THE
ELECTRICIAN

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OSRAM

FLUORESCENT LAMP

5 ft. 80 watt

The brilliant daylight effect of OSRAM Fluorescent lamps has done much to maintain and increase production in the war factories. There are situations, however, where a light of warmer tone than the existing "Daylight colour" is desired. *For these situations the "Warm-white" Fluorescent Lamp has been introduced.* With the exception of the change in colour, all other characteristics remain the same.

Low Surface Brightness reduces direct or reflected glare

Large area source means soft shadows

High efficiency means economy in current consumption

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Quick starting, full light obtained almost instantaneously

Suitable for existing installations

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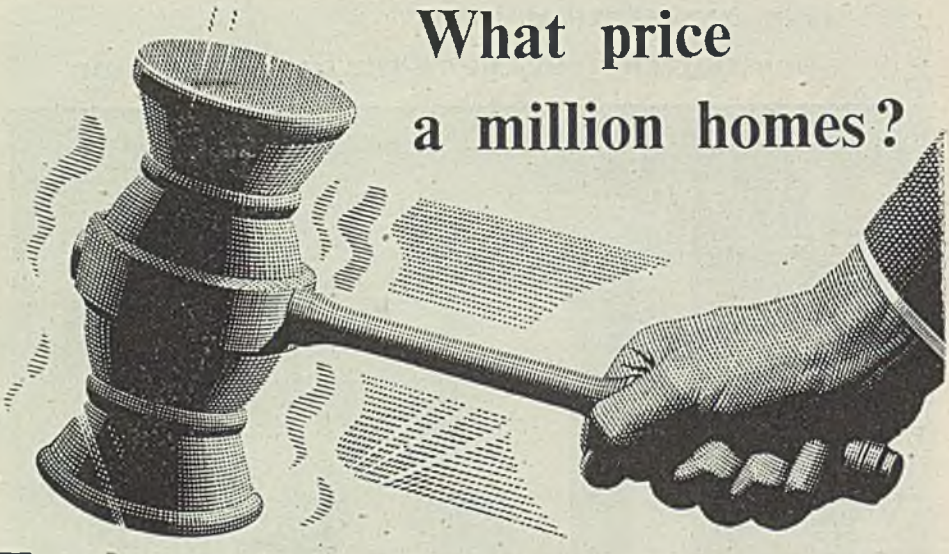

The cost of post-war building will largely depend upon the cost of each component. And the cost of each component will depend upon the way in which it is produced. Only the New Craftsmanship of large scale production organised upon the most efficient lines can combine low cost and quantity with the quality which the public will demand.

M.E.M. Switch and Fuse Gear has shown how this can be done. In the largest and most self-contained factory specialising in such gear M.E.M. had, up to the war, progressively reduced costs and prices and at the same time improved quality. This steady increase in production efficiency goes on and M.E.M. are ready to pass its benefits on as a contribution to the rebuilding of Britain after the war.

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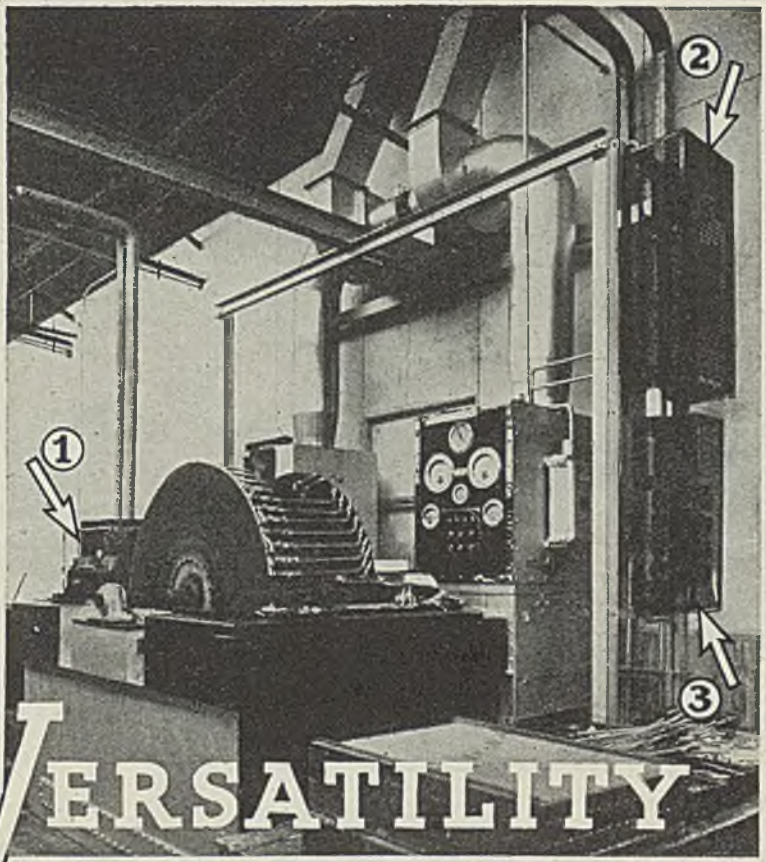

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For nearly 20 years Westinghouse Metal Rectifiers have been called upon to perform a great variety of duties, ranging from small instrument work to high voltage for electrostatic precipitation or heavy current for electrodeposition.

The illustration shows a typical installation of an automatic magnetic plating plant where metal rectifiers are used for three different functions—(1) D.C. current to the vat, (2) current for the rotating magnet to hold the work, and (3) D.C. supply for the variable speed motor rotating the magnet

WESTINGHOUSE

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WESTINGHOUSE BRAKE & SIGNAL CO. LTD., PEW HILL HOUSE, CHIPPENHAM, WILTS

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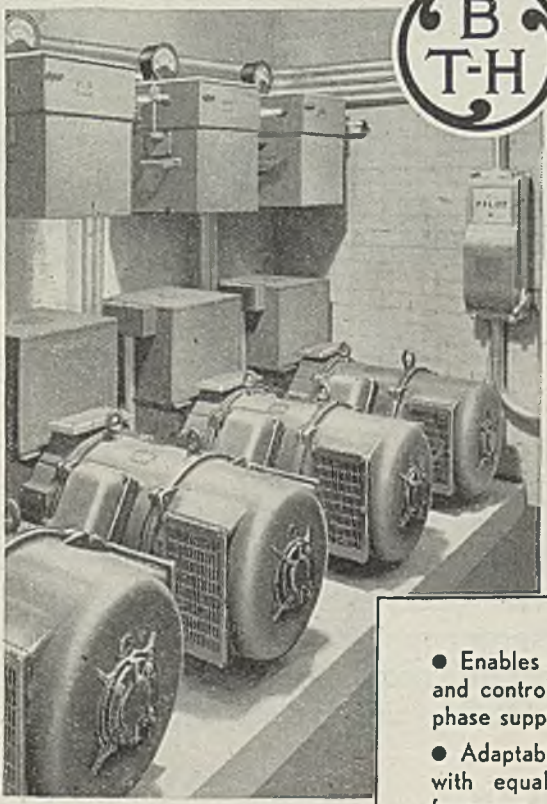

Group of single- to three-phase converters in an 800 H.P. Factory installation.

Let BTH Engineers advise you.

B T-H CONVERSION SYSTEM

(PATENT No. 485495)

The most economical method of installing or extending electric drives in Factories where single-phase supply only is available.

- Enables standard three-phase motors and control gear to operate on single-phase supply.
- Adaptable to all likely load conditions with equally high standard of performance.
- Gives exceptionally good voltage balance under all working conditions, thus enabling the full three-phase output to be obtained from the load motors.
- Easy to control.

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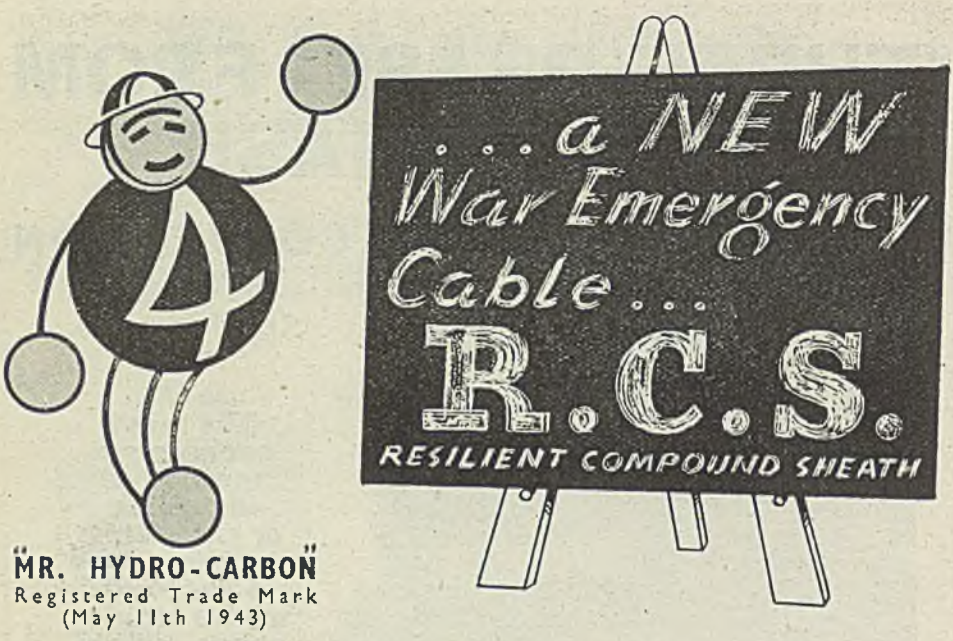

"MR. HYDRO-CARBON"
Registered Trade Mark
(May 11th 1943)

This new STERLING War Emergency Cable, although not T.R.S., is an unusually effective replacement for Tough Rubber Sheath Cables. It is available in 1/044, 3/029, 3/036 and 7/029 in Single, Twin and Tri-Core. Fullest details, samples and prices will gladly be sent on request but orders for this War Emergency Cable in common with all Rubber, Synthetic Rubber and Thermo-Plastic Insulated Cables and Flexibles, are subject to the rules and conditions of CP. 104.

STERLING
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MANUFACTURERS OF ALL TYPES OF RUBBER, SYNTHETIC RUBBER AND THERMO-PLASTIC INSULATED CABLES AND FLEXIBLES

All Sterling Cables are entirely British Made to B.S. and G.D.E. Specifications.

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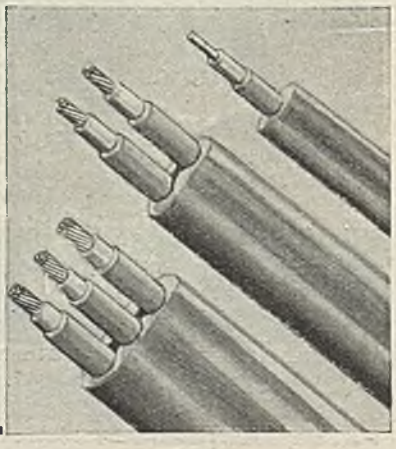

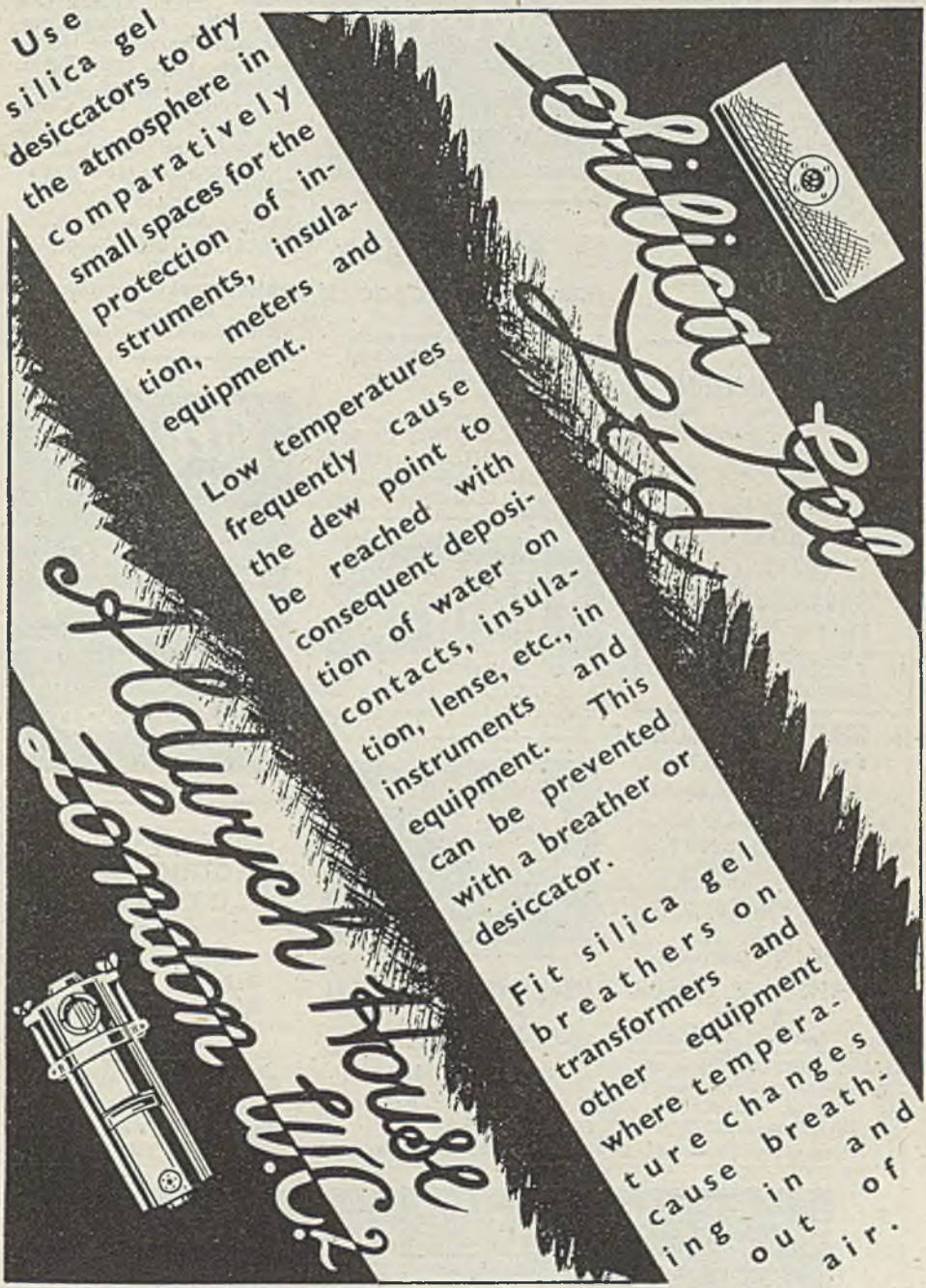
Silica gel
Use silica gel desiccators to dry the atmosphere in comparatively small spaces for the protection of instruments, insulation, meters and equipment.
Low temperatures frequently cause the dew point to be reached with consequent deposition of water on contacts, insulation, lense, etc., in instruments and equipment. This can be prevented with a breather or desiccator.
Fit silica gel breathers on transformers and other equipment where temperature changes cause breathing in and out of air.
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MANUFACTURERS' SUPPLIES SECTION

MISCELLANEOUS ADVERTISEMENTS

SITUATIONS VACANT

COUNTY BOROUGH OF BLACKPOOL.

APPOINTMENT OF BOROUGH ELECTRICAL ENGINEER.

APPLICATIONS are invited from persons experienced in the management and administration of an electricity undertaking for appointment as Borough Electrical Engineer of the Council.

The salary will be:—First year, £1,490 per annum; second year, £1,620 per annum; third year and thereafter, £1,750 per annum, plus cost of living bonus.

The appointment will be subject (i) to the provisions of the Local Government Superannuation Act, 1937, (ii) to the person appointed satisfactorily passing a medical examination by a medical officer on behalf of the Council and (iii) to the other terms and conditions relating to the appointment.

Application forms, together with terms and conditions of the appointment, may be obtained from this Office, and must be returned to the undersigned, endorsed "Borough Electrical Engineer," not later than the 17th March, 1945.

Canvassing directly or indirectly will be deemed a disqualification.

TREVOR T. JONES,
Town Clerk.

Municipal Offices,
Town Hall Street,
BLACKPOOL.
21st February, 1945.

ASSOCIATED MUNICIPAL ELECTRICAL ENGINEERS
(Great Britain and Ireland)
and
THE ELECTRICAL POWER ENGINEERS' ASSOCIATION

NOTICE

BLACKPOOL CORPORATION.

APPOINTMENT OF BOROUGH ELECTRICAL ENGINEER.

ON account of the terms of the Corporation's advertisement of the above post, the Standing Joint Committee hereby cancels its previous notice and members are free to apply for the vacancy.

W. ARTHUR JONES, A.M.I.E.E.,
Secretary,
Standing Joint Committee
A.M.E.E. — E.P.E.A.

EDUCATIONAL

INTENSIVE COURSES FOR THE HIGHER NATIONAL CERTIFICATE IN MECHANICAL AND ELECTRICAL ENGINEERING.

IT is proposed under the Intensive Training Scheme (Engineering) to conduct full-time intensive courses of six months duration for the award of Higher National Certificates in Mechanical Engineering at the Technical College, Gamble Institute, St. Helens at which there will be accommodation for 20 students, and in Electrical Engineering at the Royal Technical College, Salford, at which there will be accommodation for 24 students.

The courses, which will both commence on the 9th April next, will be open to engineering apprentices and others, whose firms wish them to attend and who have reached the standard of the Ordinary National Certificate in Mechanical or Electrical Engineering or an equivalent standard.

Application forms, together with full details of the courses, maintenance allowances, etc., may be obtained from the Principal, The Technical College, Gamble Institute, St. Helens, or from the Principal, Royal Technical College, Salford, according to the course which it is wished to pursue.

PATENTS

NOTICE IS HEREBY GIVEN that Thomas Charles Gilbert seeks leave to amend the Specification of the application for Letters Patent No. 565,995 entitled "Improvements in or relating to conduits for electrical wiring."

Particulars of the proposed amendment were set forth in the Official Journal (Patents) No. 2927 dated February 28th, 1945.

Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2., on or before the 31st March, 1945.

H. L. SAUNDERS,
Comptroller-General.

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PATENT AGENTS

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

THE ELECTRICIAN

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CHIEF CONTENTS OF THIS ISSUE

The Domestic Fire

THE problem of smoke and its solution have of necessity during the war years received little attention, compared with peace-time interest, but last week something of the old-time enthusiasm was witnessed at a joint conference of the Institute of Fuel and the National Smoke Abatement Society. The relation of smoke to various industries was dealt with by a number of speakers, and it was made abundantly clear that the biggest contributor to the pollution of the atmosphere is the domestic consumer of raw coal. This conclusion is not new, of course, but it may not even yet be realised that whereas in industry there is generally speaking, at least a good attempt to reduce pollution, domestic circles in 1938 were responsible for about a half of the smoke, a quarter of the ash and a fifth of the sulphur dioxide produced by the whole internal coal usage of the country. The amount of coal consumed for various purposes in that year was 179 million tons, of which the proportion burnt domestically in the raw state was over 42 million tons producing 1.14 million tons of smoke, 0.12 million tons of ash, and 1.02 million tons of sulphur dioxide.

No one can readily appreciate the actual volume of these statistics, but all will agree that such pollution of the atmosphere at the present stage of engineering achievement is by no means necessary. The most obvious method of smoke reduction is the replacement of coal by smokeless fuel, and although in this respect electricity has gone a long way, it is the hope of the industry that it will go even further.

The substitution of electric heat for solid fuel has in the past few years come about at a faster rate than manufacturers have been able to cope with on account of the materials position, but within some reasonable time the industry will once again be able to satisfy all the demands for current consuming appliances, and greater efforts to replace the coal fire with electric heat should then be made, as much in the national interest as in that of the industry.

Everyone will recall the intensive campaigns supported by the industry for the popularising of electric cookers, everyone will remember the exhibition displays, designed to promote wider domestic electrification; but so far as we know there has never been in the past a campaign which had as its objective the substitution of electricity for the coal fire. Considerable publicity has been devoted to it, many show houses have exhibited examples, and the time seems opportune for arranging a campaign for the sole promotion of electric heating in all its many forms.

The old argument that the British home is not complete without a coal fire

only holds good where the argument is not countered by all the disadvantages which go with the burning of coal, including the pollution of the atmosphere. Housing committees concerned with post-war reconstruction, architects and even house-holders themselves in many cases claim a coal fire to be as much a necessity in the home as the kitchen sink, though when reasonable, as opposed to sentimental, support of that claim is asked for, the arguments advanced are poor to say the least. In the majority of the post-war building schemes so far examined, the main heating arrangements follow broadly, those in general use before 1939, and we shall be thus faced with the same conditions of air pollution as at present prevail, qualified only by the fact that the voluntary use of portable electric fires will be more general.

Public Need of Guidance

THE subject of electric space heating is only vaguely understood by the public at large, and until some form of intensive education campaign is designed to teach them, it is reasonable to suppose that the industry will make little headway towards substituting electricity for coal except in those instances where radiant fires are used. The popularising of panel and tubular heating has never yet been attempted on a national scale, though there appears to be no really adequate argument against it. The much more speculative and little understood system of district heating has, on the other hand, received much publicity in the lay Press, with, possibly, little appreciation of the economic and technical difficulties involved.

Fifty Years of Wireless

IN the early summer of 1895, began the experiments in transmitting signals through space which ultimately led to the foundation patent of the radio industry and the establishment of the Wireless Telegraph & Signal Co., later to be known as Marconi's W/T. Co. With the present development of the radio industry it is perhaps, hard to realise that it is only fifty years since the commercial application of the Hertzian wave phenomena came into being, and even less is it appreciated that it was only in 1901 that signals were first received by radio across the Atlantic. The majority of the men who conducted these early experimentations are, fortunately, still with us, and though we may be anticipating the intention, we suggest that there should be this summer, a get-together-meeting of those spade workers. The success which attended their efforts is evident in the organisation which exists to-day under the chairmanship of Admiral H. W. GRANT, and in the wide application of wireless to communication, navigation, broadcasting, electronic devices, and in the radio industry itself. Even the conducting of War has, since 1900, been materially changed as result of radio, though whether that is an advantage or not may be in some doubt.

Severn Barrage Scheme

IN the twelve years since the first report on the Severn Barrage Scheme, developments in the design of hydro-electric plant, increases in coal costs, and electricity expansion have done much to out-date the recommendations made in 1933. Recognition of these conditions is made clear in the second report on the scheme, published on Monday, and though much in the original report is confirmed in the later report, there are substantial changes, as will be appreciated from the abstract given in this issue; an abstract which for reasons of space is of necessity shorter than it would otherwise have been. The findings of the panel which drew up the 1945 report are based on common-sense reasoning, and the case as presented shows the barrage scheme to be practicable and economically possible, subject to certain conditions. These conditions are largely concerned with coal costs and as was to be expected, the panel reached many of their conclusions by comparing the efficiencies of thermal stations with the potential efficiency of the Severn scheme. The impression gained from the report is that though the scheme may be justified under the conditions stated, before a decision is reached to proceed with construction, many considerations outside the scope of the panel will need to be taken into account.

Coal Costs and National Economy

THAT this is so is indicated in five appendices which Mr. S. B. DONKIN contributes to the report on methods of utilisation of the energy from the barrage, the gross and net electrical output,

sub-stations and transmissions, expenditure and capitalised interest during construction, and coal saved by tidal energy. The value of the scheme from an economic point of view is based on the assumption that the price of coal will have risen to 49s. 1d. per ton by about 1962, and judging by present trends this may well be. It has been suggested that the barrage should be built in order to conserve our coal assets and this it would do at the rate of 985 000 tons per annum, during the first fifteen years. Bearing in mind that the domestic consumption of coal in 1938 was around 42 000 000 tons and for the whole country 179 000 000 tons, the Severn scheme would, we submit, be an economy, too expensive to justify on those grounds alone.

Distribution of Industry Bill

WHILE one Minister last week was talking of post-war trade and declaring that Britain's salvation could be found only in expansion and freedom, another Minister was bringing forward a Bill to limit the freedom of the manufacturer to establish his works in the place which his knowledge, experience and judgment may tell him is best for his industry. The Distribution of Industry Bill is said to be intended to provide more varied employment in what were formerly known as "special areas"; but a general provision lays it down that the Board of Trade must be notified of all proposals to erect anywhere, industrial buildings with an aggregate floor space exceeding 3 000 sq. ft.

A Wrong Approach to Expansion

THE Board may by Order prohibit the erection or extension of industrial buildings exceeding 3 000 sq. ft. in any area where further industrial premises would be "seriously detrimental to the proper distribution of industry"—the Departments in Whitehall presumably deciding what constitutes proper distribution. There will be vigorous criticism, in Parliament and outside, of a legislative proposal which would carry State regimentation of industry into the peace years. Control of industry has been accepted in war-time under emergency powers regarded as necessary for the successful prosecution of the war, but every proposal to perpetuate controls without limit will be fought. Industrial expansion and the rehabilitation of trade and commerce cannot be assured by continuing controls and restrictions, nor can the promises of the restoration of our liberties be fulfilled by measures of the kind now being introduced.

An Ice-Cream Problem

THOUGH the decision of the Minister of Food, last November, to permit the sale of ice-cream, will have pleased the hearts of many small boys and girls, to say nothing of their elders, the Council of the C.E.R.A. was thereby presented with a problem. News of it became general at the annual meeting last week for in the report of the Council is explained that the difficulties encountered by the industry in renovating and servicing ice-cream plants to meet the demand, were by no means lessened by the lack of certain refrigerants, scarcity of small motors and spare parts for ice-cream plant generally, and the shortage of man-power. However, judging by the amount of ice-cream being consumed, the problem has been solved, at least sufficiently well to meet immediate demands, and the Council are to be congratulated upon the way they have satisfied the public taste.

The Ministry of Fuel

THE debate on the second reading in the House of Commons of the Bill designed to give permanence to the Ministry of Fuel and Power, will have done little to change the views of the industry with respect to its formation. In expressing our dislike of the Ministry at the time it was brought into being, we were voicing the opinion of the industry, and experience since then has shown that the Ministry is by no means as appreciative of the electrical idea as it ought to be. It opened its career with a plea for the union of all the fuel industries and a hope that the gas and electricity supply industries would "co-operate" in all future development. Many well-known personalities in the electrical industry have voiced their doubts of the benefits which the Ministry claims to offer electricity supply, and if its record so far is any indication of what may be expected in the future, the heated proceedings in the House, last week, will be as nothing to the criticisms which are yet to come. The supply industry has done, and is still doing, a magnificent job; it is doing it, however, not because of the Ministry, but in spite of it.

Llynfi Power Station

Brief Details of Air-Blast Switchgear and Other Features

THE Llynfi power station, Glamorganshire, has the double distinction of having been put into commercial service in record time for a war-time undertaking and of being the first station in the country to be fully equipped with e.h.t. air-blast switchgear. Edmundsons Electricity Corporation, who designed and constructed the station for the South Wales E.P. Co., received from the C.E.B. in March, 1942, a request to take steps for the building of the new plant at Llynfi, and the construction work commenced on the site in the following May. It was intended that the station should be a duplicate of Little Barford, but Llynfi presented different physical and geographical conditions, necessitating considerable modification of the Barford layout. To suit the characteristics of the Welsh fuels the boiler design had to be altered, and the cooling plant redesigned. The water circulating system, too, called for changes in the type of pumps used, screening plant and the cooling tower. It is of interest to note that the latter, 202 ft. high, with a base diameter of 180 ft., is, it is believed, the first in the country to have reinforced concrete filling instead of timber.

Another departure from the Little Barford model is in the ash plant. It is similar in general layout, but the ash is pumped from the ash basement through a pipeline to a valley some 2 000 ft. away and deposited at a point about 150 ft. above the station level.

High Thermal Efficiency

The ultimate capacity of the station is 120 MW, made up of four 30 MW sets. There are two sets now in commission, each set being served by a boiler of 300 000 lbs./hr. evaporation, at a pressure of 675 lbs. per sq. in. at a temperature of 910°F. The designed overall thermal efficiency of the station is 28 per cent., and the average for the first 12 months was 26 per cent. It has exceeded 27.6 per cent.

As at Little Barford the two turbo-alternators, with their boiler plant and ancillary equipment, each operates as one unit, and are housed in one building without dividing walls, but as compared with those at Little Barford the boilers are back to front.

The Great Western Railway, linking Bridgend with Maesteg, runs along the southern boundary of the site and serves the station sidings.

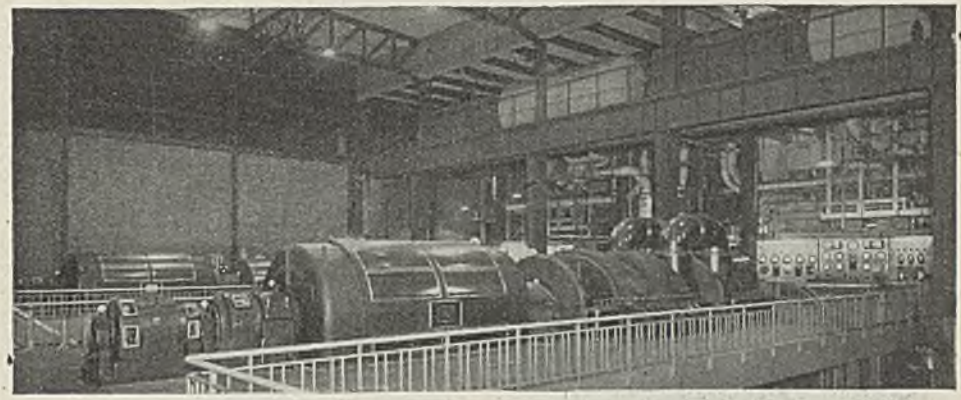
At the moment Llynfi is not connected directly to the grid, but there is provision for this to be effected. Power is fed into the South Wales network from the outside 66 kV switching station by four lines, one going direct to Upper Boat station, another to the Pyle transformer station, and the other two, respectively, to St. John's East and West sub-stations.

Coal Handling Features

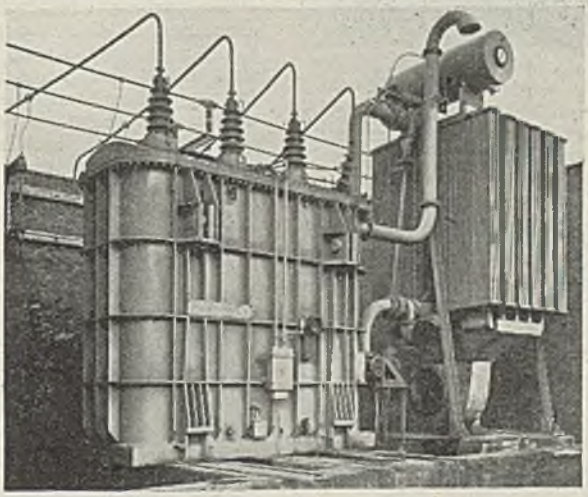
The coal handling plant, by Spencer (Melksham), Ltd., has a capacity of 120 tons an hour. From the sidings wagons run down a slight gradient to the twin tipler and weighbridge platforms. The coal falls into a central hopper covered with a grid of 6 in. × 7 in. mesh, and that which passes through is carried on a 40 in. wide rubber feeder belt to a 30 in. conveyor belt, at the head of which is suspended an electro-magnet for removing tramp iron from the fuel and thus preventing damage to the mills. On arrival at the junction tower between No. 2 belt and No. 3 belt the fuel can be diverted through a chute to a concrete-floored storage area capable of accommodating 24 000 tons, or it can pass through a hammer type crusher and a ¾ in. jigging mesh discharging on to No. 3 belt, which raises it to the bunker room at the top of the boiler house, where a reversible travelling shuttle conveyor makes it possible to deposit coal at any point in the bunker system.

The volume of coal is measured as it passes through the gravity chutes into the mills. Three B. and W. Mills, each capable of dealing with 7.6 tons per hour, are provided for each boiler. Their capacity is such that two can supply 80 per cent. of the boiler load. This permits mill maintenance to take place without impairing greatly boiler efficiency. The temperature of the air supply to the mills is controlled by a damper system.

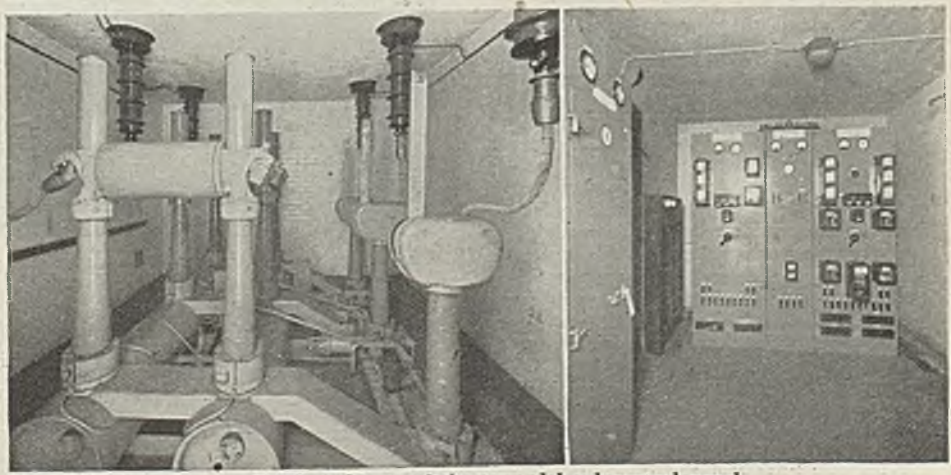
The two Stirling boilers are of the tri-drum design, class WB 58/3+5, with front, side, rear and hopper bottoms of Bailey wall construction, the whole comprising 16 902 sq. ft. effective heating surface. Each unit has a Stirling horizontal multi-loop superheater of 2 in. tubes in primary and secondary stages controlled by an attemporator, with George Kent's automatic temperature control. Each unit has also a B. and W. continuous loop economiser, 30 wide by 18 loops high of 2 in. tube, comprising 13 560 sq. ft. heating surface; and a pair of James Howden Ljungstrom air heaters, comprising a total of 67 200 sq. ft. heating surface, giving a



At the top of the page is a general view of the two 30 MW turbo-alternator sets at Llynfi



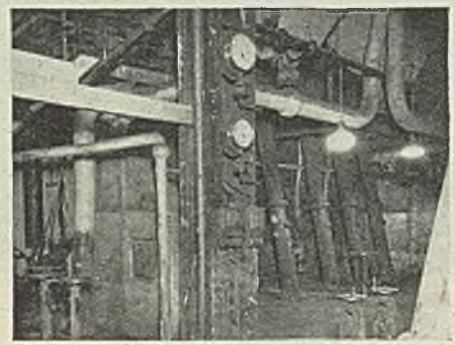
Centre: One of the 37 500 kVA 11/66 kV transformers with single oil cooler



66 kV air-blast switchgear and local control panel

temperature of 463°F. leaving the preheaters at m.c.r. load.

Each unit is fired by 12 B and W. downward fish-tail burners supplied with pul-



View of one of the boiler units

verised fuel from three mills. The oil burners for starting-up purposes are automatic in operation, and lighting-up is by h.t. ignition.

The working pressure is 675 lbs. per sq. in. at the superheater outlet valve; temperature 910°F.; feed to economiser at 370°F., and boiler feed 480°F. at normal evaporation of 270 000 lbs. and 300 000 lbs./hr. m.c.r.

The main draught plant is in duplicate, the suction of the f.d. fans being taken through vertical ducting from a point at the top of the building, giving some reclamation of radiated heat, and improved ventilation. The f.d. fans are driven by variable speed a.c. commutator motors with external induction regulator and speed control.

An electrostatic precipitator is provided for each boiler. At the outlet side are the i.d. fans, which are in duplicate. From the fans the gases pass into the base of the chimney, which serves the two boilers. The ash from the boiler combustion chambers is handled by the hydro-jet system. Each of the dust hopper outlets under the precipitator is equipped with a hydrovactor supplied with h.p. water from the same sluice pumps which supply the water for ash sluicing. From the economiser hoppers the dust is removed by a wind-swept valve of unusual design with an atmospheric connection on one side and a vacuum connection on the other. These are connected through the material at the base of the hopper when turned into the operating position. The dust is thus drawn, as required, into a hydrovactor system and discharged in the same manner as the precipitator dust. Owing to the necessity of pumping the ash to a considerable height two pumps are placed in series, and the plant is in duplicate. The rating of these pumps is 1 500 gals. per min., and the total head which they combine to overcome is 240 ft. of which 103 ft. is static head.

The gas passages are protected against fouling by an installation of 32 soot blowers for each boiler unit. The soot blowers are electric motor driven and are remote-operated by push-button, or automatically under the control of a sequence operating equipment.

Power is generated at 11 kV, three-phase, 50 cycles, and the alternator terminals are directly connected to two 11/66 kV transformers rated at 37 500 kVA, situated in the outside sub-station.

The turbines are English Electric 30MW machines of the impulse reaction type, running at 3 000 r.p.m., with steam pressure of 650 lbs. per sq. in. at 900°F. at the stop valve, and exhausting into a condenser designed for a vacuum of 29 in. Five stages of feed heating are incorporated to heat the condensate to a maximum temperature of 370° F. The condensers are of a special type, having the tubes expanded at both ends. The condenser is divided into two sections,

The control room. A unique feature is that the panels are supported on columns

which allows for one half to be cleaned while the other half is working.

The alternators are of the enclosed, air circuit type, cooling air being circulated by motor-driven fans through water coolers. Each alternator has main and pilot exciters which are also totally enclosed and supplied with cooling air from the main cooling circuit.

The main switchgear comprises an out-

door type 66 kV switching station provided with duplicate bus-bars. The circuit-breakers are of the air-blast type, having a rupturing capacity of 1 500 MVA, and are installed in small brick buildings. The circuit-breakers are of the type employing separate series isolators so that the actual interrupter contacts have only to interrupt the circuit under air pressure, the isolation being effected by separate air-operated isolating switches. The interrupter contacts are allowed to close as soon as the isolators have opened. The circuit is, therefore, remade on the isolator contacts which are designed to do this duty without damage to the current carrying surfaces.

The Remote Control System

The illustration shows a circuit-breaker in the open position. The two horizontal cylinders in the base of the circuit-breaker provide sufficient air for two complete make-break operations when charged initially at 250 lbs. per sq. in. Air is supplied from two storage receivers through reducing valves and bus mains. The main receivers are charged to a pressure of 500 lbs. per sq. in by duplicate motor-driven compressors. Control and relay panels are provided adjacent to each circuit-breaker. In addition, a remote control board is provided in a separate control room for controlling the whole of the switchgear. The design was based on A.R.P. requirements, change-over switches being fitted to local control panels. A further feature of the remote control system is that the selection of bus-bars by the use of isolators is carried out remotely by means of pneumatically-driven isolating switches.

Auxiliary power for the motors associated with each unit is normally supplied from a unit transformer, connected directly to the alternator terminals and stepped down to 3.3 kV for supplying these auxiliaries during the starting-up period. Two 66/3.3 kV transformers are also provided. These supply power also for lighting, heating, coal and ash handling and sundry other requirements. The 3.3 kV switchgear is of the air-break type mounted in truck type cubicles. The larger motors are wound for 3.3 kV and are controlled directly from the main switchboard. The smaller motors are supplied at 400 V through a number of transformers stepping down from the 3.3 kV supply. The whole of the 400 V control gear comprises air-break contactors backed up with h.r.c. fuses.

D.c. supply is provided for emergency lighting and for the various control services by means of a 500 Ah 230 V battery. The battery is normally allowed to float across a pumpless steel bulb rectifier equipped with automatic voltage control. Another similar rectifier supplies d.c. at 400 V for cranes and lifts, change-over switches being provided so that one rectifier can be used as a standby to the other.

Our illustration shows the layout of the control room panels which are of the sheet steel cubicle type, a unique feature being that the panels are supported on tubular steel columns, so that the panels themselves do not go down to the floor. The whole of the wiring to the panels is taken through the tubular columns supporting the control board to terminal boards and coupled to sealing ends which are situated in the basement.

The River Llynfi, which bounds the site on the north, supplies water of reasonably good quality, but the normal flow is insufficient to fill full condensing requirements. For this reason it was necessary to erect a cooling tower of 2 500 000 gal. an hour capacity.

The main circulating water pumps are of horizontal spindle type, driven by squirrel cage type motors. There is one pair per unit and one spare.

Electrical Contractors

In addition to both turbo-alternator sets and all station transformers, the English Electric Co., Ltd., supplied the surface condensing equipment, the d.c. switchgear together with the grid controlled mercury arc rectifier, the whole of the 66 kV air-blast switchgear, the control room equipment, and the 3.3 kV air-break switchgear. The other main contractors included Contactor Switchgear, Ltd., who supplied the motor control gear; Bailey Meters and Controls, Ltd., the automatic combustion control and unit control boards; Laurence Scott and Electro-Motors, Ltd., boilerhouse auxiliary motors; Sturtevant Engineering Co., precipitators and vacuum cleaning plant; James Howden and Co. (Land), Ltd., fans and air heaters; G. and J. Weir, Ltd., boiler feed pumps; Drysdale and Co., Ltd., circulating pumps; Film Cooling Towers (1925), Ltd., cooling tower; Blakeborough and Co., circulating water screens; Patersons, Ltd., water filtering plant; Chimneys, Ltd., chimney.

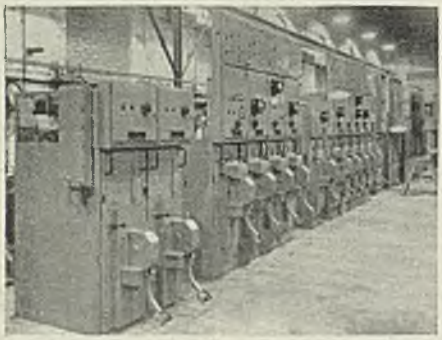
Thanks are due to Mr. H. Ewbank, chief engineer of Edmundsons Electricity Corporation, Mr. J. Palmer Rees, the station superintendent, and Mr. E. McCabe, generating engineer, for supplying information for this article.

Post-war Planning.—The Glendale (Northumberland) R.C. has approached the North-Eastern Electric Supply Co., Ltd., and the Scottish Southern Electric Supply Co., Ltd., regarding post-war electricity plans for the district. The former have replied that pre-war plans which have been held up on Government orders are now being brought up to date, while the latter asked for details of the council's post-war housing plans to help the firm draw up its development plans.

What Manufacturers are Doing—VII

Some Switchgear and Transformer Developments

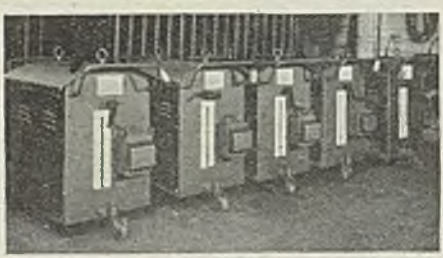
AMONG new developments produced by the switchgear and transformer departments of Johnson and Phillips, Ltd., during 1944, was air-insulated metal-clad



J. and P. type AG air-insulated metal-clad switchgear

switchgear with vertical isolation. The equipment incorporates a cross-jet box breaker and its width is 1 ft. 10½ in. It has been designed for sub-station and small power station use, and is suitable for voltages up to and including 11 kV, and for breaking capacities up to and including 250 MVA. A considerable number of these units have been sent to South Africa.

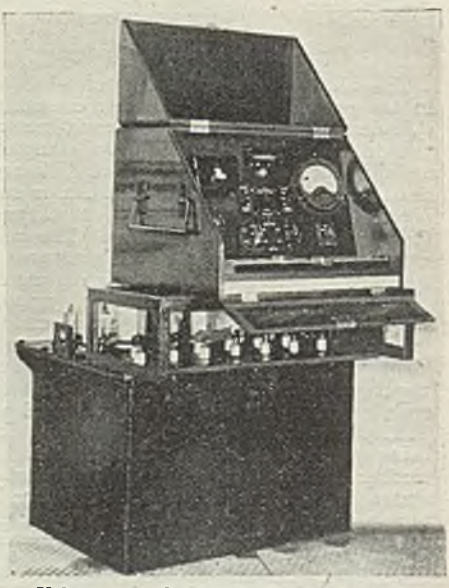
A single-operator portable a.c. welding set was also introduced last year. This equipment is suitable for welding all ferrous metals and ferrous alloys. It is lighter than other welding sets of this type, and can be used for a.c. supply voltages ranging from 190 to 440. The design provides a continuous hand-welding current of



Single operator portable a.c. welding sets

from 30 to 250 A, in two ranges by manual control with the standard five yards of cable in circuit.

The need for a quick yet accurate method of testing voltage transformers is met by a design patented by the company. The equipment consists of a special testing transformer which, in effect, combines the functions of a step-up unit, and eliminates the necessity for any phase-splitting circuits. It can be made to have errors that can be proved to be negligible, so it is claimed, making the system equivalent to



Voltage transformer testing equipment

one that is absolute. Changing from one phase to another is accomplished by means of a pair of multiple switches, there being no need to switch off or touch h.v. connections. Balancing is effected by two slide wires or decade potentiometers.

New Educational Charts.—Two new charts have been added to the E.A.W. "How It Works" series. They illustrate the construction of the electric refrigerator and the electric refrigerator mechanical unit. The charts, with "The Electric Suction Cleaner" published earlier, are reproduced in a three-page coloured leaflet which is useful for desk work, as all lettering is easily read. The charts are 4s. each post free; set of three 11s. post free. The leaflets are 2s. a dozen.

We Visit Eindhoven

A Further S.H.A.E.F. Facility—The Philips' Works

THIS is not a pretty story. It is not pleasant to write nor will it make happy reading. It was told in a room at Philips works in Eindhoven where, in May, 1943, five men were sentenced to death by the Gestapo for going on strike.

Our representative's informant was a Philips' employee who must remain anonymous in consideration of his friends still in occupied Holland.

The story must start before the war and the occupation of Holland by the Germans. Then, Philips in Eindhoven was a happy works; practically all the towns-people were employed in the company's factories making lamps, radio equipment, valves, x-ray equipment, film apparatus and other things. To all intents and purposes Eindhoven was Philipstown; the company had built houses for its works-people, schools, hospitals and recreation centres and in every way it looked after their welfare. More than 15 000 people were employed.

Turn now to the events that followed the occupation. Naturally such an important organisation as this was of vital importance to the German war machine, and employment figures rose to more than 23 000.

At first the Germans were hated silently, although to start with they behaved most correctly. Everyone in the factory, except for a handful of " quislings " decided upon a " go-slow " policy and even with over half as many workers more under occupation as there were during peace-time production, figures dropped to 40 per cent. of what they were in 1939; this in spite of the priority given to raw materials. No German nationals or overseers were introduced to any of the factories and the running of them was made the responsibility of the company's board of directors.

Work Under the German Yoke

Under what are best described as nightmare conditions, and living in daily dread, work proceeded slowly with many excuses until the end of April, 1943. From that date onward the Dutch people and the Germans became open enemies and a strike started in the Philips works, spreading all over Holland. The strike broke out on a Thursday when 23 000 employees at the Eindhoven factories failed to report for work. On the Saturday, the Germans entered the main works and demanded that the directors instruct all employees to return on the following Monday. Our representative was told of the feverish printing of leaflets asking workers to return. " On Monday," said our informant, " A mere thousand were waiting for the gates to open and at twelve o'clock the Gestapo moved in and the five Dutch directors were told they would have to stay in their room until permitted to leave. Outside communication was forbidden.

Gestapo Methods

" Later that morning the Gestapo officials advised the directors that unless all the employees returned the same afternoon, they would be shot.

" The position was almost impossible. our employees were scattered all over the surrounding districts. In the afternoon the directors were told that their clothes had been sent for and they were all put into cars and taken away.

" At four in the afternoon the Gestapo ' picked-up ' the first five men they saw. The five men were all employees in one or other of our factories, and they were told that they were to be tried for striking.

" The trial was a pitiful farce. Three Gestapo men sat at the table and told each man that he had gone on strike unlawfully and would be shot immediately. None was given a chance to reply. The whole thing took less than a quarter of an hour. Each man was subsequently shot.

" The following morning the strike was over, though from then on it was open warfare. We all worked for the underground movement; we all listened to the B.B.C. though we knew if we were caught we would be punished.

" The Germans banned all wireless sets but here, in the Dutch home of wireless, it was impossible for them to locate every set.

" In spite of being closely watched we even managed to build a secret transmitting station ready to be opened up after our liberation. We started work on this in 1941 and not a single German knew about it, although at times there were three Germans for every Dutchman in the town.

" The Germans put trustees into the works and these had to be changed three or four times because not one could obtain the results demanded.

" After the war we shall have a memorial in the factory where the shooting took place, and it will be shown to any German who visits us.

" Towards the end, open demonstrations were being made against the Germans and the Philips works were several times referred to as the ' English Fortress in Holland '."

To-day, the works operate with only fifteen per cent. of the power needed for,

more or less, full employment. There are some 20 000 workers employed and out of the 3 500 employees deported to Germany during the occupation more than 2 000 are still held.

In 1938 the works consumed 48 000 000 units of electricity of which they generated 10 000 000 by means of their own plant. The maximum load was then 15 000 kVA, while the installed capacity amounted to 25 000 kVA.

Before they left, the Germans took away all the precision machinery they could transport, and sabotaged all the plant that might be of use to the Allies. To-day, the works booster plant supplies, as best it can, the whole town with power and light.

The Germans left Eindhoven on September 5, and took with them over 200 railway vans and 200 lorries loaded with machinery and materials. A few days later they returned and organised looting. They took all the industrial diamonds, blew up furnaces and power houses.

Given gas, electricity and coal, the directors of the Philips organisation feel that reasonable production could start in all the factories almost as soon as the liberation of Holland is completed.

But prosperity does not depend on production alone, for Holland is almost without bridges; roads and railways have been damaged and commercial transport will, of necessity, have to remain at a standstill for a considerable period.

With reference to the Allied bombing of the Philips factory, on December 6, 1942, our representative was told that only three or four people were hurt. The first raid was less accurate than the second and third, but as a result of the raids the head-office was completely destroyed and the whole valve factory wrecked. The bombing provided more excuses for the go-slow movement.

To-day Philips are working for the Allies so far as the present electricity supply will permit.

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.

Sir Kynaston Studd Memorial

Sir,—As chairman of the Appeal Committee, I would like to ask for your support in aid of a memorial to our late president, Sir Kynaston Studd, who died January 14, 1944. It is proposed to complete the Great Portland Street Annexe of The Polytechnic as a permanent memorial, the first portion of which was opened in 1929 by Queen Mary. This additional accommodation will be urgently required after the war to meet the needs for technical and commercial education, as well as social amenities for the young people now serving in the Forces when they are demobilised, and also for those coming straight from school.

The Polytechnic was the pioneer institute in this country for technical education and has for many years taken a leading part in athletics, and in many spheres has gained a world-wide reputation. It will have a very important role to fill in the post-war era.

Sir Kynaston Studd longed for the completion of the new building. The designs were formulated and approved by him before the outbreak of war and they embody all he had at heart, and it is felt that no fitter memorial can be conceived for such a man. I hope, therefore, to enlist your sympathy and support.

Donations will be gratefully received and if more convenient, may be spread over a number of years. Annual subscribers by completing a deed of covenant for seven years (or life, whichever is the shorter period), enable The Polytechnic to recover income tax on their subscriptions, and can themselves deduct the amount of the subscription from their surtax return. Forms for this purpose will be gladly supplied by the secretary of The Polytechnic.

Yours faithfully,

HAILSHAM,
Chairman of the Appeal Committee.

The Polytechnic, Regent Street, W.1.

Notes for Contractors.—Gummed strips on which are printed amendments dealing with agreements as to wages and industrial conditions generally have been issued to members by the National Federated Electrical Association for insertion in the War Emergency Supplement of the "Electrical Contractors' Year Book," and the booklet entitled "Industrial Agreements and National Working Rules."

The N.F.E.A. draws attention to the Order reducing the limit of expenditure on building work without licence from £100 to £10 in areas described in the schedule, and states that applications for a licence to carry out essential work should be made immediately to the Borough or Rural District Council. Work necessary to remove danger may be put in hand without a licence, but the Council or Regional Licencing Office should be notified as soon as possible.

Severn Barrage Scheme

Its Practical Possibility and Economic Value Reviewed

THE panel, made up of Mr. A. G. Vaughan-Lee, Sir William Halcrow and Mr. S. B. Donkin, appointed by the Ministry of Fuel in November, 1943, to review the conclusions of the Severn Barrage Committee 10 years earlier, have made their report (Stationery Office, 2s. 6d.), and while they agree with the general principles of the earlier report, certain changes are suggested. With an average overall increase in prices reckoned at 65 per cent. above the 1936 figures, they estimate the cost of the scheme at £40 216 700 (with a transmission system, £47 006 700), against £24 454 000 and £28 640 000 respectively. The report states that, if construction started in 1947, the barrage works and plant could be working by 1955, and some energy might be available earlier.

The reef in the Severn estuary known as English Stones is still regarded as the best site for the barrage, and single tide working, generating power on the falling tide only, is considered the most suitable. The maximum power available at spring tides would be 800 000 kW, and the average annual output of energy at the barrage sub-stations would be 2 190 000 000 kWh. At the points of reception it would be 2 107 000 000 kWh during the first 15 years, and 2 207 000 000 thereafter.

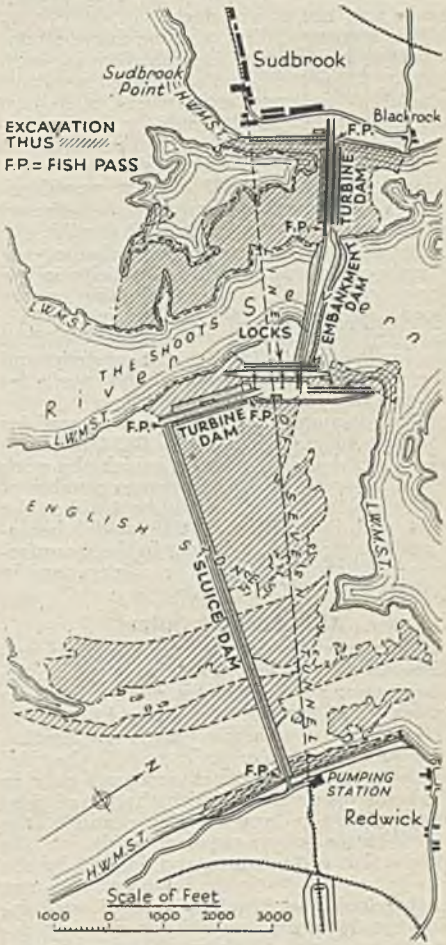
Changed Conditions Since 1933

Since the 1933 report was prepared three major variations in the conditions affecting the project have occurred. The first, developments in the design of hydro-electric plant have affected possible layout to the extent of permitting the length of the turbine dam to be reduced, leading to a more concentrated flow of water over the English Stones. Because of this the turbine dam could be in two parts, each containing 16 turbines, or 32 in all; each turbine could have an output of 25 000 kW. The second point affecting the original scheme is the increase in the price of coal delivered to power stations since 1933, and the third is the expansion in the supply and control of electricity.

It will be remembered that the 1933 Committee recommended the adoption of a system of pumped storage to overcome the variable and intermittent character of tidal power, but the present report claims that such storage is neither essential nor economic.

After consultation with the designers and manufacturers of suitable generating plant, it is recommended in the report that 32 water-wheel alternators, each of 25 000 kW at .9 pf. be installed. Turbines of the Kaplan type would be directly coupled to the alternators and would run at 50 r.p.m. The alternators would generate three-phase, 50 cycle a.c. at 11 000, 22 000 or any intermediate voltage.

The barrage output could be most economically employed in the S.E. and E. England, the Central England, and S. W. England and S. Wales areas of the grid scheme from outdoor sub-stations on the Monmouth and Gloucester shores, accommodating step-up transformers giving 132 or 220 kV as required. Each 220 kV circuit would start at one or other of the barrage sub-stations and terminate at a point in the



Part of the layout proposed in the report

London or Birmingham area, as the case may be. Power to the S.W. England and S. Wales area would be transmitted over the existing 132 kV lines.

In contrast to the 1933 conclusions, the report states that the road and railway crossings should be treated independently of the power scheme. A new dock area above the barrage is described as a matter of trade and policy, but the value of the basin created by the barrage is discounted by the fact that it would have a tidal variation of level of 20 ft., thus being a tidal basin and not a wet dock.

It is suggested that a sluice dam be constructed across the English Stones, containing 128 sluices, and of these 31 would be placed at a lower level where a natural channel exists, which would be further improved by deepening. This arrangement and the siting of a sluice dam higher upstream than in the 1933 lay-out, would enable a considerable saving to be effected in the excavation of the English Stones.

In view of the rapid expansion of the supply of and demand for electricity in the country, intermittent and variable energy from the barrage could be used in conjunction with existing and new coal-fired stations connected to the grid system, and the report considers that the need for storage of energy no longer arises.

The estimated average saving in coal for the first 15 years is given as 985 000 tons a year. In the eight years in which the work could be completed, the average number of men employed yearly would be 4 570 at the site, and in addition, 6 285 would be indirectly employed each year in the manufacture of cement, steel, and machinery, and in the transport of materials.

Utilisation of Output

The report includes a number of appendices by Mr. S. B. Donkin in which he says, among other things, that though no industry it at present equipped to utilise intermittent, variable and progressive energy supplied in accordance with the tidal cycle, it is possible that processes may in future be devised for which the use of tidal power could be applied; for example, the manufacture of magnesium oxide, or the production of hydrogen and oxygen by the electrolysis of water. Even so, it is not anticipated that the products of such industries, however, would be in sufficient demand to absorb the barrage output in the immediate post-war period.

It is suggested that district heating could utilise the whole energy from the barrage by providing sufficient heat for a number of towns within say, 50 miles of the barrage, the heat being used for space heating and hot water. There can, however, be no reasonable expectation that district heating will be developed on a sufficient scale to absorb the barrage output, or any substantial part of it, for many years to come.

The intermittent and variable characteristics of the barrage output prevent continual coincidence of the tidal peaks with the peaks of daily demand on the grid system. From an analysis of the tidal output and its relation to the system load curves, it can be shown that about 37 per cent. of the tidal energy would be absorbed during the grid peak loads. The variable barrage output might contribute, therefore, either to the relief of the less economical coal-fired stations during peak load periods, or to the relief of more economical base load coal-fired stations during off-peak periods.

Relation to Thermal Stations

The kilowatt capacity of the barrage energy would therefore be of no value from the point of view of sudden demands for power, either due to extreme weather conditions or due to any major breakdown to coal-fired stations, because the barrage power might not be available at the time when it was required. The number and capacity of coal-fired stations would therefore be just as great with the barrage as without.

Intermittent and variable tidal energy, may be classed as " dumped " energy if it is to be absorbed by the " grid " system as and when and to the extent it is available. Dumped energy having such characteristics, could also be supplied by coal-fired power stations at off-peak times. Tidal energy can under certain conditions, dependent on capital charges, working costs, and price of coal, be supplied at a cost not greater than the average cost of energy from coal-fired stations and in doing so saves the consumption of coal that would be necessary if it were supplied from such stations.

Some value should be given to the barrage scheme when running in parallel with coal-fired stations for providing greater time and opportunity for maintenance of the coal-fired stations, which could be arranged to suit the times of the tidal impulses which are known in advance. It is not proposed to place any monetary value on this advantage.

The system of operation of the barrage when running in parallel with coal-fired stations would involve the regulation of the output from a proportion of the coal-fired stations to balance the intermittent and variable output from the barrage. Such regulation and control could be undertaken.

The financial value of the barrage scheme would depend on the price of coal per ton, which has steadily increased since 1933.

It is suggested that the average price of coal necessary to pay the total annual charges over the first fifteen years of operation would be 49s. 1d. per ton when coal

was saved at the rate of 1.046 lb. per kWh. This price would certainly be possible in 1962 as the average price in August, 1944, was 42s. 2d. per ton and it only represented an average rise of about 5d. per ton per annum over eighteen years.

The following statements cover the results for the beginning and end of the second 65-year period of the life of the barrage. In view of any difference between what might be the actual, and the predicted, thermal efficiencies for this period, there would be variation in the quantity of coal saved per kWh. Figures in the report show the effect of these variations, on the price of coal with the known cost per kWh of barrage energy delivered.

The cost of generating and transmitting energy from the barrage is estimated at 0.262d. per kWh in 1970. This figure is obtained by dividing the total annual capital and running charges of £2 415 239 by the number of kWh per annum of energy available at the points of reception in 1970, i.e., 2 207 million. Assuming that the coal saved per kWh delivered during this year was 0.986 lb. this value when related to total annual charges and cost per kWh, gives the price of coal as 49s. 7d. per ton.

The statutory increases in the cost of coal in 1944 being 3s. and 4s. per ton in February and August respectively, bring the calculated present-day average cost of coal delivered to bunkers to 42s. 2d. per ton in the S. E. and E. England, S. W. England and S. Wales, and Central England areas, which is approaching the figure of 49s. 7d. for 1970. This increase would be necessary from 1944 to 1970 (i.e., over a period of 25 years) representing an average increase of 3.56 pence per ton per annum. As already stated the rise from 1944 to 1962 requires an average increase of about 5d. per ton per annum.

Coal is a diminishing national asset, and conditions ruling at the present time seem to indicate that the trend of increasing coal prices and associated transport costs may be maintained. It is not therefore unlikely that the average price of coal delivered to power station bunkers during the year 1970 would be 49s. 7d. per ton or that the price in 1962 (average of the first 15 years of operation) would be 49s. 1d.

For the end of the 65-year period the tidal energy per annum would remain constant at 2 207 million kWh and the cost would be 0.262d. per kWh. The required price of coal to pay the annual charges would be 90.5s. per ton, and the rate of increase over the 65 years would therefore have to be about 7½d. per ton per annum.

Atmospheric Pollution

Joint Fuel and Smoke Abatement Conference

AMONG the papers read at a joint conference of the Institute of Fuel and the National Smoke Abatement Society at the Institution of Electrical Engineers, London, on February 23, was one on "Electricity Generating Stations: Cleaning of Boiler Plant Flue Gases," by Mr. John Bruce.

The author said the electricity supply industry had always appreciated that everything scientifically and commercially possible should be done to mitigate atmospheric pollution, and he proceeded to give a clear and concise account of the energetic steps taken by the owners of generating stations 20 years ago to prevent nuisance from chimney emission, and the application and development of dust extraction plant that had taken place since then.

At the opening of the conference Mr. Tom Smith (Parliamentary Secretary to the Ministry of Fuel and Power) said the gas and electricity industries would have to improve distribution and reduce cost. He could not discuss Government policy on this occasion, but the Hayworth Committee was looking into the gas industry and there had been a good deal of discussion with regard to policy concerning electricity.

Dr. R. Lessing said special attention had been drawn by one speaker to the emission of sulphur into the atmosphere from the burning of coal. In the past, this had taken second place, but the ravages of smoke pollution had been caused by the sulphur in it. This was a point to which attention must be given in the future, and the solution was not impossible. For instance, in the case of the Fulham and Battersea power stations, by treatment of the flue gases they were extracting the equivalent of at least 10 per cent. of the total sulphur emitted from the coal burned in London. This emphasised what Mr. Tom Smith had said that this problem must be regarded as a communal one and that wherever possible there should be the concentration of generation of energy in power stations and gas works.

Sir James Kennedy (vice-chairman, Electricity Commission) said the electricity supply industry had been forced to consider the question of the reduction of

pollution, because if they had not made every endeavour to burn coal efficiently, they would not have been able to sell electricity at prices which the consumer could afford to pay. Furthermore, the Electricity Commissioners had been making more and more stringent conditions relating to the extensions of existing power stations and the establishment of new ones, and had insisted on the installation of the latest types of plant for the removal of grit from the flue gases. In the case of new power stations, the Commissioners insisted on space being left for the installation at a later date, if required, of gas washing plant for the removal of sulphur from the flue gases. At the Battersea and Fulham power stations practically the whole of the sulphur was removed from the flue gases by a washing process. That process, however, was expensive and added to the cost of electricity, and at the request of the Commissioners the Department of Scientific and Industrial Research set up a Committee to make recommendations as to what form, if any, of gas washing plant should be installed in the future. He made this plea on behalf of the electricity supply industry, that although they were prepared to play their part in improving atmospheric conditions, they felt they ought not to be penalised by the insistence on gas washing plants in power stations unless similar conditions were imposed upon industry generally.

The combination of the supply of heat in the form of steam, and electricity from power stations was under consideration by a sub-committee of the Heating and Ventilating Committee and their report was awaited with great interest. Another and, perhaps, semi-political point regarding conditions being imposed upon industry concerning cleaning of flue gases, etc., was that industrial power stations benefitted from de-rating, whereas public electric power stations had to pay rates in full. He stressed the need for the installation of electrostatic precipitators wherever pulverised fuel was used.

Sulphur Emissions

Referring to details given at the conference indicating the comparative emissions of sulphur from coal, gas and electricity, Sir James said the comparison of the SO_2 from gas and coke on the one hand and from electricity on the other hand, was not fair because unless gas and coke were made from coal which had a lower sulphur content than the coal used in the generation of electricity, the total sulphur emission must be approximately the same.

As to the new forms of domestic grate that were being evolved, he felt there would be an inclination to change over to electricity or gas rather than handle the rather delicate apparatus which had been referred to.

Remarking that the smoke emission near railway main lines and districts where locomotives were continually starting up with heavy loads, was really intolerable, Sir James said the obvious solution was the electrification of the railways. This would not only result in a saving of two-thirds of the coal used on steam railways, but it would mean that the coal required was burned under controlled conditions in a power house.

Alternative Fuel Costs

Mr. James Law (chief smoke inspector, Sheffield, Rotherham and District Smoke Abatement Committee) referring to certain comments made on alternative fuels, said he had been taking some records of local institution heating plants and had found the following relative figures: coal, 1.75d.; coke, 3.1d.; gas, 3.2d.; and electricity 6d. As a smoke inspector he ought to recommend electricity because at the moment they had run out of gas, but it was very difficult because compared with coal the cost was three times as much. Expressing a preference for the sprinkler type of stoker, he said this was more flexible and would deal with lower grade fuels. There was more grit deposit with Lancashire boilers using the sprinkler type of stoker than with pulverised fuel fired boilers, because there were no grit arresters and it was not possible to get them at the present time.

Mr. G. P. Tinker (Birmingham Electric Furnaces, Ltd.) thought that not sufficient credit had been given to one type of furnace which was outstanding as regards the prevention of atmospheric pollution, viz., the electric furnace. Here was an equipment, he said, which had proved itself both efficient and reliable. The speaker had mentioned gas furnaces and the elimination of smoke, but surely the conference was concerned with pollution and not only smoke, for the harmful elements such as C_0, CO_2, hydrocarbons and, to some extent, SO_2, were always present. It had been said that sulphur was removed in the gasworks, and that was true up to a point. The average sulphur content of town's gas was 20 gr. per 100 cu. ft., which must inevitably arrive in the atmosphere. The speaker had also referred to efficiencies as high as 60 per cent., but surely he knew that electric furnaces quite easily reached 80 per cent. and even higher. In other words, electric heating was a method in which there was very little loss, due to the absence of flues.

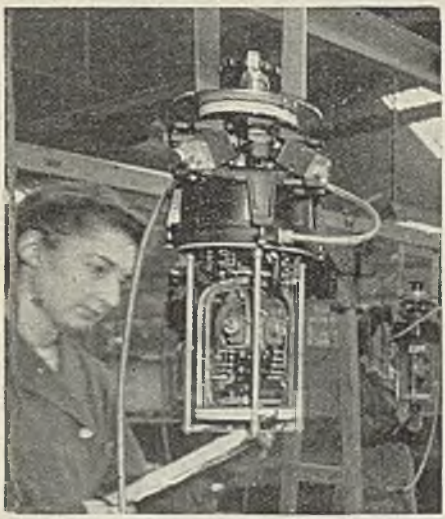
Portland.—A transformer and cables to deal with additional load is to be provided at a cost of £1 100.

Distant Reading Compass

Ingenious Aid to Aircraft Navigation

WE are indebted to Ferranti Ltd., for the following particulars, concerning the distant reading compass, which has made a valuable contribution to our bombing operations.

It was designed by the Royal Aircraft Establishment at Farnborough in order to overcome the limitations which pilots found in the ordinary magnetic compass, which only functions normally when the aircraft is flying a dead level course. This was a disadvantage in operational flying as, after dropping his bombs, a pilot should be able to take evasive action rather than be forced to fly straight for a spell in order to be able to take compass readings. It was also found that in the cockpit the interference from electrical circuits and various metals was considerable. The d.r. compass overcomes these disadvantages. All interference is damped out, and the pilot can "weave" with impunity. Also, the compass remains unaffected by unusual circumstances such as vibration from heavy gunfire, abnormal changes in speed, high altitudes, etc.; and can find the difference between the true and magnetic north.



The compass in the test department

Ferranti Ltd. were asked to tackle this highly complicated piece of apparatus in 1941. They set to work with a will, and, using their own plant and equipment, buildings and skilled workpeople, with no assistance whatsoever, turned out an instrument within 12 months of the placing of a contract.

The d.r. compass comprises a master unit, which is normally carried in the tail of the aircraft as far away as possible from magnetic disturbances. This combines a gyroscopic direction indicator and a magnetic compass, each of which has the effect of checking on the other. Repeaters, situated elsewhere in the aircraft, transmit the indications of the compass and thus, by aligning the pointer and grid lines parallel, the pilot can steer his course.

The directional indicators are also capable of controlling "George" the automatic pilot, and, among other instruments, the Mark XIV bomb-sight.

For both large-scale bombing and pinpoint attacks, and in all enterprises where accurate navigation is essential the value of the d.r. compass cannot be over estimated.

I.E.E. London Students

A new war-time record attendance of over 450 marked the meeting of the I.E.E. London Students' meeting on February 13, when Dr. W. Wilson spoke on "The Cathode-ray Tube and its Applications." After a description of advances made, there followed a detailed description of the high voltage, continuously evacuated tube and the smaller glass bulb sealed-off version. The generation of the beam, its focussing by electron lenses and its deflection and final recording on film or fluorescent screen was clearly explained. A few examples of scanning generators, or time bases were given and circuits both of a constantly recurring and a waiting type were described. A description was also given of the diverse uses of the instrument, and finally a description was given of the electron microscope devised by Dr. Hillier of Toronto.

British Legion.—In its twenty-fourth annual report the Council of the British Legion welcome the steps taken by the Minister of Labour and National Service to set up throughout the country re-settlement advice offices where officials will be in attendance to give advice to those returning to civil life, and states that continued representations have been made, pressing for adequate schemes for the training of fit men and women on demobilisation to equip them for permanent careers.

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.

Capt. R. C. Petter, who has been appointed managing director of British oil Engines (Export) Ltd., has for many years associated himself with the extensive study of export trade and has travelled much in this connection.

Capt. R. C. Petter

Lieut.-Col. Sydney Smith, a joint managing director of Phelon and Moore, and a director of Cleckheaton, Engineering and Motor Co., has been appointed a director of the Yorkshire E.P.C.

Sir Felix J. C Pole has been elected to the Council of Reading University for three years.

Capt. C. W. Grange (managing director) has been elected chairman of the Hankow Light and Power Co., Ltd., in place of the late Mr. W. S. Tucker, and **Mr. Harold Tucker** has been appointed a director.

The Admiralty have announced that **Mr. H. D. MacLaren,** Acting Assistant Director of Electrical Engineering, has been appointed Director of Electrical Engineering in succession to **Sir James Pringle,** who will relinquish his appointment on March 31.

Mr. A. E. L. Chorlton, M.P., owing to pressure of other business, has resigned the position of chairman and director of Lancashire Dynamo and Crypto, Ltd. **Mr. H. W. Bosworth,** managing director of the company, has been appointed chairman.

At the twenty-fifth annual meeting of the National Joint Board of the Electricity Supply Industry, in London, on February 23, **Sir William Walker** was re-elected chairman. He has held that office since the establishment of the Board in 1920. **Mr. G. E. Moore,** president of the E.P.E.A., was elected vice-chairman.

Mr. E. G. Batt has been elected independent chairman of the British Refrigeration Association, which has superseded the Commercial Electric Refrigeration Association, and the Domestic Electric Refrigeration Association. He held similar office with those organisations last year.

Mr. C. C. Hill, deputy engineer and manager of the Brighton electricity undertaking, has been appointed assistant general manager of the Northmet Power Company, and he is succeeded at Brighton by **Mr. T. Yule,** power station superintendent; **Mr. W. J. Gibbons,** assistant power station superintendent, has been made power station superintendent; **Mr. G. R. A. Carr,** electrical maintenance and construction engineer, is to be assistant power station superintendent; and **Mr. F. Lynn,** sales engineer, is to be chief commercial assistant and sales engineer.

The young people at Magnet House, Kingsway, were, once again, the luncheon guests of the Hon. Mrs. Gamage (wife of Mr. Leslie Gamage, vice chairman of the G.E.C.). Afterwards, the guests were entertained at the Stoll Theatre, Kingsway, where they saw J. M. Barrie's fantasy, "Peter Pan." This year's function was the second of its kind to be held during the war and is indicative of the importance

A snapshot taken at the G.E.C. junior staff social

which the G.E.C. attaches to the happiness and contentment of its future senior personnel.

Obituary

Mr. F. B. Collard, for many years contracts manager for Callender's Cable and Construction Co., Ltd., on February 20.

Professor E. G. Baily, Emeritus Professor of Electrical Engineering at Heriot-Watt College, Edinburgh, on February 23. Born on March 18, 1868, he served his engineering pupilage with James Simpson and Co., and from 1890 till 1892 was on the staff of Siemens Brothers and Co. From there he was appointed lecturer on electrotechnology at University College, Liverpool, where he remained until 1895. A year later he was appointed Professor of Electrical Engineering at Heriot-Watt College, Edinburgh, occupying the chair there for 37 years.

News in Brief

School Installations.—The Hove Education Committee proposes to instal new electrical equipment, including electric roasting ovens, and exhaust fans in the new extension of school meals cooking depot. The North Riding Education Committee is to instal an electric lift at Whitby County School in connection with the school meals plan at a cost of £240.

The I.M.E.A. Annual Meeting,—The annual general meeting of the I.M.E.A. will be held on June 14, at the Kingsway Hall, London, W.C.

Social Item.—Superflexit, Ltd., sports and social club held a successful dance recently, at Slough, there being an attendance of 500.

Street Lighting Conversion. — The Preston Corporation proposes to proceed with the conversion of existing street gas lamps to electricity.

Water-heater Installation. — The Clitheroe Mayor's Parlour is to be supplied with a five-gallon automatic electric water heater to provide hot water for the Town Hall.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of February 27, 1920: At a luncheon preceding a visit to the all-electric house arranged by the General Electric Co., at the Ideal Home Exhibition, Mr. Hirst said the exhibition had greatly disappointed him owing to the small part which electricity played in it. Six years of war had caused electric heating and cooking to be forgotten, and the industry was now beginning again where it left off in* 1914. *The real electric home would only come when the price of electricity fell to one-tenth or one-twelfth of a penny per unit.*

Contribution to Rate Relief.—The Exeter Electricity Committee has decided to make a contribution of not exceeding £1 500 to the rate fund.

Dispensary X-ray Apparatus.—The Worcestershire Health Committee is to provide X-ray apparatus at Oldbury tuberculosis dispensary at a cost of £1 200.

Rural Electrification in Northern Ireland.—Addressing a meeting in Belfast, under the auspices of the Belfast Electrical Association, Dr. Scott-Robinson said that he would be pleased to see the State take electricity at low rates to Ulster farms, even though it lost money on the scheme for a year or two. Rural districts should have electricity as cheap as towns.

Location of Underground Services.—The Institution of Civil Engineers, with the Institution of Municipal and County Engineers, have appointed a Joint Committee to draw up notes for the use of engineers on the best location of underground services. The Committee will consist of Mr. W. H. Morgan, county engineer, Middx., as chairman, and ten members. Members representing electricity supplies and post office services have been nominated by or in consultation with the I.E.E., and the Chief Engineer G.P.O. respectively. The Joint Committee will welcome any notes or suggestions which should be addressed to the Secretary, Joint Committee, c/o Secretary, Institution of Civil Engineers, London, S.W.1.

Food Conveyors for Hospital.—The Middlesex Health Committee is to purchase 44 electrically-heated food conveyors for the West Middlesex Hospital at an estimated cost of £2 652.

Birmingham University Developments.—At the annual meeting of the Court of Governors held recently, the Pro-Chancellor said that immediate extension schemes for the University required approximately £1 000 000, of which about £250 000 would be needed for mechanical and electrical engineering.

Birmingham Electric Club. — The annual meeting of the Birmingham Electric Club is to be held at the Grand Hotel on March 19 at 6 p.m. In spite of the war, the growth of the Club continues at a rapid pace, and according to the annual report, membership on December 31 last, numbered 498.

Housing Equipment Demands.—At a Co-operative Women's Guild conference held at Didcot, a demand was made in connection with local housing schemes for a 10 A electric heating point in every room, and also a 5 A point in every room for an electric kettle.

New Canadian Short-wave Station.—An international service was inaugurated by the Canadian Broadcasting Corporation recently, when a new short-wave station was opened at Sackville, New Brunswick, with an address by Mr. Mackenzie King.

Portland Lamp Demonstration.—The Highways Committee reports that it has obtained permission to demonstrate for a period not exceeding one hour, new types of electric and gas lamps, and has made arrangements for the electricity and gas engineers to obtain lamps for the test.

Electricity Supply

Bedford.—The Electricity Committee is to improve the distribution system at a cost of £5 995.

South Shields.—The T.C. proposes spending £5 600 for the supply of electricity to temporary houses.

Stockport.—The Electricity Committee is seeking sanction to borrow £2 260 for the provision of supply to a housing estate.

St. Marylebone (London).—Sanction is being sought by the Electricity Committee for a loan of £2 000 for change of system and pressure.

Elston.—The Electricity Committee estimates for a post-war expenditure of £20 000 for the conversion of the distribution system from overhead to underground.

Torquay.—The Housing Committee has decided to instal in temporary houses cooking and clothes washing apparatus of which 50 per cent. will be operated by gas and 50 per cent. by electricity.

Lichfield.—The Electricity Committee is to lay underground in place of overhead cables to Whittington at a cost of £2 617 and an additional feeder in the Trent Valley district at a cost of £965.

Brighton.—The Public Utilities Committee is to change over the supply in the Hollingbury Road area at a cost of £9 179.

Hull.—Sanction to borrow £5 000 for mains and services and £5 000 for substations, is being sought by the electricity committee.

Aberdeen.—A supply of electricity is to be afforded to the temporary housing site at Rosehill, and the T.C. has approved the laying of electricity cables at an estimated cost of £6 815.

Croydon.—The T.C. is recommended to approve the provision of switchgear, etc., in connection with temporary bungalows on the Long Heath housing estate. The expenditure is estimated at £14 617.

Birkenhead.—The Estates Committee has decided that in 50 per cent. of the temporary houses gas be installed for wash boilers and cookers, and electricity for lighting and immersion heaters, that electricity be installed in the remaining 50 per cent. for all purposes and that the Ministry of Health be requested to state the type of refrigerator which will be supplied.

Result of Kitchen Planning Questionnaire

A QUESTIONNAIRE on kitchen planning, circulated by 52 electricity supply authorities in North-West England and North Wales, produced 3 976 replies (nearly 20 per cent.). The results represent a very fair cross-section of thought in the North-West among present and future housewives.

Replies were divided into two groups with basically different outlooks, namely: Group A— flats and small houses with three bedrooms or less—3 241 (81.5 per cent.); and Group B—larger houses with four bedrooms or more—735 (18.5 per cent.). The relative popularity of various types of electrical appliances was shown as follows:—Group A: 1, cooker; 2, water heater (circular or immersion heater); 3, washing machine; 4, refrigerator; 5 wash boiler. Group B: 1, cooker; 2, water heater; 3 refrigerator; 4 washing machine; 5 wash boiler.

Forty-eight per cent. were in favour of permanently " built-in " kitchen units, 50 per cent. were in favour of movable units, and 2 per cent. sent incomplete replies.

A vote of nearly 93 per cent. was given in favour of a refrigerator.

Those who thought the modern kitchen needed a coal-fired range represented 31.6 per cent., while 66.7 per cent. were not in favour. and incomplete replies were given by 1.7 per cent.

Conventional or " table height " type of cooker: For conventional type (with oven underneath the hot plate) Group A, 66 per cent; Group B, 49 per cent; table-height type (with oven alongside hot plate): Group A, 24.9 per cent.; Group B, 45 per cent.; incomplete, Group A, 9.1 per cent. ; Group B, 6 per cent. Many of those who answered this question had no experience of horizontal cookers. Over sink water heaters: In favour, 84.6 per cent.; against 12.7 per cent.; incomplete, 2.7 per cent.

Home Laundering: The answers showed that in Group A, 76.7 per cent. and in Group B, 51.5 per cent. want to do all laundry at home; in Group A, 19.7 per cent. and in Group B, 45.9 per cent. want to wash " smalls " only at home.

The B.E.D.A. Area Committee in their report on the results concluded that the minimum requirements of the working portion of future homes would be as follows: —A working kitchen of ample size, with sufficient window space to ensure good daylight. Areas of less than 110 sq. ft. would not be acceptable. Equipment should include an electric cooker of the conventional type, a sink (preferably of stainless steel) with draining board, an electric water heater, space for a 3 to 4 cu. ft. refrigerator, and preferably two lighting points, to give good light over the sink.

Industrial Information

E.D.A. Electric Kitchens.—The exhibition of electric kitchens arranged by the E.D.A. at the Building Centre, London, was visited by the Queen, yesterday, Thursday. The closing date for the exhibition has been extended to March 17.

Change of Address.—The Chief Licensing Office, Civil Building Control, Ministry of Works (Chief Licensing Officer, Mr. Winston V. Wastie; Senior Technical Officer, Mr. A. E. S. Payne) has moved from Lambeth Bridge House, to the first floor, 51-54, Gracechurch Street, E.C.3. (Telephone: Mansion House 9855).

Price of Aluminium Reduced.—It is announced that as from March 1 the Minister of Aircraft Production will sell virgin aluminium in ingot or notch bar form at £85 a ton delivered into consumers' works, with extras for purities. As from that date also, the Minister of Aircraft Production will cease to trade in the following forms of unwrought aluminium, which will in future be obtained under licence issued by the Light Metals Control from the normal commercial sources:—Rolling blocks, rolling slabs, billets, and wire bars.

War Risks Insurance.—The Board of Trade announce that all policies for fixed sums under the Commodity Insurance Scheme which are in force on March 2, 1945 (whether policies extended without payment from December 2, 1944, or new policies), will be extended until June 2, 1945, without further payment of premium or the necessity for further action. Holders of adjustable policies will be required to continue weekly declarations and to pay premium on any excess of the average cover during the three months of extension over the average cover in the three months ending December 2, 1944, or in the case of policies effected during the period ending March 2, 1945, on any excess over the average cover in that period. For new or additional insurance under the Commodity Insurance Scheme, the rate of premium will continue to be 2s. 6d. per cent. for the three months March 3 to June 2, 1945, with a minimum of 5s.

Britannic Cables.—The post-war policy of the Britannic Electric Cable and Construction Co., Ltd., was announced by Mr. Laurence Bennett, chairman, at a recent meeting. The company is now a member of the Philco group, and it is intended to continue its independent policy. The company was formed principally to produce paper-insulated cables, but a rubber shop to deal with the manufacture of comparatively heavy conductors to meet certain industrial needs was included in the plant. This side of production has grown considerably during the war, while demands for paper-insulated work were reduced to a minimum by Government control. Plans are in hand to effect a quick change-over at the end of hostilities to a peace-time production, which would embrace the manufacture of high and low tension paper-insulated mains cables, and all types of rubber-insulated power and lighting cables. Mr. A. S. McHugh is the managing director of the company. Research and development are catered for by the Philco group's central establishment, P.R.T. Laboratories Ltd., under the director of research, Group-Captain C. K. Chandler; the cable research section of this organisation will be under the direction of Flight-Lt. Mildner.

Electrical Machinery Traders Unite.—The objects of the newly-formed Electrical Machinery Traders' Association were stated at a general meeting on Tuesday. The chairman, Mr. W. E. Lawton (Industrial Electrical Co., Ltd.) said that after the Government had announced that surplus electric machine tools were to be disposed of, representatives of a number of firms met in London, on January 2, and decided to form an association to enable electrical machinery traders to speak collectively and take appropriate action. It came to their notice that details of a proposed disposal plan were being discussed solely between the B.E.A.M.A. and the Ministry of Supply. The plan had not become an accepted fact and the association was able to make known its view that the electrical machinery traders were entitled to have a say in the preparation of any plan for the disposal of surplus electrical equipment. Negotiations hitherto had taken place very largely between the Machine Control of the Ministry of Supply and the B.E.A.M.A., and as the latter was an organisation of manufacturers of the equipment concerned, the association felt it necessary to raise its voice and say that the matter could not be considered adequately from the point of view of the best interests of the nation if a body like themselves with very large experience was not called in to advise in the preparation of the plan. Further, they claimed a voice in the operation of the plan. The whole thing was now in the melting pot. The meeting endorsed the action that had been taken. The association is to be registered under The Companies Act, and to be national in character, members meeting in Manchester, Glasgow as well as London. Membership is open to all stockists and/or factors of electrical machinery and asso-

ciated equipment, who provide adequate facilities for servicing and repairing the range of equipment in which they normally trade.

Machine Tools.—The Machine Tool Control has announced that the disposal of Government surplus machine tools begins on March 15.

Classification of Copper and Copper Alloys.—This publication, by the Copper Development Association, which gives in tabular form concise data concerning the composition, mechanical properties, and principal uses of copper and the most important copper-base materials, has now been revised and brought up to date. A great deal of essential information is given in the 18 tables which are clearly set out.

Air Raid Incidents at Battersea.—The Battersea electricity undertaking received a share of the damage inflicted during the numerous air attacks on the London area. The most serious was the effect of a direct hit on one of the sub-stations, shown in the photograph reproduced on this page. A temporary sub-station was working within two and a half days. Protective measures prevented serious damage to the generating station. A 500 lb. oil bomb fell on the control room but, due to the provision of a special additional protecting roof, only the nose of the bomb penetrated to the control room, and the fire was confined to the ordinary roof. The glazing and some parts of the roof of the generating station were blown away by a flying bomb, but no serious damage occurred, nor was supply interrupted. A bomb damaged one of the

Sub-station demolished by a direct hit at Battersea

e.h.t. feeders which was in parallel with other e.h.t. feeders supplying an important factory, but due to the use of the special type of cable known as the "Bowden-Thompson," which operated before the main cores were reached there was no interruption of supply.

Contracts Open

Shipley U.D.C., March 2.—Supply and delivery of paper insulated cables for twelve months from April 1, 1945. Specification from Mr. Nigel L. Duncan, Electricity Works, Dockfield, Shipley, Yorks.

Belfast Electricity Department, March 6.—Supply of the following materials:—Spare parts for mechanical stokers and ash conveyors (4); refined bitumen (6); feeder and section pillars (9); armourclad compound filled 6 600 V switchgear (10); meters and instrument transformers (11); l.t. fuse units, house service cut-outs and house service connector boxes (14); static transformers (15); v.b. and p.i. cables and cast iron joint boxes (16); bare hard drawn high conductivity copper conductors and p.b.j. insulated cables (22); overhead line materials (25); v.i.r. electric cables, wires and flexibles (29); electric lamps (30); oilskin coats, tarpaulins, rubber jointing, etc. (31); switch tripping batteries and charging equipments (33). Particulars from the City Electrical Engineer, East Bridge Street, Belfast.

Westhoughton U.D.C., March 7.—Supply of electric lamps for the year ending March 31, 1946. Particulars from Mr. F. H. Walker, Town Hall, Westhoughton.

Plymouth T.C., March 10.—Supply of synchronous motor driven time switches. Specification from the City Electrical Engineer, Armada Street, Plymouth.

Stockport Education Committee, March 14.—Supply of electric lamps for the period April 1 to September 30, 1945. Forms of tender from Mr. G. Holgate, Director of Education.

Leeds, T.C., March 14. — Supply and erection of one 750 kW automatic mercury arc rectifier equipment, complete with h.t. and l.t., d.c. switchgear. Specification from Mr. W. Vane Morland, 1, Swinegate, Leeds, 1; deposit, £1 1s.

Lincolnshire, March 16.—Supply of electrically-driven land drainage pumps for Witham Fifth District Internal Drainage Board, and Skegness Internal Drainage Board, Particulars from Mr. F. H. Tomas, 50, Wide Bargate, Boston; deposit £3 3s. each specification.

Company News

FARNHAM GAS AND ELECTRICITY CO.—Fin. $3\frac{1}{16}$%, mkg. $6\frac{1}{8}$% ($6\frac{1}{16}$%).

CRABTREE ELECTRICAL INDUSTRIES LTD.—Intm. div. on ord. 5% (same).

LLANELLY AND DISTRICT ELECTRIC SUPPLY CO., LTD.—Div. on ord. 6% (same).

NORTH WALES POWER CO., LTD.—Fst. and fin. div. $5\frac{1}{2}$% (same).

MERSEY RAILWAY CO.—Fst. and fin. on consd. ord. $2\frac{3}{8}$% (same).

CANADA NORTHERN POWER.—Div. 15 cents on no par. Common qtr. to Mar. 31.

GENERAL ELECTRIC (U.S.).—Qtrly., 40 cents (35c.).

CLYDE VALLEY ELECTRICAL POWER CO.—Pft. for 1944, £731 519, after tax, (£670 919).

CITY OF LONDON ELECTRIC LIGHTING CO., LTD.—Fst. and fin. div. on ord. 6%, less tax ($5\frac{1}{2}$%) for 1944. Net pft. is stated as £88 450 (£55 623).

BRITISH POWER AND LIGHT CORPORATION, LTD.—Fin. div. on ord. 5% (same), mkg. 7%, less tax for yr. (same). Net pft. £382 432 (£335 483).

LANCASHIRE ELECTRIC LIGHT AND POWER CO., LTD.—Fin. div. 5% (same), mkg. $7\frac{1}{2}$%, less tax (same). Pft. is given as £369 588 (£370 466).

MIDLAND COUNTIES ELECTRIC SUPPLY CO., LTD.—Fin. div. on ord. 5%, mkg. 8% (same) for yr. Net rev. £275 902 (£267 779). Net tradg. pfts. of operatg. cos. £850 919 (£854 041) of which £521 981 (£528 072) is for deprecn. and res.

DUBLIN UNITED TRANSPORT CO., LTD.—Net rev. to Dec. 31, £265 785 (£279 711), brot. in £65 612 (£54 081), mkg. £332 397 (£333 792). To taxn. £134 392 (£166 580), pensions £25 000 (same), goodwill £97 405 (nil), 6% pref. div. for yr. £36 000, intm. ord. 3% £19 800, fin. 3% £19 800 (all same), fwd. nil.

BELFAST ROPEWORK CO. LTD.—Tradg. pft. and other inc., 1944 (after exes., deprecn., war damage and tax) £38 522 (£32 737). To audit fees, etc., £382 (£410), net pft. £38 140 (£32 326), plus pft. on realisatn. invstmts. £2 971 (£447). Pref. div. £2 500 (same), ord. div. 8% (7%) £24 000 (£21 000), to div. res. £10 000 (£5 000), fwd. £21 716 (£17 104), subject to dirs.' fees.

FOSTER, YATES AND THOM, LTD.—For yr. ended Sept. 30, show pft. of £57 003 (£84 025). A.R.P. takes £6 186 (£7 243), war damage £965 (£1 197), fees £2 200 (same), deprecn. £14 054 (£13 833) and taxatn. £23 500 (£49 500), leavg. net blce. of £10 098 (£10 052). Dirs. recommend div. of 5%, less tax, costg. £6 000 (same) and a transfer to gen. res. £4 000 (same). Blce. carried fwd. is £1 925 (£1 827).

BROOM AND WADE LTD.—Trdg. pft. to Sept. 30, £256 685 (£237 533). Deprecn. £20 809 (£20 306), tax £199 243 (£161 772), net pft. £36 632 (£55 455). To defd. reprs. nil (£32 879), brot. in £33 718 (£31 467), mkg. £70 350 (£54 043). Pref. div. £3 450 (same), ord. div. $22\frac{1}{2}$% £16 875 (same), to gen. res. £17 692 (nil), fwd. £32 333.

BRISTOL TRAMWAYS AND CARRIAGE CO. LTD.—Rev. blce. £891 788 (£861 390). Fuel tax and licences take £133 409 (£127 688), war damage insurance £3 516 (£7 827) and fees £2 351 (£2 455). To inc.-tax and E.P.T. £560 582 (£524 515), leavg. net credit blce. of £191 930 (£198 905). Divs. require £175 030, and genl. res. is allocated £25 000 (same), so that the £29 408 brot. in is reduced to £21 308.

PACIFIC GAS AND ELECTRIC (U.S.).—Gross operatg. rev. for yr. to Sept. 30, $148 630 758 ($135 529 680), exes., taxn., etc., $65 606 873 ($63 406 522), to deprecn. $20 001 357 ($19 666 002), net operatg. rev. $63 022 528 ($52 457 156), miscellaneous income $226 404 ($445 824), to bond and other int. $11 458 066 ($10 864 664), Federal tax $28 777 666 ($19 459 295), div. on Com. $12 522 548 (same), blce. $2 079 473 ($1 645 334)).

Metal Prices

Monday, February 26.

		Price.	Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9⅝d.	—	—
Sheet	„	10⅞d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	per lb.	1s. 0½d.	—	—
Brass (60/40)—				
Rod, basis	per lb.	—	—	—
Sheet „	„	—	—	—
Wire „	„	10⅞d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£6 18 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£27 10 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	per ton	£26 10 0	—	—
Foreign or Colonial	„	£25 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	per ton	£303 10 0	—	—
Wire, basis... ...	per lb.	3s. 10d.	—	—
Aluminium Ingots ...	per ton	£110 0 0	—	—
Spelter...	„	£25 15 0	—	—
Mercury (spot) Warehouse ...	...per bottle	£69 15 0	—	—

NOTE.—Above prices are nominal only, no allowance being made for tariff charges, charges for insurance, etc. Prices of galvanised steel wire and steel tape supplied by Cable Makers Association. Other metal prices by British Insulated 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.*

NORTH BRITISH ALUMINIUM CO., LTD., London, E.C.—Feb. 5, disposition by Abbey National Building Society with consents granted in implement of a Trust Deed dated Sept. 12, 1934; charged on 10 and 12 Grange Terrace, Fort William, and fittings, etc. *—. Mar. 28, 1944.

R. K. O. RADIO BRITISH PRODUCTIONS, LTD., London, W.—Jan. 31, assignment and an agreement pursuant thereto securing to Bankers Trust Co. £100 000 or such sum in excess thereof not exceeding in the aggregate £130 000; charged on moneys received or to be received by the co. under a production and distribution agreement dated Aug. 28, 1940. *Nil. Sept. 12, 1944.

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.*

WHITEHEAD, Ronald, Whitehall, Hillside Green, Chelmsford, electrical engineers. £24 0s. 7d. Dec. 22.

GARTON, A. E. AND CO., 16, Lyndhurst Avenue, Sunbury-on-Thames, electrical engineers. £17 17s. 9d. Jan. 11.

LAND, J. H. (male), 158, Chatsworth Road, Clapton, radio dealer. £11 6s. 10d. Jan. 16.

INDUSTRIAL AMPLIFIER AND TELEPHONE CO., Tower Works, Old Town, Clapham, dealers in wireless apparatus. £10 12s. 1d. Jan. 9.

NEWTON, Albt. W., 6a, Beeches Avenue, Carshalton Beeches, propr. radio repair business. £34 16s. 6d. Nov. 29.

PRATT, Horace, 125, Allerton Road, Bradford, electrician. £11 4s. 9d. Jan. 10.

Coming Events

Friday, March 2. (To-day.)

ROYAL INSTITUTION OF GREAT BRITAIN.—London, W.C.1. "Some Aspects of Pre-War and Post-War Television," H. L. Kirke.

Saturday, March 3.

I.E.E., LONDON STUDENTS' SECTION.—Visit to the Stonebridge Park, Middlesex, power station of the L.M.S. Railway. *2.30 p.m.*—I.E.E., N.W. STUDENTS' SECTION, visit to the Greengate and Irwell Rubber Co., Manchester.

A.M.E. and M.E., SOUTH WALES BRANCH.—Tredomen Works, Ystrad Mynach, (Powell Duffryn Co.). Exhibition of electrical equipment for mining purposes, and film show, followed by a Brains Trust. *3 p.m.*

Monday, March 5.

I.E.E., LONDON STUDENTS' SECTION.—London, W.C.2. "Mercury Arc and Mercury Vapour Rectifiers in Transmitters," T. N. Ellison. *7 p.m.* — S. MID. CENTRE, Birmingham. "Organisation of Industrial Electrical Maintenance," J. C. B. Nicol. *6 p.m.*

I.E.E., MERSEY AND NORTH WALES CENTRE, Liverpool. "The Development of Polythene as a High Frequency Dielectric," Prof. Willis Jackson and J. S. Forsyth. *5.30 p.m.*—I.E.E., SCOTTISH SUB-CENTRE, Dundee. "Electrical Research," H. W. H. Warren, *7 p.m.*

Tuesday, March 6.

I.E.E., S. MID. CENTRE (STUDENTS' SECTION).—Coventry. "High Frequency Transmission." D. H. Ray. *6.30 p.m.*—N.W. CENTRE, INSTALLATIONS GROUP, Manchester. "Industrial Fire Risks," W. Fordham Cooper and F. H. Mann. *6 p.m.*

COVENTRY ELECTRIC CLUB.—Coventry Electricity Showrooms. "Brains Trust." *6.30 p.m.*

Wednesday, March 7.

I.E.E., RADIO SECTION.—London, W.C.2. "Frequency Modulation," K. R. Sturley. *5.30 p.m.*—N.E. STUDENTS' SECTION, Newcastle-on-Tyne. "Adventures in Transport," Mr. Poulson. *6.30 p.m.*

Thursday, March 8.

I.E.E., INSTALLATIONS SECTION.—London, W.C.2. "Modern Electric Lift Practice," L. S. Atkinson. *5.30 p.m.*—N.W. STUDENTS' SECTION, Manchester. "Electronic Control of Resistance Welding Machines," F. J. Wilkinson. *6.30 p.m.*

ROYAL INSTITUTION.—London, W.1. Lecture II (Course of four lectures), by Sir L. Bragg, F.R.S., "Some Physical Problems of the Solid State." *5.15 p.m.*

BRITISH DISPLAY ASSOCIATION.—E.L.M.A. Lighting Service Bureau, London, W.C.2. "Colour in Display," Mr. Wilson. *6 p.m.*

I.E.E., SCOTTISH SUB-CENTRE, Dundee. Royal Hotel. Annual dinner. *6 p.m.*; "The Electrical Aspect of Farm Mechanisation," C. A. Cameron Brown, *7.30 p.m.*

Friday, March 9.

I.E.E., EAST MID. SUB-CENTRE.—Leicester. Joint meeting with the Leicester Society of Engineers.—CARDIFF STUDENTS' SECTION, Cardiff. "Carrier Telephony," W. P. Warren.

BIRMINGHAM ELECTRIC CLUB.—Grand Hotel, Annual dinner.

Saturday, March 10.

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.—Connaught Rooms, London, W.C.2. Annual luncheon and reunion. *12.30* for *1 p.m.*

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