Sir Felix J. C. Pole,** who has resigned owing to eye trouble. Sir Felix, who had been chairman since 1929, will remain on the board, and has been appointed deputy-chairman. Mr. Lyttelton was Minister of Production in the National Government and President of the Board of Trade in the Caretaker Government. Before the war he was a managing director of the British Metal Corporation and chairman of the London Tin Corporation.

Mr. O. Lyttelton

Mr. H. King, assistant commercial manager, Ilford electricity department, has retired after 45 years' service.

Mr. T. Duerden, chief technical assistant to Blackburn electricity undertaking for 14 years, has been appointed deputy city electrical engineer at York. He was with the Corporation of Nelson for four years.

Mr. A. M. Hicks, the general manager and secretary of Siemens Electric Lamps and Supplies, Ltd., retired on September 30, after 45 years' service in the company's organisation. He is succeeded by **Mr. C. J. N. Borg. Mr. J. R. Naish** has been appointed assistant secretary.

Mr. A. M. Hicks. The cable ship "Faraday," sunk by enemy action during the war, is seen in the picture

After 25 years' service with A. Reyrolle and Co., Ltd., **Mr. C. E. Stott** retired at the end of September. He joined Reyrolle's as engineer-in-charge of switchgear-contracts for the London area and South-East England, and later extended his responsibilities to other areas.

Mr. W. C. Huston, manager of the B.T-H. lighting section since 1939, has been appointed a director of Harcourts, Ltd. Harcourts belong to the A.E.I. group of companies. Before joining the British Thomson - Houston Co., Ltd., in 1932, Mr. Huston received his early training and business experience in shipbuilding and general engineering.

Mr. W. C. Huston

Mr. W. H. Higham, head of the staff payroll department of the British Thomson-Houston Co., Ltd., Rugby, since 1925, has retired after more than 44 years' service. He joined the cashier's department in 1901. **Mr. A. E. Browne** has been appointed head of the staff payroll department as from October 1. He joined the company in 1909.

At the invitation of the French Government, a party of British industrialists representing the Federation of British Industries, is leaving for Paris, under the leadership of **Sir Clive Baillieu,** president of the F.B.I., and **Lord Dudley Gordon.** The delegation includes **Mr. E. C. Holroyde,** president of the B.E.A.M.A.

Cable and Wireless, Ltd., announce that **Rear-Admiral G. P. Thomson,** on the termination of his appointment by the Admiralty as Chief Press Censor, has accepted an appointment with the company as from December 1. He will undertake duties connected with the handling of Press traffic. **Air Vice-Marshal C. W. Nutting,** formerly Telecommunications Adviser to the Minister Resident in the Middle East, has also accepted an appointment with the company.

Mr. O. H. Buckingham has been appointed a director of the Hotpoint Electric Appliance Co., Ltd. He joined the staff of the British Thomson-Houston Co., Ltd., Rugby, in 1912, and has filled the position of general manager of the Hotpoint Electric Appliance Co., Ltd., since 1932. **Mr. N. V. Everton,** sales manager, lamp de-

partment of Metropolitan-Vickers Electrical Co., Ltd., has also joined the board of the Hotpoint Electric Appliance Co., Ltd.

The third annual conference of the Foremen's Association of the Brush Electrical Engineering Co., Ltd., was held at the company's works at Loughborough on September 21, 22 and 23 and the subject of discussion was "Education and Training in Industry." The delegates numbered over 140 and included the foremen of the company and its subsidiaries, together with foremen representing important industrial concerns throughout the country. **Mr. F. S. Mitman**, managing director of the company presided at the dinner opening the conference on the first evening, at which **Dr. Mont Follick**, M.P. for Loughborough, was the principal guest.

The funeral service for **Mr. James Young Fletcher**, a director of the General Electric Co., Ltd., whose death was announced in our last issue, was held on September 26, at Christ Church, Virginia Water. Among those present were:—

Sir Harry Railing (chairman, General Electric Co., Ltd.) and Lady Railing, Captain Leslie Gamage (vice-chairman) and the Hon. Mrs. Gamage; Mr. G. Chelioti, Dr. C. C. Paterson and Mr. F. Winstanley (directors, G.E.C.); Mr. S. H. Callow (Siemens Brothers and Co., Ltd.), Mr. Guy Campbell (Benjamin Electric, Ltd.), Mr. Alfred Clark (chairman, Electric and Musical Industries, Ltd.), Mr. H. A. Deacon (Cryselco), Mr. Z. Deshaw (J. Ismay and Sons, Ltd.), Mr. C. F. Dickson (Crompton Parkinson, Ltd.), Mr. Milton V. Ely (chairman, Foster Transformers and Switchgear, Ltd.), Mr. N. V. Everton (Metropolitan-Vickers Electrical Co., Ltd.), Mr. H. Senior Fothergill (secretary, E.I.B.A.), Mr. T. G. Frost (representing Chamberlain and Hookham, Ltd.), Mr. E. W. Hann (representing G.E.C. oversea branches), Mr. A. de Jong (Philips), Mr. W. J. Jones (director, E.L.M.A.), Mr. W. W. Kublin (Britannia Electric Lamp Works, Ltd.), Mr. H. A. Lingard (chairman, E.L.M.A. and B.T-H. Co., Ltd.), Mr. R. V. Macdonald (director, Electric Lamp Statistical Offices, Ltd.), Mr. A. Middleton (representing V. Z. de Ferranti and Ferranti, Ltd.), Mr. F. E. C. Miller (director, Ediswan Co.), Mr. W. F. Moir (Cryselco), Mr. M. R. Neville (representing Mr. T. W. Heather and Mr. C. Pinkham), Mr. B. N. Purdie (representing Sir Montague Hughman, W. T. Henley's Telegraph Works Co., Ltd.), Mr. F. Smith (M.O. Valve Co., Ltd.), Mr. R. Wilson Smith (managing director, Drake and Gorham, Ltd.), Mr. W. Lewis Smith (representing head office and Pirelli-General Cable Works, Ltd.), Mr. F. H. Spotswood (Siemens Electric Lamps and Supplies, Ltd.), Mr. H. E. Spreadbury (Z Electric Lamp and Supplies Co., Ltd.), Mr. A. J. Sturgeon (Foster Transformers and Switchgear, Ltd.), Mr. A. H. Young (Edmundsons Electricity Corporation, Ltd.).

Obituary

Alderman R. H. Noble, chairman of South Shields Corporation Transport Committee, aged 67 years.

Sir Connop Guthrie, on September 28, aged 63 years. He was a director of A. C. Cossor, Ltd.

Dr. E. J. Williams, F.R.S., Professor of Physics at the University of Wales, Aberystwyth, on September 29, aged 42 years. He distinguished himself early as one of the first students of the new University College of Swansea, from which he went to Manchester and then to Cambridge. He gained first-class honours in physics when he graduated B.Sc. (Wales); he became Ph.D. (Manchester) in 1926, Ph.D. (Cantab) in 1929, and D.Sc. (Wales) in 1930. After a period of study with Professor Niels Bohr at Copenhagen, he returned to Manchester as a lecturer in physics, and then proceeded to a special lectureship under Sir James Chadwick at Liverpool. In 1938 he was appointed Professor of Physics at Aberystwyth, and the next year was elected a Fellow of the Royal Society. His researches were mainly in atomic physics.

Delegates at the third annual conference of the Brush Electrical and Engineering Co.'s Foremen's Association at Loughborough

Plastic Notes

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

CONTINUING the review of cellulose acetate plastics, the methods adopted for handling the sheet material are almost the same as those used for celluloid sheet and many articles formerly made from celluloid have, in recent years, been made from cellulose acetate to reduce the risk of fire. For this reason cellulose acetate has sometimes been called "non-flam. celluloid" but this is a misnomer. Strictly speaking the term should only be applied to celluloid which has had added to it some ingredient to reduce the inflammability.

In the same manner as celluloid, cellulose acetate sheet can be shaped over formers, it can be drilled, sawn, etc. It can also be cemented, using organic solvents as adhesives. Amongst the solvents used for this purpose may be mentioned a mixture of acetone (8 parts), alcohol (6 parts) and ethyl lactate (40 parts) or equal weights of acetone and ethyl lactate.

Most of the articles made from celluloid can be made from cellulose acetate, provided resistance to water is not an essential. Cellulose acetate cannot be used for accumulators. On the other hand it is used in electrical equipment as windows, in safety glass interlayers and as dials for radio sets. Name and number plates for electrical equipment are often made from cellulose acetate. On account of its non-flam. properties, it is extensively used for lamp shades, for screens for coloured flood lights and many other purposes where its transparency, or translucency, and various colours are of value.

Moulding Material.—Cellulose acetate moulding powders can either be moulded by compression or by injection. In the former case, it is necessary to heat and cool the mould alternately with the result that the cycle of operations is somewhat lengthy. As a result compression moulding is only used in certain very special circumstances.

Injection moulding is much more speedy and is the process usually adopted. It is a process very much akin to die-casting and consists more or less of forcing the material under pressure through a heated nozzle into a cold mould where it sets. The mould is opened and the article ejected, almost ready for use. The cycle on a modern injection machine, even on fair sized articles, is something of the order of 1 minute and, as multi-impression moulds are commonly used, the rate of output is fairly high.

Mouldings made from cellulose acetate are suitable for many purposes but there is always present the inherent difficulty of a thermoplastic material that the mouldings will soften and distort at elevated temperatures. In the same way as cellulose acetate sheet is somewhat hygroscopic, cellulose acetate mouldings are not suitable for use under humid conditions.

Amongst the uses of mouldings in cellulose acetate may be mentioned, knobs for radio sets, etc., handles of tools, cupboards, etc., fountain pen barrels and pencils, spectacle frames and so on. Applications in the electrical industry, except as knobs, handles, etc., are not very extensive. On account of its resilience, cellulose acetate is used for the cradle of hand-microphone telephones. Originally the set used by the G.P.O. was made entirely in phenol-formaldehyde material (except when in light colours) but, owing to the rough usage the cradle receives, it was decided, some time before the war, to change over to cellulose acetate and the cradle is now manufactured as an injection moulding.

Cellulose Aceto-Butyrate.—Although not manufactured in this country, cellulose aceto-butyrate has been developed in America, mainly as a moulding material, to supply the need for a thermoplastic material which can be moulded but which possesses better resistance to moisture than cellulose acetate.

As its name implies it is a mixed ester of cellulose and, in general properties, it resembles cellulose acetate, except for the lower moisture absorption. When made up into a moulding powder, it requires a lower content of plasticiser with the result that mouldings made from it are less subject to dimensional change or distortion at increased temperatures.

To enable a comparison to be made with cellulose acetate, its main physical and electrical properties are set out below:

Specific gravity 1.21; tensile strength 4 000/6 000 lb. per sq. in.; impact strength 0.8 to 5.5; volume resistivity 10^{13} ohms. cms.; dielectric strength 250-400 V per mil.; water absorption (24 hrs.) 1.2 to 2 per cent. by weight.

It is manufactured in the same manner as cellulose acetate. Cotton linters are treated with a mixture of acetic and butyric acids and anhydrides. Mixed esters of varying properties can be produced by altering the proportions of the acids and anhydrides used. Plasticisers are added to the mixed ester to make the moulding powder. Generally speaking a lower plasticiser content is employed and it has also

been found that the mixed ester is compatible with a much wider range of plasticisers than the ordinary acetate. The moulding material is moulded in the same manner as cellulose acetate but, generally speaking, less pressure is necessary.

Mouldings made from it are much more resistant to heat and moisture than mouldings of cellulose acetate. In fact it is claimed by the American manufacturers that some mouldings have been immersed in boiling water for a short time without being affected dimensionally. Because of this general increased power of resistance, it has found considerable outlet in U.S. military and naval equipment for the Pacific war. Conditions of humidity and temperature in these regions do not permit of cellulose acetate being used.

In America, cellulose aceto-butyrate has found use as a foil or film and has been used as a primary insulation on solid and stranded wire and cable for the Army and Navy. Its light weight in this connection has made it of special value in wiring in aircraft. Cellulose aceto-butyrate wire laminated to both sides of rope paper has been used as slot insulation in fractional horse power motors in America.

Cellulose aceto-butyrate has been used to produce rayon just in the same way as cellulose acetate and was placed on the American market during the latter part of 1941.

Turning again to injection mouldings of cellulose aceto-butyrate, there are reports from America of a weather resistant lightning arrester with a transparent aceto-butyrate housing being used by the U.S. Signal Corps. Whilst whistles in this country were moulded in cellulose acetate, the Americans have used aceto-butyrate, thus obtaining a stronger and more resistant article. Amongst the American service articles made in aceto-butyrate may be mentioned Army badges, ammunition rollers, bayonet scabbards, bugles, parts of gas masks, parts of pistols, rifles and machine guns, and so on.

Cellulose aceto-butyrate provides an instance of where the Americans have made greater headway than we have in this country, simply because they had a material available which we had not got in this country. Because of this, it is often thought by the public that the Americans have gone further than we have in plastics. This is not necessarily the case. We too had at least one material, polythene, which was entirely a British development, but because of the fact that it was used almost exclusively for secret wartime purposes, nothing was published about it until fairly recently. Our restrictions on publication were of necessity much stricter than the American.

Ethyl Cellulose.—Ethyl cellulose is another plastic material for which the starting-off point is cotton linters. The cotton linters are treated with a strong solution of an alkali such as caustic soda, producing an intermediate product which is known as alkali cellulose. Alkali cellulose is then ethylated by means of ethyl chloride or ethyl sulphate, and the ethyl cellulose formed is washed and purified to give a white granular product.

As a plastic material ethyl cellulose possesses some interesting properties. It is a thermoplastic, it possesses remarkable, toughness and is not readily inflammable, it is flexible and, unlike many other flexible plastic materials, it retains its flexibility at low temperatures down to −60°C. This property has made it of special value in arctic equipment and in components to be used in aircraft at high altitudes. It possesses good resistance to water and certain chemicals and it is dimensionally stable over a wide range of temperature. From the electrical standpoint it is superior to all other cellulose plastics.

Physical and Electrical Properties

Its main physical and electrical properties are as follows:—

Specific gravity, 1.14; tensile strength, 6 000/9 000 lb. per sq. in.; impact strength, 0.6 to 1.8 ft. lbs.; volume resistivity, 10^{15} ohms. cms.; dielectric strength, 1 500 V per mil.; water absorption (24 hrs.), 1.25 per cent.

Comparison of these figures with the figures already quoted for cellulose acetate and cellulose aceto-butyrate shows up very well in favour of ethyl cellulose. The specific gravity is lower which makes it useful for aircraft work. The volume resistivity is very much better and also the dielectric strength. Its water absorption is lower.

Ethyl cellulose can be moulded by injection or compression. It can also be extruded. Components made in it can be sawn, cut, drilled and punched. It can also form the basis of lacquers and for coating fabrics. It is manufactured in quantity by two or three firms in America, but production in this country is somewhat limited.

Amongst its main electrical applications should be mentioned the coating of wires and cable cores. Where flexibility at very low temperatures is desired, it is one of the very best materials obtainable. It has been used in America for moulding radio cabinets and radio components generally and for various electrical mouldings such as pocket torches, but the supply position has prevented such applications in this country.

In addition to being available as a plastic moulding material, it is manufactured in sheet form up to 0.02 ins. thick and in film and foil in continuous lengths of varying thicknesses up to 0.02 in. It is also

available in a number of different viscosity grades for use in lacquers and varnishes. However it is mainly in the moulded form that it is of interest to the electrical industry.

Methyl Cellulose and Benzyl Cellulose.—As a result of the interesting and valuable materials obtained in ethyl cellulose, workers have been encouraged to experiment to produce such materials as methyl cellulose and benzyl cellulose.

Methyl cellulose is in commercial production in America but its main applications have been in the lacquer field and in coatings. It possesses the interesting property of being soluble in cold water unlike ethyl cellulose but it is insoluble in hot water. As far as is known it has not been adapted for use as a plastic moulding material.

Benzyl cellulose was originally developed on a commercial scale in this country about fifteen years ago but, for some reason or other, never came very much into prominence. Within very recent times it has come to the fore again, but from America.

It is somewhat similar to ethyl cellulose and is available in forms suitable for lacquers and for mouldings. It is not, however available in very large quantities and full information about it has not yet been published.

It is claimed by the American manufacturers that it combines low water absorption with good electrical properties, especially arc resistance. Its specific gravity is stated to be 1.23 and its water absorption is quoted as being 0.44 per cent. As a plastic it can be moulded by injection and it can be extruded over wires, etc.

Now that the war is over, it is likely that work on this interesting material will be extended and that before very long more information will become available.

News in Brief

New Power Station.—It is announced that the erection of a new electricity power station in Leeds at a cost of between £4 000 000 and £5 000 000 has been sanctioned as part of the national grid scheme. It is to be erected on a 55-acre site at Skeleton Grange, Knoscrop, on the south-eastern confines of the city.

Andrew Laing Lecture.—At a meeting of the North-East Coast Institution of Engineers and shipbuilders, to be held at the Bolbec Hall, Newcastle-on-Tyne, on November 2, the Andrew Laing Lecture will be delivered by Sir Lawrence Bragg, his subject being "Problems of the Metallic State."

Radio Industry Co-ordination.—At the first annual dinner of the Liverpool branch of the Radio and Television Retailers' Association held recently, Mr. F. W. Perks, representing manufacturing trade interests, said it was a welcome sign that all branches of the radio industry were now aiming at some form of better co-ordination. Mr. A. B. Leech, thought retailers ought not to be saddled with the responsibility of abiding by a guarantee given in the first place by a manufacturer.

Marine Engineer Examinations. — The next examinations for admission to the Institute of Marine Engineers will be, Students (Common Preliminary Examination), April 2 to 5 and October 1 to 4, 1946; Graduates (Section A of Associate Membership Examination), May 27, 29 and 31, 1946; Associate Members, May 27 to June 3, 1946. Syllabuses of the examinations, copies of previous papers, and particulars of exempting qualifications will be supplied on application to the Secretary, 85, Minories, London, E.C.3.

Liverpool Victory Lighting.—The Ministry of Fuel and Power gave permission for the display of a small number of low-powered lights in the parks during the Victory Week celebrations in Liverpool. An elaborate programme of illuminations had been arranged but this had to be abandoned.

Trolley-bus Extensions.—A special meeting of the Reading T.C. has approved a proposal to make application to the Minister of War Transport for a provisional order authorising the Corporation to extend all their existing trolley-bus routes and to introduce new routes.

Nidderdale Protest.—It is reported that the villagers of Nidderdale have protested against the erection by Harrogate electricity department of a transformer housing, which they state mars the beauty of the place, and interferes with the view of motorists approaching the bridge over the Nidd.

Electricity in Spain.—According to a recent announcement, the supply of electricity, already greatly reduced, is again to be cut throughout central and eastern Spain. The use of power will be restricted in the capital to five hours between 7 a.m. and 5 p.m. on three alternate weekdays, and in villages lighting will be allowed for two hours a day at the most.

British Wireless Equipment for Uruguay.—The first post-war contract for a new broadcasting station in South America has been awarded by "Radio Rural," Montevideo, to the Marconi Wireless Telegraph Co., Ltd. The equipment, a 5-kW medium-wave transmitter, is being constructed at the Chelmsford works.

Answers to Technical Questions

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

What are the factors which govern the frequency employed for dielectric heating ?

In dielectric heating use is made of the dielectric loss which occurs when a non-metallic material is placed in an alternating electric field. The material is placed between metallic electrodes across which a voltage, V, is maintained ; it thus forms the dielectric of a condenser and can be represented by the equivalent electric circuit as shown in Fig. 1. The vector diagram for this circuit is shown in Fig. 2.

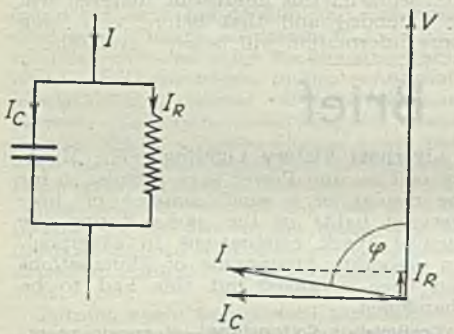


Fig. 1.—Equivalent circuit

Fig. 2.—Vector diagram

The power dissipated in the circuit, i.e., the heat generated in the material being heated, is $V I \cos\varphi$ watts. Since φ is, in practice, nearly 90° this can be written

$$\text{Heat} = V I_c \cos\varphi$$
$$= V \cdot 2\pi f C \cos\varphi$$

where f is the frequency in c.p.s. and C is the capacitance in farads.

For given dimensions of material, the capacitance C is proportional to the permittivity, k, so that it can be said that—

$$\text{Heat} \propto V^2 . f . k . \cos\varphi$$

Typical values of k lie between 3 and 6 and typical values of $\cos\varphi$ lie between 0.02 and 0.08. Although the values for a particular material vary somewhat with frequency and temperature, this variation is not usually large and it can be said that

$$\text{Heat} \propto V^2 f$$

To obtain a given amount of heat therefore a high voltage and medium frequency can be used or a medium voltage and a high frequency. The voltage is limited, particularly for thin specimens of material being heated, by its breakdown voltage and also by considerations of insulation and safety. Voltages up to 20 kV are sometimes used but more usual values lie between 500 and 3 000 V. In order to get a high rate of heat production, therefore, with consequent small heating times, it is necessary to use very high frequencies and values up to 40 megacycles per sec. are employed.

There are, however, certain limits to the value of frequency which can be used—the high-frequency supply is always obtained from an oscillator, an essential part of which consists of an inductance tuned to resonance with the capacitance of the material being heated. The impedance of a given imperfect dielectric tuned to resonance decreases with an increase of frequency; to get maximum power transfer from the oscillator to the load the oscillator impedance must be matched to that of the load, and if the latter is very low, due to a high frequency, a special matching circuit may be necessary; such conditions are likely to arise at frequencies above 20 Mc.p.s.

Another limit is imposed by the possibility of a standing wave being set up along the surface of the dielectric, with the result that the voltage varies from zero to a maximum over the surface; such a state of affairs would result in uneven heating. A standing wave will occur if the length of the electrode from its point of connection to the edge is equal to, or a large fraction of, a quarter wave-length corresponding to the frequency used. If the above distance is about a foot the frequency should not exceed about 40 Mc.p.s., whereas if it is 5 ft. the frequency should not exceed about 8 Mc.p.s.

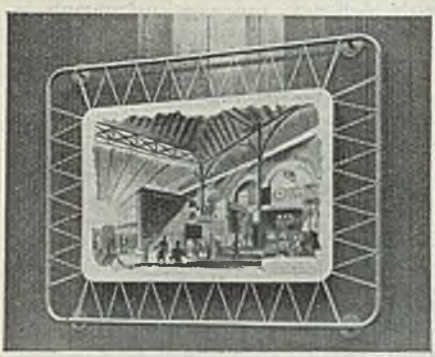
A final consideration is the difficulty of constructing a tuning inductance having a sufficiently low value of inductance to resonate with the relatively high capacitance at very high frequencies. Taking about 0.15 microhenry as the smallest inductance which can be used and assuming a load having a capacitance of 500 micro-microfarads, the resonant frequency comes to about 50 Mc.p.s.

As a result of all these factors, the frequencies commonly used lie between 10 and 30 Mc.p.s. E.O.T.

St. Dunstan's Men.—The St. Dunstan's annual report shows that fifty young men blinded in the war just concluded, have taken up industrial employment in factories. Some operate capstan lathes, with electric motors, involving eight or ten separate mechanical operations. Another has been placed as a research engineer.

Industrial Information

Change of Address.—From October 1, the address of the Import Licensing Department of the Board of Trade will be 198, Regent Street, London, W.1. (Telephone: Regent 4090.)



One of the railway station scenes outside Magnet House, Kingsway, London, in connection with the Osram lamp publicity campaign

E.D.A. Bulletin.—The current issue contains reports of the electrical display at the Watford Agricultural Show, the laying of the foundation stone of the main building of the new Meaford generating station, other events, an article on electrically-heated piggeries, and news from the areas.

Fuel Efficiency.—Bulletin No. 40, prepared by the Fuel Efficiency Committee of the Ministry of Fuel and Power, deals with combined power and heating, and has been written to help factory managements to investigate their power and steam balances.

Electrical Goods.—A manufacturer's agent established in Toronto wishes to secure the representation of United Kingdom manufacturers of electrical goods on a commission or consignment basis for the whole of Canada, (Ref. Z42631(d) Dept. of Overseas Trade, Hawkins House, Dolphin Square, Pimlico, London, S.W.1).

Electrical Engineering Courses.—Special courses in (a) high voltage engineering, and (b) electric circuit calculations are being arranged at the South East London Technical Institute, Lewisham High Road, S.E.4. Details can be obtained from Mr. C. W. Robson, head of the electrical engineering department.

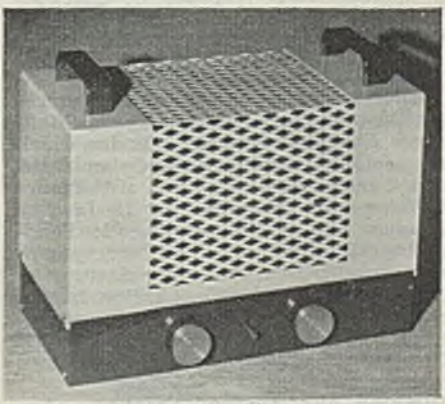
Mass Radiography.—The first company within the Durham County Council area to avail themselves of the mass radiography service is A. Reyrolle and Co., Ltd., of Hebburn, and the eager willingness of the workers to obtain this "passport to health" has justified the company's decision to make the necessary arrangements.

Fluorescent Lamps and Fittings.—Under the title of "Seeing Under Natural Conditions" Siemens Electric Lamps and Supplies, Ltd., have issued an illustrated price list (No. 980) giving full particulars of Sieray fluorescent lamps and fittings. They will be pleased to send a copy to anyone who is interested in the subject.

Henley's Acquire Another Factory.—W. T. Henley's Telegraph Works Co., Ltd., advise us that they have acquired an up-to-date factory at Birtley, Co. Durham, for the manufacture of their cables. The factories at Gravesend and Woolwich are in no way affected and will continue production as at present.

Gauge and Tool Makers' Exhibition.—The Gauge and Tool Makers' Association is arranging an exhibition of its member-firms' products to be held in the New Hall, Vincent Square, London, S.W.1, during the fortnight, from Monday, January 7, to Saturday, January 19, 1946, inclusive.

Exhibition of Modern Instrument Cases.—From October 1 to 13, Alfred Imhof Ltd., of 112-116, New Oxford Street, London, W.C.1, who celebrate their centenary this year, are holding an exhibition of instrument cases. The complete process of manufacture as well as the preliminary work of designing is demonstrated. A feature of the exhibition comprises equipment, components and parts made by Imhof's for radar, Asdic and many other purposes. The exhibition is open daily from 11 till 6; Saturdays, 10 till 1.



Standard instrument case by Imhof

A.E.I. News.—The current number contains a description of a new spot-welding machine developed by the Metropolitan-

Vickers Electrical Co., Ltd., for dealing with mild steel plate of 10 to 22 standard wire gauge thickness. It is a smaller version of their air-operated spot-welding machine (type A.S.). Personal, social and other news from the various works complete the issue.

Vactric Works at Airdrie.—Work has begun at Airdrie, Lanarkshire, on the site of a big new factory for Vactric, Ltd. Mr. Tom Johnston, former Secretary for Scotland, after cutting the first sod of the site, which is on the Newhouse Industrial Estate, said this was the first move towards bringing prosperity to depressed areas. The Board of Trade was sinking some £500 000 in the project.

Termination of Trade Agreement with Argentina.—The Board of Trade have received a copy of a note, dated August 21, 1945, from the Argentine Minister for Foreign Affairs to H.M. Ambassador in Buenos Aires giving formal notice of termination of the agreement of trade and commerce concluded between the United Kingdom and Argentina on December 1, 1936. The agreement is due to expire on February 21, 1946.

Siemens Magazine.—The current issue contains, in addition to sports, personal and social news, an article by one of the company's senior radio officers, Mr. A. W. Hearnden. He was radio officer-in-charge on the m.v. " Australind " when that ship was sunk on August 19, 1941, by a German surface raider. He was taken prisoner and interned at the Milag Nord Camp, until his release in May last.

Traffolyte Arrangement.—An arrangement has been made with the Metropolitan-Vickers Electrical Co., Ltd., under which the section manufacturing laminated plastics, under the trade name of " Traffolyte " has been taken over by De La Rue Insulation, Ltd., as from October 1. Pending the completion of a new factory now under construction, the manufacture of " Traffolyte " for the De La Rue Insulation organisation will continue to be carried out at Trafford Park, and it is hoped that all enquiries and orders will be sent there for the present.

Housing and Factory Location.—Concerted operation of dispersal planning policy by the departments responsible for planning, housing, building and factory siting is demanded in a memorandum issued by the Town and Country Planning Association. It has been sent to the heads of the Ministries concerned and Members of Parliament, and asks that in the essential job of building houses quickly, our good intentions for making more room in our congested cities, for a better balance of industry throughout the country and for avoiding excessive suburban sprawl, shall not be frustrated. " Town planning cannot wait," it states, " because the siting of the first houses built affects permanently the whole future of town and countryside. A good planning policy does not mean delay in housing—it may mean greater speed."

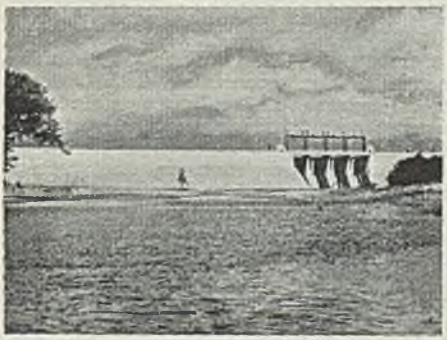
Precision Engineers Pool Resources.—To ensure that a comprehensive range of British high-class precision instruments is available for both home and export markets, the Coventry Gauge and Tool Co., Ltd., Taylor, Taylor and Hobson, Ltd., and E. R. Watts and Son, Ltd., have agreed to co-operate in the development and distribution of precision equipment. The firms will pool their technical and manufacturing resources for the development of new instruments, while the sales and service departments will handle the products of all three firms. The present range of equipment manufactured by the three firms includes gauge measuring equipment, electric profile gauges, microscopes (toolmakers', workshop, mechanics', jig borer, etc.).

Motor Application Research.—As the result of investigation of electric motor troubles experienced in service, Crompton Parkinson Ltd. found that the majority of these had developed initially from incorrect application. It was discovered that motors were selected without due regard to all the factors involved; as for instance, there was little appreciation of the fact that a motor can possess excessive starting torque which can be as detrimental as too little; or that if the horsepower is too large, there is incurred an excessive capital expenditure, and consequent loss in efficiency. During the war an increasing number of incorrect applications—probably due to peak production demands—have been noted. It became clear that with the growing use of electric motors for an increasing number of widely different applications, scientific selection would be essential in certain cases. From previous experience the company knew that many preconceived ideas could be dispelled when exact data were obtained, and concluded that a comprehensive analysis of the duty cycle of motors would solve application problems in those instances where size and type requirements were not clear. To ensure correct motorisation based on exact data it was therefore decided to form a motor application research department to co-operate with the motor users. This department acts in conjunction with the sales department and in those cases where pre-installation investigation is essential, the department ensures minimising the risk of failure in service. When application investigations are made a comprehensive report is submitted to interested parties.

Ontario Water Power Supply

Commission's Thirty-Seventh Annual Report

THE thirty-seventh annual report of the Hydro-Electric Power Commission of Ontario for the year ended October 31, 1944, states that the electrical energy generated and purchased by the Commission to supply the Ontario load reached an all-time high record, exceeding 12 billion kWh. Except for a few peak load



The Shand Dam, the first conservation unit constructed by the Grand River Valley Conservation Commission

periods when temporary cuts of short duration had to be made in " at will " power, all the demands for war activities in Ontario were met and essential civilian domestic and municipal requirements suffered no shortage.

During the winter 1943-44, strict economy and conservation of energy was required on the part of all citizens to enable the Commission to meet war demands. Later in 1944, due to some curtailment in the power demands of a few industries, the Dominion Power Controller was able to ease certain restrictions against commercial and municipal use which had been in effect since 1942. The margin between available supplies and present demands was still very small. During the year operating conditions on the whole were favourable. All the Commission's generating plants, with an aggregate normal capacity of 1 630 000 H.P., were operated to the maximum extent. The total output from all sources of over 12 000 000 000 kWh was 2.2 per cent., or about 260 000 000 kWh, above the previous year's output. Energy output for primary power purposes, which represented about 90 per cent. of the total, decreased slightly from 10 853 000 000 kWh in 1943 to 10 787 000 000 kWh in 1944. Over the last ten years the Commission's business practically doubled, its revenues from the supply of power and other operations increased from 30¼ to 58¾ million dollars and the energy handled by the Commission increased from 6½ to more than 12 billion kWh. Much of this was due to the war.

There were now 298 urban hydro utilities. To meet the costs of maintenance work which had been deferred, and of new construction, the Commission and the local utilities had set aside during the war special reserves and surpluses. The programme at present planned would involve expenditure for deferred maintenance and new capital construction of about $6 000 000 per annum for the immediate post-war period.

The Commission had agreed, on behalf of the Government, to purchase the power system of the Northern Ontario Power Co., Ltd., for $12 500 000, and operation was taken over on March 27 this year. The properties included eight hydro-electric plants with an installed capacity of 66 840 H.P., 739 miles of transmission lines, 157 miles of distribution lines and 421 miles of telephone lines.

The release by the Metals Controller of an increased quantity of material for the construction of rural primary lines that would bring hydro service to food producers, or otherwise be of assistance to the war economy in rural areas, enabled the Commission to resume on a moderate scale the extension of rural service. A total of four hundred miles of primary line, chiefly short extensions to existing lines, was constructed and service was given to about 10 000 new consumers, 7 000 of whom received service from lines which already existed. The total number of consumers on rural lines at the end of 1944 exceeded 146 600. The average power sold to all rural consumers, including war industries in rural areas, increased by nearly fourteen per cent.

Financial Considerations

The total revenue of the municipal electric utilities served by the Southern Ontario system was $41 653 417.31, an increase of $1 658 835.58 as compared with the previous year. The total net surplus was $3 729 360.56, as compared with $1 767 449.09 in 1943.

The total revenue of the municipal electric utilities served by the Thunder Bay system was $1 181 817.01, an increase of $52 252.90 as compared with the previous year. The net surplus amounted to $172 198.32, as compared with $144 848.45 for 1943.

Electricity Supply

Liverpool.—In a report to the Liverpool City Council Mr. James Eccles, electrical engineer, states that production and distribution costs have doubled in recent years. As there had been no corresponding increase in tariffs during the past six years the trading surplus had been materially reduced. This was likely to continue unless a serious and successful attempt was made to reduce the price of fuel and to stabilise wage rates.

Salford.—The report of the city electrical engineer, Mr. L. Romero, for the year ended March 31, 1945, shows that the total sales of electricity amounted to 134 647 543 units, an increase of 4.25 per cent. on the previous year and a record. This increase, due to greater use in domestic and shop premises, is attributed to shortage of household coal. A profit of over £18 000 was converted into a debit balance of £17 865 by the inclusion of a very large debit item to provide for increased payments to the C.E.B. for purchases of electricity in the four years up to March, 1944. To meet this, an advance of $\frac{1}{16}$d. per unit has been made on all rates except those for power and traction. The income of the department during the year, which includes a final allocation of £9 300 from the second area grid pool, amounted to £623 200, compared with £585 371 for the preceding year, an increase of 6.46 per cent. The total working cost was £470 782 (excluding £45 991 for arrears on cost of energy purchased during the years 1940-43), compared with £427 576, an increase of 10.1 per cent. The gross profit amounted to £152 418, compared with £157 795 for the previous year. The number of consumers had increased by 616 to 54 514, with a total of 234 140 kW's connected.

Belfast.—Extensions to Harbour power station, at a cost of £1 079 000, have been approved by the Ministry of Commerce. At the same time, it is proposed to proceed with extensions at Ballylumford station, which is the property of the Ministry of Commerce. Recently, there was a controversy between the Ministry and the Belfast Corporation as to allocation of new plant at Ballylumford and the Harbour station, and, finally, the matter was left to arbitration, the approved arbitrator being Mr. F. W. Lawton, chief engineer and manager of the Birmingham electricity supply department. On Mr. Lawton's report the Ministry has decided that " the future requirements of the electrical industry will best be served by the immediate initiation of simultaneous extensions at Ballylumford and at the Harbour station." This scheme will form part of the fifteen years' plan for the electrification of Northern Ireland. The Belfast Electricity Committee expresses some alarm in regard to the Ballylumford station extension on the ground that it had already been agreed that the installation of more than one 30 000 kW plant would not be justified until it became more clearly apparent that the rate of increase of the load would be higher than estimated, and that the supply industry would be overburdened by unnecessary capital outlay.

Camberwell.—The Works Committee reports that in connection with reduced street lighting it has discussed various schemes with the supply company's representative and given instructions that a reduction of 50 per cent. in the present lighting in all roads is to be effected by the removal of a proportion of the lamps. It is not practicable to use alternate lamps only throughout the whole area, as in many cases this would result in the standards being lit on one side only of the street. In a few localities it may be that the lighting could be wholly discontinued. This proposal has the advantage over the other schemes discussed that it requires the minimum labour, and accordingly the least expenditure, with a saving in power consumed little less by total extinguishment at midnight. It also avoids alterations to the time switches to bring the lights on again in the early morning, with the further operations which would be involved on the change from British summer-time to Greenwich mean-time. Moreover, the demand on the lighting companies during the peak evening hours is reduced. A scheme involving the substitution of lower-powered lamps would be very expensive, as new lamps for the grade A roads alone would cost £900. The cost of the work involved will probably be less than £100, the saving in energy in the region of 2 000 000 units per annum, and the reduction in the annual cost of street lighting of £6 000 per annum.

West Midlands J.E.A.—The annual report of the West Midlands J.E.A. for the year ended December 31, 1944, gives the total generation capacity of the authority's station as 288 530 kW. The maximum load was 279 700 kW, compared with 278 300 kW in the previous year. The authority's own m.d. was 248 210 kW, compared with 240 180 kW in 1943. The Central Board's programme of operation for 1945 envisages a maximum load of 306 150 kW on the selected stations next winter; and it is estimated that the

authority's own demand will be 259 300 kW. The number of units generated decreased from 1 133 492 411 in 1943 to 1 051 769 630 in 1944, and the number sold from 1 056 782 to 978 689 307, including an export of 44 694 710 units, as compared with 154 208 270 in 1943. The Central Board's programme for 1945 provides for an output of 1 051 500 000 units from the authority's selected stations, of which it is estimated that the latter's own requirements will amount to 910 847 000 units.

Reference was made in the last annual report to a direction to extend the Ocker Hill station by the installation of two 30 000 kW turbo-alternator sets, and five 150 000 lb./hr. boilers. The authority, following representations from the Board, have arranged for manufacture of the turbo-alternator and boiler to be put in hand at once, leaving the settlement of prices for subsequent negotiation. Provisional estimates of capital expenditure in connection with this extension amounting to £2 015 000 were approved by the authority and were subsequently revised to £2 123 300, or approximately £35.4 per kW installed. The contractors for the equipment in, or load include: Babcock and Wilcox Ltd., boiler plant; British Thomson-Houston Co., Ltd., turbo-alternators; Clyde Crane and Engineering Co., engine-room crane; George Ellison Ltd., auxiliary switchgear; Charles H. Price, cooling tower; British Thomson-Houston Co., Ltd., main switchgear; Horseley Bridge and Thomas Piggott, Ltd., steelwork. During the year the authority received a direction to extend the Walsall station by the installation of two 30 000 kW turbo-alternator sets, and five 150 000 lb./hr., with two cooling towers each of a capacity of 1.6 million galls. of water per hr. for operation by September, 1948. The authority have approved estimates of capital expenditure amounting to £2 299 750 or £38.3 per kW, and have decided to duplicate at Walsall the boilers and turbo-alternators to be installed at Ocker Hill. Under the direction of the Central Board the Ironbridge station has been operated extensively during the past year. The maximum load was 206 200 kW, and the total units generated 909 503 000, representing a m.d. load factor of 50.2 per cent., compared with 52.1 per cent. in 1943. The thermal efficiency was 22.1 per cent. The Wolverhampton station operated at an increased thermal efficiency from 20.4 in 1943 to 21.6 in 1944. The 30 000 kW set was taken out of commission for approximately four months (July to October) to enable the manufacturers to carry out certain tests.

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.

Bradford T.C., October 5.—Provision of 6.6 kV overhead distribution line and underground cable to Scholebrook Farm, Tong (Contract C.36). Particulars from Mr. T. H. Carr, Electricity Department, 27, Bolton Road, Bradford.

Walsall Electricity Supply Committee, October 5.—Supply of meters, conduits, troughing tiles, bonding clamps, feeder pillars and sub-station panels, underground link to boxes and covers and transformers. Particulars from Mr. E. A. Newburn, Upper Bridge Street, Walsall.

Redcar T.C., October 6.—Supply, laying and jointing of e.h.t. and associated pilot cables. Particulars from the Borough Electrical Engineer, Electricity Offices, 112, High Street, Redcar.

Woolwich B.C., October 9.—Supply, delivery and erection of one 750 kW Diesel alternator and four 30 MVA outdoor reactors. Specifications from the Borough Electrical Engineer, Electric House, Powis Street, Woolwich, S.E.18; deposit, £1 1s.

Manchester Public Health Committee, October 10.—Electric heating installation at the Dr. Garrett Memorial Home, Conway. Specification from the City Architect, Town Hall, Manchester; deposit, £1 1s.

North of Scotland Hydro-electric Board, October 15.—Supply, delivery and erection of 132 000 V transmission lines. Specification from Mr. T. Lawrie, 16, Rothsay Terrace, Edinburgh, 3; deposit, £5 5s.

Stone (Staffs.) Electricity Department, October 15.—Supplies of underground main and overhead line materials. Particulars from Mr. C. Scholefield, 56, High Street, Stone, Staffs.

Hackney B.C., October 26.—Supply and delivery of six 500 kVA transformers. Specification from the Borough Electrical Engineer, 18/24, Lower Clapton Road, E.5.

Overseas

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.

Company News

E. AND H. P. SMITH LTD.—Intm. 5% (same).

URBAN ELECTRIC SUPPLY CO., LTD.—Intm. div. 4% (same).

TWEEDALES AND SMALLEY (1920) LTD.—Intm. div. 5% (same).

SOUTH WALES ELECTRIC POWER.—Intm. div. 2%, less tax (same).

THOS FIRTH AND JOHN BROWN, LTD.—Intm. div. on ord. 3% (4½%).

JOHN THOMPSON ENGINEERING CO., LTD.—Intm. div. 5% on ord. (same).

SALISBURY ELECTRIC LIGHT AND SUPPLY CO., LTD.—Intm. div 4% (same).

EXCHANGE TELEGRAPH CO., LTD.—Pft. for yr. to June 30, £10 978 (£10 773).

CANADA NORTHERN POWER.—Div. of 15 cts. per com. sh. for qr. ended Sept. 30, 1945.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD.—Intm. div. 5% less tax, or ord. (same).

ST. AUSTELL AND DISTRICT ELECTRIC LIGHT AND POWER CO., LTD.—Intm. div. 4% (same).

WOKING ELECTRIC SUPPLY CO. LTD.—Intm. on ord. 3%, tax free (same), payable Oct. 8.

SHROPS., WORCS. AND STAFFS. ELECTRIC POWER.—Int. on " A " ord. 4%, on " B " 2½% (both same).

LANCASHIRE UNITED TRANSPORT AND POWER CO., LTD.—Intm. 4% less tax (same) payable Oct. 31.

MIDLAND ELEC. CORPN. FOR POWER DISTRIBUTION.—Intm. on ord. 3%, less tax (same), payable Oct. 15.

CABLE AND WIRELESS (HOLDING) LTD.—Div. on pref. 2¾%, less tax, for hlf-yr. ended June 30, payable Nov. 15.

CABLE AND WIRELESS, LTD.—Intm. 1½% (same), less tax, payable Nov. 15 to holders registered on that date.

ELECTROLYTIC ZINC CO. OF AUSTRALASIA, LTD.—Final div. 5% (same) on participatg. pref. and ord., mkg. 9% for yr. to June 30 (same).

JERUSALEM AND PUBLIC SERVICE.—Fst. and fin. on ord. 5%, less tax (same, less U.K. tax). Pft. for yr. to Mar. 31, £P.90 604 (£P.80 263).

EDMUNDSONS ELECTRICITY CORPN.—Drawgs. will take place on Oct. 10 to redeem £27 400 3½% and £28 800 4% deb. stks. for repayment at par on Dec. 30.

BENNIS COMBUSTION LTD.—Net pft. after taxtn. £10 030 (£10 029). Div. is maintained at 10% (same). Trans. to res. £3 000 (same), mkg. £36 000. Carry fwd. £2 927 (£2 647).

N. GREENING AND SONS, LTD.—Dirs. propose to increase cap. to £300 000 in 100 000 £1 pref. and 200 000 £1 ord. by creation of 100 000 £1 ord. shs. to rank parri passu with existing ord.

HERBERT MORRIS, LTD.—Final div. 15% net (same), mkg. 20% tax free on ord. Net pft. is stated to be £129 856 (£145 683). After deductg. £10 000 pref. div. net earngs. on ord. are 23.9%. Fwd. £79 039 (£78 998).

BRAITHWAITE AND CO. ENGINEERS LTD.—Net pft. to Mar. 31, after taxn., etc., £22 541 (£20 533), plus £21 501 (£17 861) brot. in. To pref. div. £11 250 (same), intm. ord. div. £6 356 (same), fin. ord. div. 4½% (5½%), mkg. 7½% (6½%), fwd. £29 717.

MUREX LTD.—Fin. div. on ord. 10%, and cash bonus 2½%, mkg. 20% (same) for yr., payable Oct. 30. Pft. for yr. to June 30, includg. an estimated refund of E.P.T. and after mkg. prov. to cover full inc. tax and N.D.C. liabilities, is stated as £213 032 (£239 446).

RAWLINGS BROS. LTD.—Net pft. to Mar. 31 £7 261 (£8 078), plus £4 257 (£4 348) brot. in. To directors' fees £1 000 (same). Pref. div. £1 314 (same), ord div. 7½% £4 605 (same), employees' benev. and retirement acct. £250 (same), defd. repairs nil (£1 000), forward £4 348.

RENOLD AND COVENTRY CHAIN CO., LTD.—Initial bonus of 2½% is announced, with usual fin. of 7%, payable Oct. 25, mkg. 12½%, less tax (10%). Pft. on tradg., after chargg. deprec., etc., £202 930 (£207 098, after both deprec. and E.P.T.). Add E.P.T. recoverable £16 000, makes a total of £218 930. Deduct inc.-tax £102 600 (£102 000), leaves net pft. of £116 330 (£105 098).

HURST NELSON AND CO., LTD.—Net tradg. pft. (after taxatn.) £45 360, (£45 038), for yr. to July 14. Fees, W.D.C., depreciatn. and deferred repairs absorb £12 724 (£12 425), leavg. available for divs. £32 637 (£32 613), pref. takes £6 000, and net earngs. on ord. £26 637 (£26 613), ord. div. takes £25 000 net and leaves £16 187 (£14 550) for 1946.

MADRAS ELECTRIC TRAMWAYS (1904).—After £5 252 (£5 445) deb. int., £3 198 (£3 005) deb. skg. fund. £40 000 (£15 000) Indian and Brit. inc.-tax and £10 000 (same) deprecn. and renewal, net pft. 1944 £25 192 (£17 095). To pref. div. £4 945 net (£19 045 net 5 yrs.), ord. div. 10%, tax free (5% tax free), £10 000 (£5 000), fwd., £21 639 (£11 392).

SUDAN LIGHT AND POWER CO. LTD.—Rev. for 1944, includg. interest and pft. on sale of investmts., £47 834. Deduct rent, fees and sundry exes. £3 697, re-

funded by Public Services in Khartoum £3 697. Taxatn. £16 000, deb. int. £20 000, less refunded by Sudan Govt. £20 000. Pft. £31 834 (£31 543). Brot. in £39 970 (£36 167). Gen. res. £5 000 (nil), div. 5% (6%), fwd. £43 125 (£39 970).

STOTHERT AND PITT LTD.—After creditg. over-prov. for E.P.T. last yr. of £7 643 (£6 152), tradg. pft. to June 30 £151 621 (£143 528). To inc. tax £47 480 (£44 352), inc. tax res. £6 000 (£2 050), E.P.T. £35 000 (same), bank int. and chgs. £8 980 (£8 973), dirs.' fees £1 034 (£896), leavg. net pft. £53 126 (£52 257), plus £32 433 (£30 920) brot. in. Pref. div. absorbs £1 995 less tax (same), ord. div. 10% and bonus 5% (both same), but on incrsd. cap., to war conting. res. £20 000 (£30 000), fwd. £41 064.

DUBILIER CONDENSER (1925) LTD.—Pft. after E.P.T., £41 213 (£40 166), disc., royalties, etc., £5 855 (£7 296), mkg. £47 069 (£47 462). To fees, renewals and deprecn. £9 152 (£8 780), inc. tax 1945-46 £18 000 (£13 000), lvg. net pft. £19 917 (£25 682), plus £25 675 brot. in. To res. £10 000 (conting. £10 000), pref. div. 10% £5 000 (same), ord. div. 20% (10%), less tax, £7 697 (£3 848), fwd. £22 895. Both ord. div. and net pft. previously annod. Curr. assets £362 298 (£366 871), includg. stk. and work £142 065 (£140 792), debtors £219 403 (£225 096). Creditors and curr. taxn. £186 479 (£200 349), overdraft £31 804 (£25 359).

NIGERIAN ELECTRICITY SUPPLY CORPN.—Power sales to Feb. 28 £221 506 (£194 577), plus trans. fees £76 (£35) and int. £3 941 (£3 579). To operatg. cost £36 133 (£29 751), insurance £2 369 (£2 136), rents £1 296 (£1 302), gen. exes. London £2 329 (£2 123), Nigeria £2 651 (£3 072), dirs.' fees and tax thereon £2 628 (£1 329), deprecn. £30 273 (£24 007), leavg. net pft. before tax £147 845 (£134 471). Brot. in £15 036, mkg. available blce. £162 880 (£172 402). To taxn. £75 500 (£65 000), deb. int. £9 638 (£13 004), deb. redmptn. £13 622 (£12 850), gen. res. £7 500 (£26 500), int. div. 3%, £12 126 (£12 194), and fin. 5%, plus bonus 2%, less tax (both same), £28 295 (£27 818), fwd. £16 200 (£15 036).

Company Meetings

VERITYS, LTD.—The annual meeting was held in London on Sept. 25. In the statement circulated with the report, Mr. B. C. Evans, the chairman, said the greater bulk of the company's output had consisted of apparatus for H.M. ships and mercantile marine. Some 40 000 electric motors and ventilating units—70 000 desk and ceiling fans and various other types of electrical apparatus—with the essential control and switchgear, had been supplied to more than 100 centres engaged directly or indirectly in shipbuilding. In order that the company might be well equipped to meet post-war conditions, contracts are now being placed for the installation of modern machine tool and other equipment, at a cost of approximately £50 000.

VENNER TIME SWITCHES LTD.—The annual meeting was held at New Malden on September 26, when Mr. Arthur A. Rowse, the chairman, said the trading profit for the year had been mainly regulated by circumstances which had been entirely outside the control of the company. It was as a result reduced from the figure of £56 342 to £5 128, and in arriving at this latter figure the directors pointed out that the depreciation provided, although adequate in their opinion and in excess of that allowed by the Inland Revenue, was, nevertheless, lower than had hitherto been provided. The profit carried forward in the 1943 accounts was £15 733, and it was proposed to appropriate £4 000 from the war contingencies fund, making an amount of £24 861 for disposal. Income tax absorbs £2 545 and the preference dividend £1 200. A dividend of 10% on the ordinary shares was proposed, absorbing £5 400, leaving £15 716 to be carried forward.

Metal Prices

		Monday, Price.	Oct. 1. Inc.	Oct. 1. Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9 7/8d.	—	—
Sheet	„	11 1/4d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. 0 7/8d.	—	—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
Wire „	„	11 1/4d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£28 5 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	—	—
Speller...	„	£31 5 0	—	—
Mercury (spot) Warehouse ...	per bott.	£69 15 0	—	—

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

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.*

DALYTE ELECTRICAL CO. LTD., London, W.—Aug. 31, charge, to Midland Bank Ltd. securing all moneys due or to become due to the Bank; charged on Deco Engineering Works, London, W.10. *Nil. Oct. 28, 1944.

Company Winding Up

AMAZON TELEGRAPH CO. LTD.—At a meeting of the members of the above named company, at Dashwood House, 69, Old Broad Street, London, E.C.2, on September 19, 1945, a resolution was duly passed that the company be wound-up voluntarily as a members' voluntary winding-up and that Mr. Arthur Cecil Dickinson be appointed liquidator.

Satisfactions

PROGRESS CABLES AND ACCESSORIES CO. LTD., London, N.W.—Sat'n. Aug. 9, £1 000, reg. Apr. 28, 1939.

STANTON IRONWORKS CO. LTD., Stanton-by-Dale.—Sat'ns. Sept. 14, of Trust Deed reg. Feb. 4, 1925 (fully), and of deb. stock reg. Aug. 2, 1938, to the extent of £38 360.

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.*

BASTON, Nathan J., Lyndale, Greenover Rd., Brixham, electrician. £13 16s. 3d. July 24.

SULLIVAN AND CO., St. Mary's Row, Moseley, Birmingham, electricians. £52 7s. 3d. July 23.

NEAL (ELECTRICAL) LTD., R/O., 44, Upper Tooting Rd., S.W.17, electrical engineers. £24 2s. 1d. Aug. 8.

Coming Events

Friday, October 5 (To-day).

I.E.E., N.E. STUDENTS' SECTION.—Newcastle-on-Tyne. Chairman's address. *6.30 p.m.*

JUNIOR INSTITUTION OF ENGINEERS.—London, S.W.1. Discussion Groups. Research Circle. *6.30 p.m.*

Saturday, October 6.

I.E.E., N.W. STUDENTS' SECTION.—Manchester. Luncheon, *1.15 p.m.*, followed by chairman's address, "The Place of the Gas Turbine in Future Electricity Generation," B. V. Poulston, *2.30 p.m.*—I.E.E., LONDON STUDENTS' SECTION.—Visit to Barking Power Station. *2 p.m.*

Monday, October 8.

I.E.E., N.E. CENTRE.—Newcastle-on-Tyne. Chairman's address. *6.15 p.m.*

Tuesday, October 9.

ILLUMINATING ENGINEERING SOCIETY.—School of Hygiene and Tropical Medicine, London, W.C.1. Presidential address, H. C. Weston. *6 p.m.*

Wednesday, October 10.

I.E.E., RADIO SECTION.—London, W.C.2. Inaugural chairman's address, A. H. Mumford. *5.30 p.m.*

INSTITUTE OF WELDING, E. COUNTIES BRANCH.—Ipswich. "Design and Welding Techniques," F. Clark.—N. LONDON BRANCH.—South-West Technical College, Walthamstow. "X-rays and Their Use in Weld Testing," Drs. R. J. Barnes and S. Torrence. *8 p.m.*

ILLUMINATING ENGINEERING SOCIETY.—E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, W.C.2. Film of "Let Us See." Lessons in Industrial Lighting. *5 p.m.*

Thursday, October 11.

I.E.E., INSTALLATIONS SECTION.—London, W.C.2. Inaugural chairman's address, Forbes Jackson. *5.30 p.m.*

ELECTRICAL ASSOCIATION FOR WOMEN.—Twenty-first birthday celebrations. Two-day conference. Thursday: Exhibition, Dorland Hall, opened by the Duchess of Kent, *11 a.m.*; luncheon, Connaught Rooms, *1 p.m.*, speaker, Sir Stafford Cripps; reception, Grosvenor House, Park Lane, *7 p.m.* Saturday: Symposium of speeches at the Institution of Electrical Engineers, *2.30 p.m.*

Friday, October 12.

I.E.E., N.W. CENTRE (RADIO GROUP).—Manchester. "Studio Technique in Television," D. C. Birkinshaw and D. R. Campbell. *6 p.m.*

Friday, October 12-13.

WOMEN'S ENGINEERING SOCIETY.—Two-day conference. Friday: Visit to the Motion Study Exhibition, Carlton Theatre, Haymarket, London, S.W., *10 a.m.*; Symposium of speeches at the Institution of Electrical Engineers, by invitation of the E.A.W., *2.30 p.m.*; annual luncheon, Forum Club, 6, Grosvenor Place, S.W.1, followed by presidential address by Miss M. Partridge, "The Next Twenty-one Years," *7 p.m.* Saturday: Annual meeting, 20, Regent Street, S.W.1, *10 a.m.*; visit to First Women's Electrical Exhibition, *11.30 a.m.*; evening visit to Battersea Power Station.

Saturday, October 13.

JUNIOR INSTITUTION OF ENGINEERS, N.W. SECTION.—Manchester. Annual general meeting, followed by presidential address, "The Engineer's Tools—Words and Figures," L. H. A. Carr. *2.30 p.m.*

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