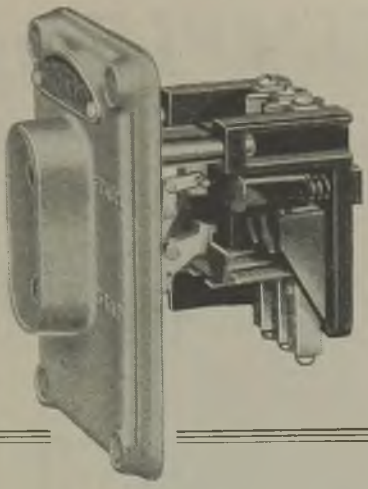
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXV. No. 3497 DECEMBER 1, 1944 9d. WEEKLY



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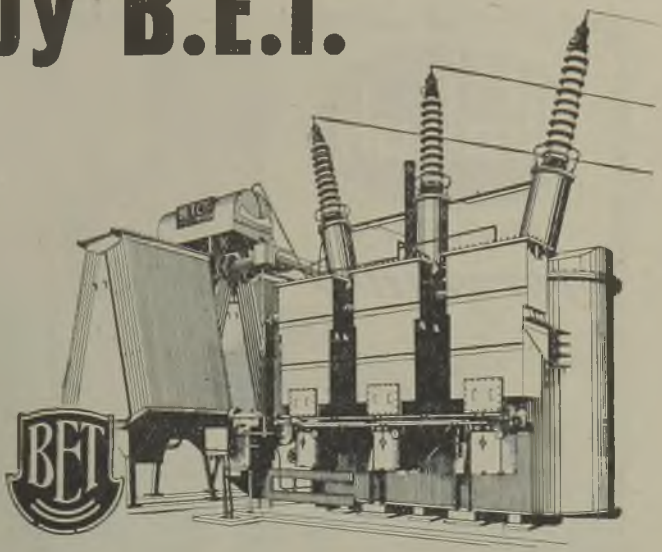

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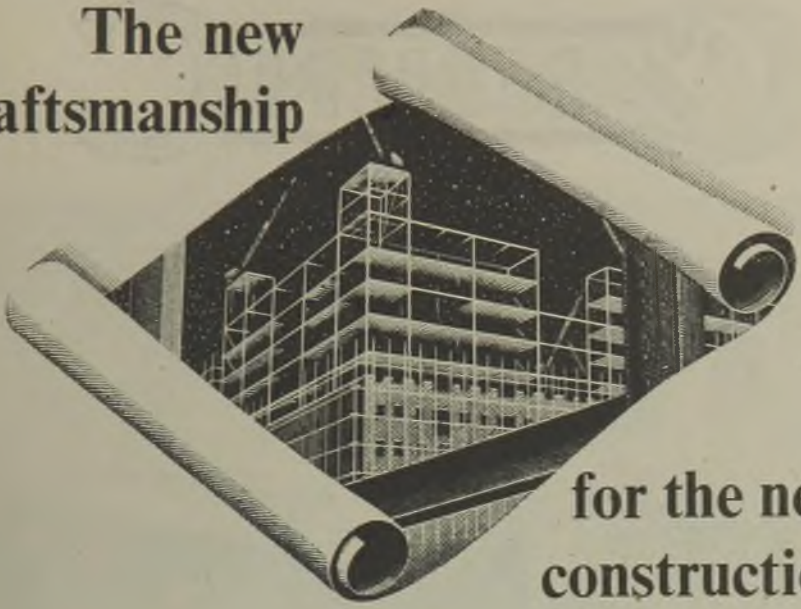

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

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Power-Heat Stations

Very High Thermal Efficiency

GROWING appreciation of the need for economising the nation's coal resources has stimulated interest in proposals for the public distribution of heat in the form of steam or water from electric power stations. It is indisputable that very high overall thermal efficiencies are theoretically obtainable in this way; the extraction of more than 80 per cent. of the BThU of the fuel has been claimed as feasible, against something over 30 per cent. for modern condensing stations.

Attainment of the higher value mentioned pre-supposes the use of high initial steam conditions in association with back-pressure turbines and that the exhaust from these can all be utilised to meet a demand for heat that varies with the electrical output (apart from the possibilities of short-period heat accumulation) rather than with changing climatic conditions.

Part Steam Finally Condensed

An alternative method which, although not promising efficiencies comparable in magnitude, shows imposing results as a practicable compromise, is embodied in the station described in this issue. In this only part of the steam entering the turbine is finally condensed, the remainder passing to the heating system as low-pressure steam.

This plant has been built specifically to meet conditions in Russia and its design is based upon ten years' experience of a national policy of fuel saving in which bitter winters (minus 45 deg. C. is allowed for) make the provision of bulk space heating a paramount need. Medium steam pressures have been employed with a view to minimising difficulties in operation and availability of material.

Although British practice might prescribe a somewhat higher pressure, the steam characteristics of the station are generally in accordance with those which would be found suitable in similar circumstances in this country. The total steam entering the turbine is normally divided equally between the condenser and heat exchangers to provide for the distribution of hot water under pressure in the neighbourhood.

Steam to the condenser furnishes approximately 68 per cent. of the maximum continuous rating of the turbine at the value of thermal efficiency generally associated with the pressure and temperature employed (say 26 per cent). The balance of 32 per cent. of the whole is produced at a much higher thermal level owing to the combination of electricity generation and water heating by pass-out steam.

Forty-Two Per Cent. Efficiency

Allowing for mechanical and electrical losses in the boilers, turbine and alternator, this combined efficiency is expected to be of the order of 76 per cent., giving a thermal efficiency of some 42 per cent. for the station as a whole when working under full pass-out conditions. Of great importance to the overall functioning of the scheme is the pressure-reducing and de-superheating plant for supplying boiler steam direct to the heating system, should the turbo-alternators not be available. With

a view to securing the utmost reliability for this purpose, either heating plant can work with any boiler or turbine, while the greater flexibility of operation of the plant afforded by a comprehensive system of steam interconnections also plays an important part in achieving the results. The power station, however, presents only one side of the district-heating question. The awaited report of the Department of Scientific and Industrial Research may be expected to be even more concerned with the less readily predictable aspects of distributing the hot water to consumers. The analogy between supplying electricity and heat by public mains holds good only within narrow limits.

Coal Supplies

ALTHOUGH no improvement in coal production has been reported, a reassuring statement on the position this winter was made last week by Mr. J. Innes, Director of Supplies in the Ministry of Fuel and Power. If coal is produced in the expected quantities, the transport conditions are reasonably good and there is no waste, supplies should be sufficient. Stressing the need for economy in the use of electricity, he mentioned that the industry was consuming 33 per cent. more coal than before the war. This is, in fact, a surprisingly low figure, for the last statistics published by the Electricity Commissioners (for 1942-43) showed that 50 per cent. more electricity was being used. Coal supplies have also, of course, been of greatly inferior quality.

Shifting Peak

NOT many years ago the normal peak electricity demand occurred in the evening, at the time when the lighting and industrial loads coincided. More recently it has been at about eleven o'clock in the morning; extended use of electric canteen equipment probably helped to bring this about. Now a new peak load is occurring at breakfast time, with a 5 per cent. advance on last year between 8 and 9 a.m. This is causing a strain on undertakings and Mr. Innes intimated that measures might have to be taken to keep down the load if an actual danger point was reached. The switching on of electric fires at breakfast time is one reason for the new peak, and the situation should be eased by propaganda on the lines of the "Cut the Peak" campaigns successfully carried out in the past by Edmundsons and Guildford for instance.

Limited Tenders

COMPETITION, within limits, ensures fair prices to the customer; if carried too far it may result in unfair prices to the successful. Unscrupulous firms will quote absurdly low prices in the hope and with the determination of cutting everything to the bone to scrape a profit and by this means secure an unfair advantage over their competitors at the customer's expense. To guard against this there has been a growing tendency in recent years to limit competition for important contracts to a few well-tried concerns who can be relied upon to play the game. Provided it does not lead to the formation of "rings" this method guards against the risks attendant upon rash undercutting. A possible alternative is the preparation of a rigid schedule to be priced by the contractor, as proposed by Mr. T. Dunwoody in the *Electrical Review* of November 3rd.

Possible Hardship

THIS question as it affects building contracts (which include electrical installation work) is dealt with in a report by the Ministry of Works Central Council for Works and Buildings which we reviewed last week. The Committee makes a definite recommendation that tenders should be called for from a limited number of firms known to be capable of and likely to do work of the required standard. Such a procedure may bear hardly on sound concerns outside the list, but it is unlikely that any public authority would be permitted to refuse to admit to its circle of tenderers firms which have shown themselves capable of doing the required job and request to be allowed to tender.

Report Resented

THE I.M.E.A. has put a spoke in the wheel of the Association of Municipal Corporations for its intervention in the matter of reorganising electricity supply. Resentment is expressed that a body which does not include Scottish local authorities, but does include many authorities who do not own electricity undertakings, should have professed to represent the views of all its members in the document which it has sent to the Minister of Fuel and Power. We

agree that as the municipal point of view had already been adequately set forth in the I.M.E.A.'s own memorandum the A.M.C. report was superfluous. In fact the superfluity of reports on the subject from all kinds of bodies has complicated and confused the whole matter.

Switching off Motors

THE extent to which it pays to shut down intermittently loaded machines during idling periods is discussed in *Fuel Efficiency News* for October. Tests on a shipyard punching machine driven by a 20-HP motor showed that 640 kW-sec. was consumed during starting. When running light the energy required per minute amounted to 264 kW-sec. with delta connection and 154 kW-sec. with star connection. Therefore switching off would be justifiable if the unloaded period exceeded 2·4 minutes in the first instance and 4·1 in the second. Change over from one type of connection to the other while idling would be worth considering in any event. If rheostatic control is employed a limit would be imposed to the number of starts permissible in an hour.

Freedom of Choice

FOLLOWING upon the decision at Hull to install electricity only in the first hundred Portal bungalows comes a memorandum on "Temporary Accommodation" for the guidance of local authorities. This lays down that "cookers and wash boilers should be served by the same supply. All houses on one site must have either gas or electricity for these purposes: individual variations cannot be allowed." Thus the "freedom of choice" is with the local authorities and not the individual consumers who may, however, be able to choose between living on a gas or an electric estate if both kinds are considered desirable by the local authority. It should be noted that the phrase "for these purposes" (*i.e.*, cookers and wash boilers) is used above. This might be thought to permit the provision of electric lighting in gas equipped houses although this would not seem to accord with the general idea of economical expenditure.

Kitchen Equipment

DOUBT is deepened by the suggested equipment of the kitchen. The specification for the Ministry of Works unit includes a cooker, a wash boiler and a refrigerator which can be gas or electric (choice being limited by the considerations already referred to). But it also includes lighting and kettle points and an electric control and fuse panel. There is in addition a lighting point and power plug for an electric iron over the kitchen folding-table unit. Are these to be wired in a gas-equipped house or will they merely be "blanked off." It rather looks as though the Ministry realises that electricity must be provided in every type of house. What is the logical conclusion from that?

Undertakings' Accounts

SINCE 1942 electricity undertakings have not been permitted to publish accounts, or information contained in them. Consequently, apart from a vague statement that the year's operations had been satisfactory, or otherwise, shareholders or ratepayers as the case may be have not been told much about the finances of the undertakings with which they are concerned, some of which have been badly hit by the war. The decision of the Minister of Fuel and Power to revoke the ban, with effect from December 1st, will therefore be welcomed. In addition, the prohibition against divulging information regarding stocks of coal which dates back to January 30th, 1940, when the Electricity Commissioners prescribed a modified form of accounts, is lifted, and undertakings must now give particulars of these under the former heading of "Stocks in Hand."

Diesel-Electric Ships

WHILE the main function of an electric motor in a Diesel-electric combination for ship propulsion is to provide a form of gearing that will stand up to mechanical shock between a low-speed propeller and a relatively high-speed engine, the system as a whole possesses other advantages of comparable importance. Among these is the possibility of using a higher-speed engine than would be practicable with a direct drive, running at almost constant RPM and situated where most convenient, thus liberating valuable cargo space. In view of developments abroad many will share the difficulty found by Mr. C. R. Young, who discusses these and other merits of the Diesel-electric drive in the *I.E.E. Journal* for October, in understanding why it has not made more headway in this country.

Mixed Power Station

British Plant for Providing Electricity and District-Heating Supplies in Russia

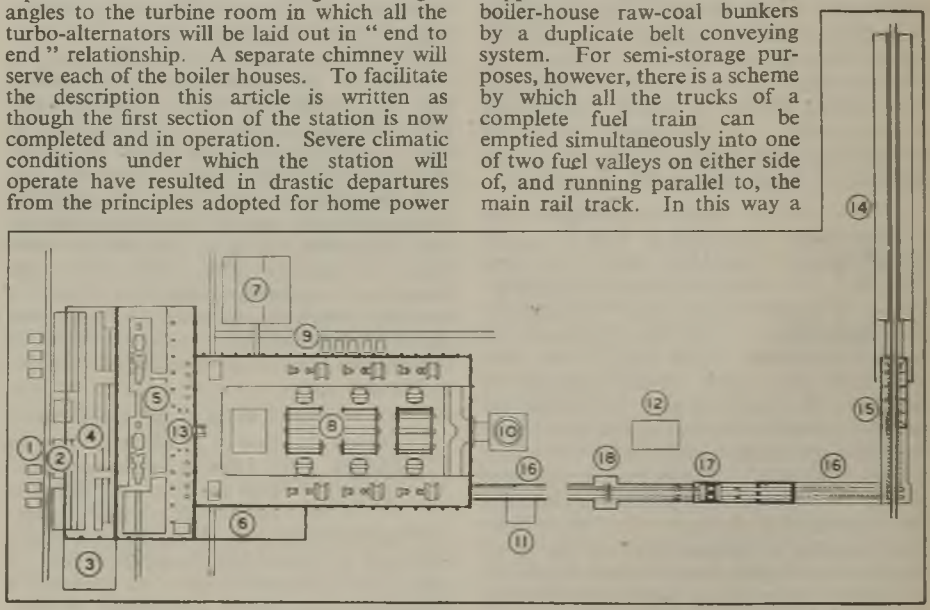
A NOTABLE achievement on the part of British engineering manufacturers in the effort to help the U.S.S.R. to recover from the ravages of war is the design and production of the complete plant for a power station to supply both electricity for power and hot water for district heating. The initial capacity of the electricity generating plant is 50,000 kW, while the general station design provides for an ultimate capacity of 125,000 kW. The electricity generating and water-heating plants are both served by the same steam raising installation.

Finally the station will incorporate two separate boiler houses arranged at right angles to the turbine room in which all the turbo-alternators will be laid out in " end to end " relationship. A separate chimney will serve each of the boiler houses. To facilitate the description this article is written as though the first section of the station is now completed and in operation. Severe climatic conditions under which the station will operate have resulted in drastic departures from the principles adopted for home power station practice, it having been necessary to cater for an ambient temperature as low as minus 45 deg. C.

The whole of the power station buildings, including the chimney, a switchgear annexe with a control room, the turbine room, a water-heating plant annexe, the boiler house, an office block, an ash-plant house, an oil-storage, heating and pump house, a water-treatment plant block, an outdoor substation, cooling ponds, a circulating-water pump house, and the coal reception ground hoppers, are constructed of reinforced concrete. The coal-conveyor gantries are framed in steelwork.

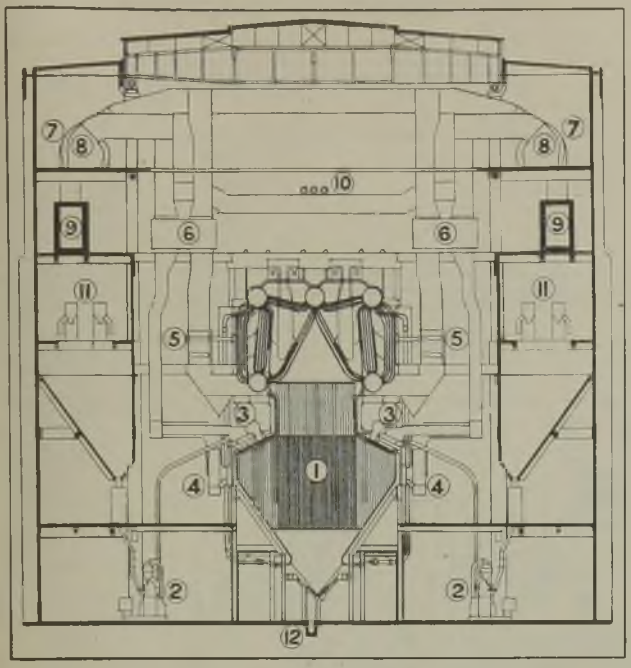
The boiler-house building has been designed to permit the future installation on the roof of electrostatic precipitation plant. The coal allocated to this plant has a lower calorific value of about 6,800 BThU. and a volatile content of about 40 per cent. The fuel is received by rail in 60-ton containers and is normally emptied into suitable ground hoppers from which it is transported to the boiler-house raw-coal bunkers by a duplicate belt conveying system. For semi-storage purposes, however, there is a scheme by which all the trucks of a complete fuel train can be emptied simultaneously into one of two fuel valleys on either side of, and running parallel to, the main rail track. In this way a train containing sufficient fuel for 24 hours' operation of the initial station can be unloaded rapidly to permit the quick return of the train. The fuel in the valleys is then left under the control of two drag-scraper equipments, one in each valley, serving the ground hoppers.

The New Conveyor coal-handling plant incorporates hammer-type crushers which



General layout of the electricity and heat generating station, excluding the remotely situated spray cooling ponds, circulating-water pump house, and the 6·3/115-kV outdoor substation

1, Auxiliary Transformers ; 2, Reactor Annexe ; 3, Control Room ; 4, Switch House ; 5, Turbine House ; 6, Office; 7, Water Treatment House ; 8, Boiler House ; 9, Boiler House Auxiliary Transformers ; 10, Chimney ; 11, Oil Firing Service Plant ; 12, Ash Handling Plant ; 13, Water Heating Plant ; 14, Drag Scraper Plant ; 15, Ground Hoppers; 16, Coal Conveying Plant; 17, Automatic Continuous Belt Weighers; 18, Coal Crusher House



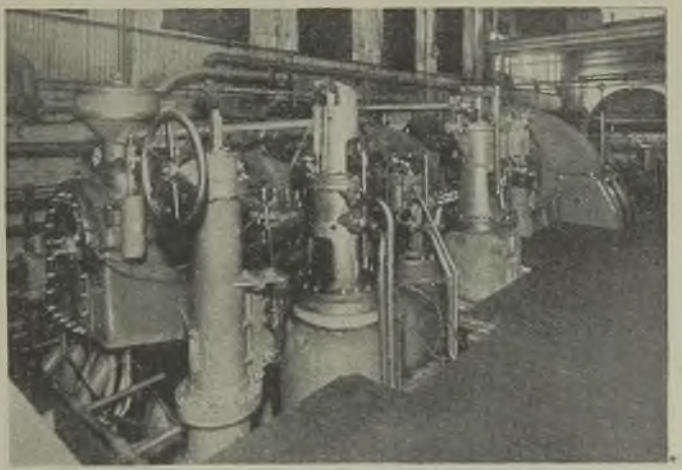
Cross sectional view of the boiler-house installation
1, Water-cooled Combustion Chamber ; 2, S.C. Unit Type Pulverisers ; 3, Pulverised Fuel Burners; 4, Oil Burners; 5, Economisers ; 6, Air Preheaters; 7, Induced-draught Fans; 8, Forced-draught Fans; 9, Main Flues ; 10, Superheated Steam Mains ; 11, Coal Conveyors ; 12, Ash Sluicing System

reduce the coal from 6-in. to ¾-in. cubes, and belt-weighers with magnetic separators for the removal of tramp iron from the fuel. The system is sequence controlled to prevent the piling up of coal at any section of the plant. The gantry housings are artificially heated as a precaution against belt damage or loss of lubrication due to low atmospheric temperatures.

The first boiler house accommodates four Simon - Carves steam-raising plants, each having an output of 331,000 lb. per hour m.c.r. The output steam conditions are 462 lb./sq. in. and 797 deg. F. The boilers are pulverised - fuel fired and of the twin-circulation, multi-drum type, with water-cooled combustion-chamber walls. The heating surface of each boiler proper is 28,210 sq. ft. and the heat release per cu. ft. of combustion chamber is 16,000 BThU. per hour. Each boiler is equipped with Superheater Company's double superheaters, with Green economisers and Howden air heaters, and all five drums, three steam and two water, are of fusion-welded construction.

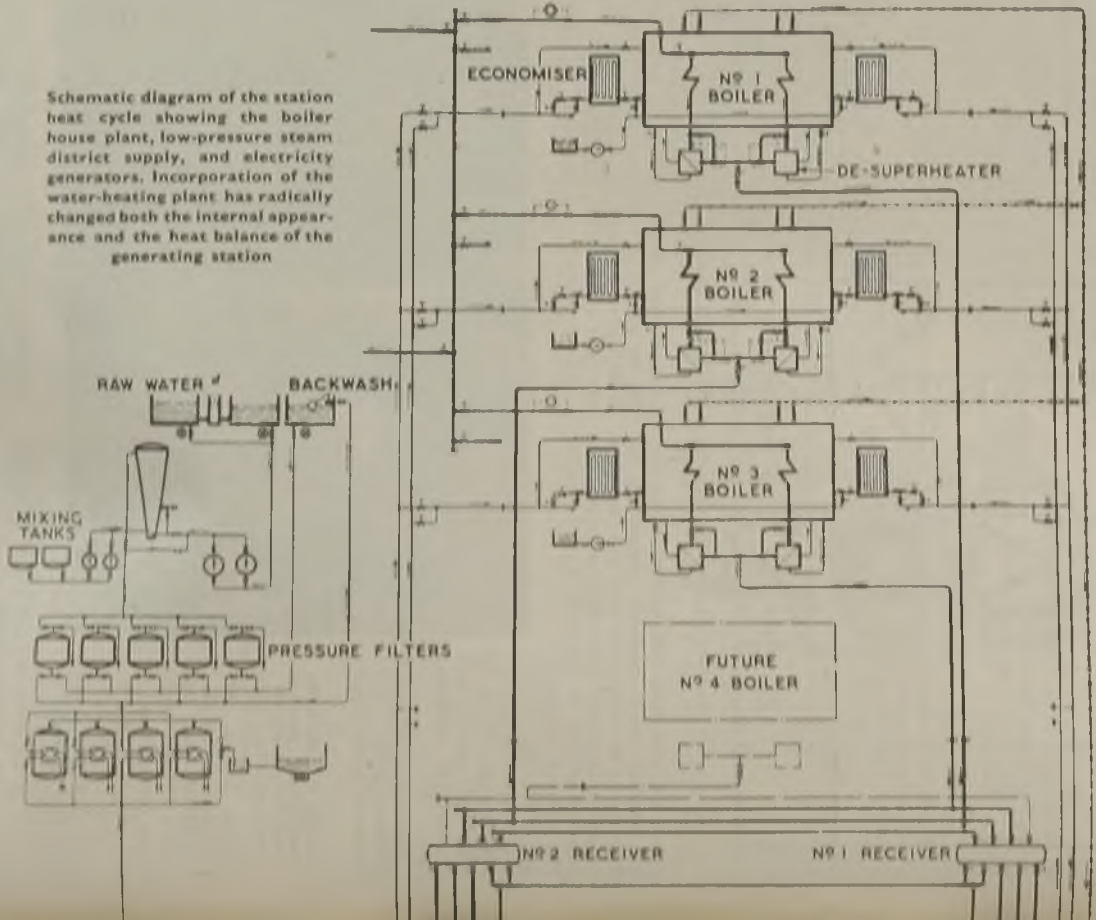
The firing equipment for each boiler consists of twelve Simon-Carves directly driven beater-type mills, each being fitted with an integral exhauster fan, a static classifier and a magnetic separator, and completed with a fuel-delivery connection and burner. An oil-firing system is incorporated in the boilers for starting-up purposes, and it will permit steam generation at up to 40 per cent. of the boiler capacity.

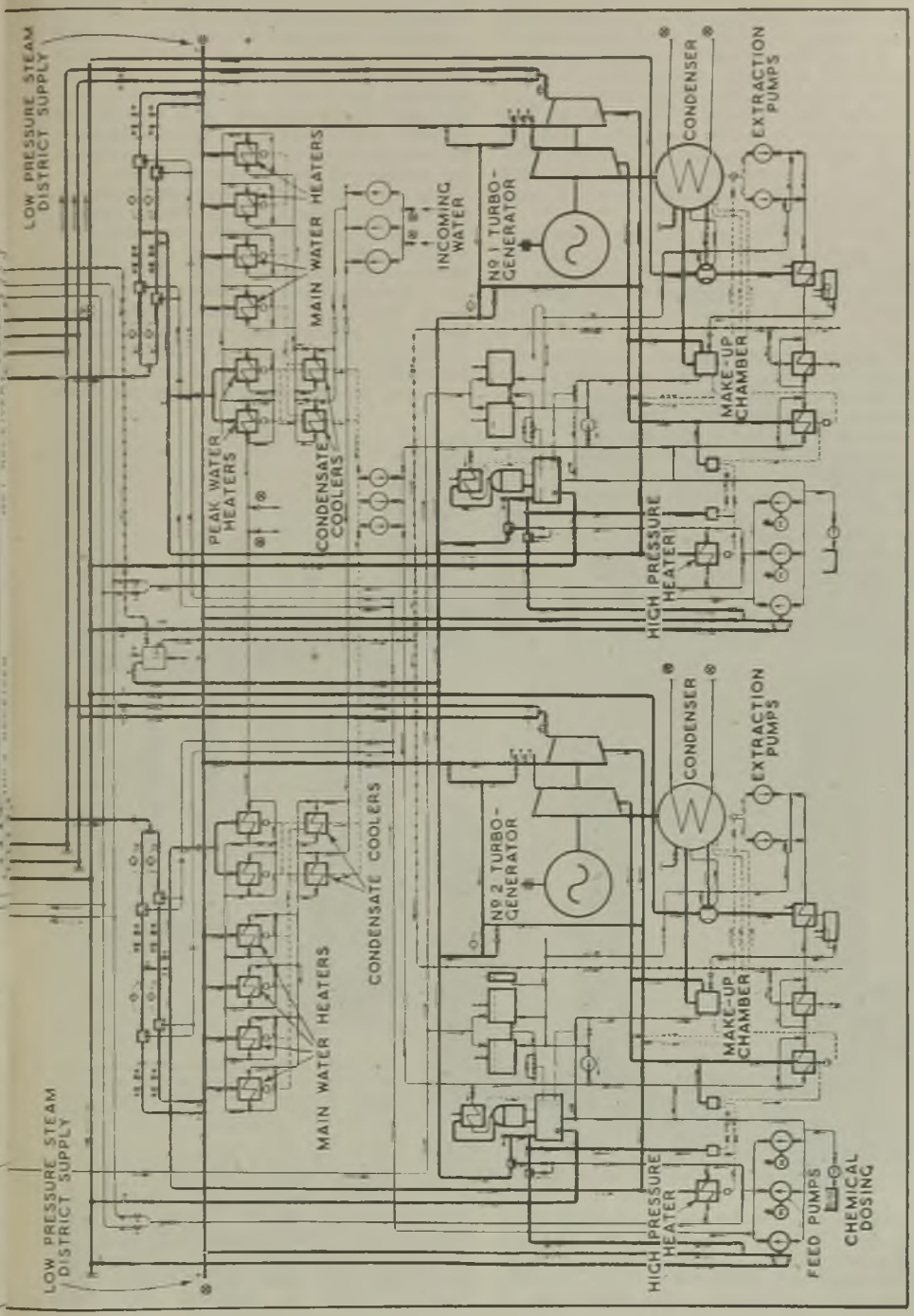
The superheater installation includes an automatic electrically controlled de-superheater system with an alarm device which operates when the maximum permissible



25,000-kW, 3,000-RPM, two-cylinder pass-out turbo-alternator set

Schematic diagram of the station heat cycle showing the boiler house plant, low-pressure steam district supply, and electricity generators. Incorporation of the water-heating plant has radically changed both the internal appearance and the heat balance of the generating station



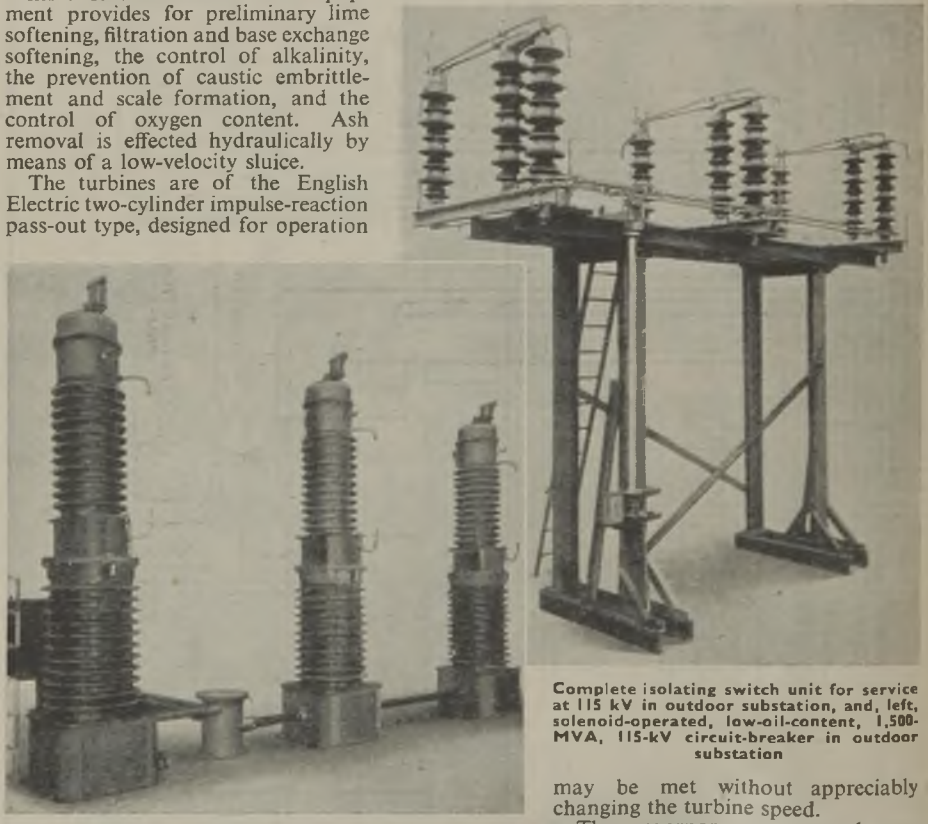

LOW PRESSURE STEAM DISTRICT SUPPLY
LOW PRESSURE STEAM DISTRICT SUPPLY
MAIN WATER HEATERS
PEAK WATER HEATERS
CONDENSATE COOLERS
INCOMING WATER
No 1 TURBO-GENERATOR
CONDENSER
EXTRACTION PUMPS
MAKE-UP CHAMBER
HIGH PRESSURE HEATER
MAIN WATER HEATERS
CONDENSATE COOLERS
No 2 TURBO-GENERATOR
CONDENSER
EXTRACTION PUMPS
MAKE-UP CHAMBER
HIGH PRESSURE HEATER
FEED PUMPS
CHEMICAL DOSING

final steam temperature is exceeded. The economisers are of the gilled-tube pattern.

The air heaters are of the rotary regenerative type, and each is connected to associated vane-controlled induced- and forced-draught Howden fans, each of which is driven by a single-speed direct-on-line started squirrel-cage motor. Electrically and automatically sequence-controlled soot blowers are fitted at all gas passages vulnerable to the accumulation of deposit.

The special attention which is given to the control of the boilers in view of their large capacities, and the duplication of auxiliaries, etc., is evidenced by the Electroflo central combined instrument and remote-control station for each boiler, from which all operating variations can be carried out, including motor switching, and observations of the operating conditions made. Comprehensive feed-water treatment equipment provides for preliminary lime softening, filtration and base exchange softening, the control of alkalinity, the prevention of caustic embrittlement and scale formation, and the control of oxygen content. Ash removal is effected hydraulically by means of a low-velocity sluice.

The turbines are of the English Electric two-cylinder impulse-reaction pass-out type, designed for operation with steam stop-valve conditions of 430 lb./sq. in. and 750 deg. F., and to pass out 220,500 lb. of steam per hour at from 18 to 36 lb./sq. in. The condenser performance is 28·2 in. Hg., with a circulating-water inlet temperature of 78 deg. F. The turbine governing system is of particular interest because of the dual control of the steam pass-out and of the normal steam flow for electricity generation. The main speed governor is of the centrifugal type and controls the main throttle valve by means of oil relay gear. Hand and motor operation are provided. A pressure governor controls the pressure of the pass-out steam by regulating the amount of steam passing to the low-pressure cylinder. This steam travels into two pass-through valves, each of which is operated by an oil relay piston; this in turn is controlled by the pressure governor which is operated by the pass-out steam pressure. The pass-through valves work in parallel and are mechanically interlocked. The pressure governor is also interlocked with the speed governor, so that variations in the demand for pass-out steam may be met without appreciably changing the turbine speed.



Complete isolating switch unit for service at 115 kV in outdoor substation, and, left, solenoid-operated, low-oil-content, 1,500-MVA, 115-kV circuit-breaker in outdoor substation

The governor gear controls two steam admission valves, namely, the main throttle valve admitting steam to the first-stage nozzles, and the by-pass valve which admits steam to a lower stage of the turbine when pass-out steam is required. The main

throttle valve will pass sufficient steam to give full load on the turbine without pass-out, and the additional opening of the by-pass valve enables full load to be generated when passing out. Two emergency governors operate independently of the main governor, and cause both the combined stop and emergency valve and the main throttle valve on the steam inlet to the turbine, as well as the non-return valve on the controlled pass-out branch, to close in the event of the turbine speed exceeding the normal value by a predetermined amount. Electrically operated barring gear is provided to enable the rotor to be kept turning when the machine is warm after shutting down, so as to avoid non-uniform cooling and distortion of the rotor. Starting from cold is provided for by English Electric oil jacking gear.

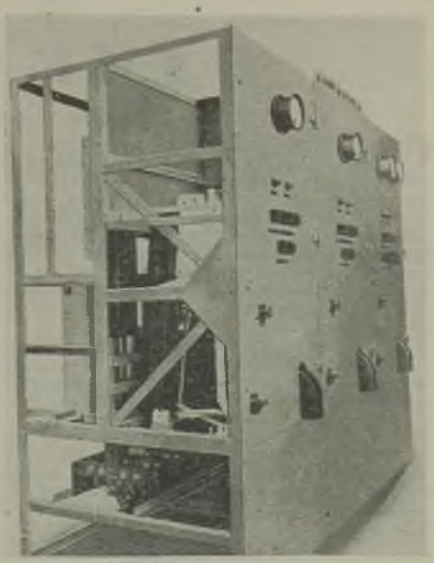
The incorporation of the water-heating plant has radically changed both the internal appearance and the heat balance of the generating station. The full pass-out of each turbine is used to raise the temperature of 290,000 gallons of water per hour from 158 deg. F. to 240 deg. F. in calorifier plant. Further heating to 270 deg. F. can be effected in peak heaters.

Calorifier Plant

The calorifier plant is arranged in two banks, each associated with its respective turbo-alternator, but there are steam and water interconnections to permit the maximum flexibility of operation. So that the water-heating plant may continue in operation with the turbo-alternator out of commission, the steam-raising plant may supply the calorifier through a British Arca Regulator steam-pressure reducing and de-superheating station, and by this means the station may operate solely for the generation of electricity, for the supply of district heating, or as a combined station for the two services.

The condenser is of the two-flow divided type, and it operates in conjunction with a spray-type cooling-water system. Two 100 per cent. duty two-stage steam air ejectors and one "Hivac" single-stage ejector are provided. The plant is also served by two 50 per cent. duty motor-driven Drysdale circulating-water pumps. The condensate is passed through a blow-down cooler to No. 1 low-pressure surface-type feed heater which is steam fed from one of the low-pressure turbine stages. It then passes to the vent condenser and thence to a direct-contact low-pressure de-aerator feed heater which is supplied with steam from the pass-out mains. The condensate is withdrawn from the de-aerator heater surge tank by one of the 100 per cent. duty boiler feed pumps. The feed water then passes through the high-pressure bled steam heater and on *via* an automatic by-pass valve to the boilers. Of the three 100 per cent. duty boiler feed pumps, two are electrically driven and one steam driven, the latter being provided with an automatic starting device to bring it into operation should the feed pressure fail.

The English Electric alternators each have a continuous maximum rating of 31,250 kVA at 0·8 p.f., 6,300 V. They are of the totally enclosed type, the cooling air being recirculated by separate motor-driven fans through a water-cooled finned-type air cooler. The main transformer consists of four 10,500-kVA, double-wound single-phase units, three of which are connected together to form a 31,500-kVA three-phase group; the fourth unit is a spare. The no-load ratio of the group is 115,000/6,300 V, the windings being fully insulated throughout and connected star on the h.v. side and delta on the l.v. side. Cooling is effected by detachable radiators mounted on the tank of each single-phase unit which can be transported on rails on its own wheels, in its completely assembled form. These main transformers are provided with bushings located in the tank covers and are suitable for outdoor service.



Part of a 525-V, 3,000-A, 30-MVA cubicle-type switchboard containing air-break circuit-breakers

For the station auxiliaries there are ten three-phase transformers varying in size from 4,200 kVA (6,300/3,150 V) to 180 kVA (3,150/400 V). There are twenty three-phase feeder reactors and one bus-bar reactor on the 6,300-V system. Ten of the feeder reactors are designed with 5 per cent. reactance at 600 A, while the remainder have 5 per cent. reactance at 400 A. The bus-bar

reactor is designed to give 12 per cent. reactance at 2,000 A. Each transformer and reactor is provided with its own conservator and silica gel breather, and the larger units are fitted with Buchholz protection.

The main switchgear consists of an indoor, cellular-type switchboard which embodies remotely controlled, solenoid-operated 500-MVA oil circuit-breakers with duplicate bus-bars for on-load selection. These are installed on the lower and upper floors, respectively, of the two-storeyed switch house. The switchgear is arranged in two parallel rows and is operated from a common control gangway which affords easy supervision of all the component parts. The control room, at the end of the switch-house, contains the indicating instruments, control gear, mimic diagrams, protective relays and metering equipment mounted on either side of a control board.

The larger switchgear units for the auxiliary power services are remotely controlled, 150-MVA, 3,000-V truck-type air circuit-breakers and contactors fitted with back-up fuses.

A remotely controlled porcelain-clad circuit-breaker of low oil content is employed on the 115-kV outdoor switchgear system, and the isolators are provided with special ice-breaking contacts. Simon-Carves, Ltd., were responsible to the Ministry of Supply for the design of the station and for the supply of all the equipment.

I.M.E.A. Notes

Objections to A.M.C. Report

COMMENTS appear in the November *I.M.E.A. Journal* upon the electricity reorganisation proposals put forward by the Association of Municipal Corporations (see *Electrical Review*, October 13th, p. 516). The competence of the A.M.C. to handle such a matter is questioned. It is pointed out that Scottish local authorities are not members and that the membership includes a large number of local authorities who do not own electricity undertakings.

The *Journal* says :—" The I.M.E.A. represents local authorities owning electricity undertakings and although its purpose is to support the retention and extension of municipal control, it recognises that to propound, at this juncture, a scheme to retain *in toto* municipal undertakings, would not be in accordance with its realist views on reorganisation. The Council of the I.M.E.A. has expressed its disagreement with the proposals and has so informed the Minister of Fuel and Power."

Wayleave Payments

Agreement has been reached between farmers and landowners on one side and the electricity supply organisations on the other upon the subject of payment of compensation for interference with agriculture. It is provided that electricity undertakings in England and Wales shall be recommended to increase by 25 per cent. the existing rates paid for interference with agriculture by poles and stays on arable land and cultivated grassland. The increase will apply to all payments that become due on or after December 31st, for a period of three years, after the rates will be subject to review.

Street-Lighting Equipment

A member authority of the I.M.E.A. recently reported to the Council that its application for authority to acquire cast iron and steel for the repair and maintenance of street-lighting equipment had been refused by the Ministry of Health. The Ministry stated that it was prepared only to authorise the release of materials for the repair and maintenance of public lighting equipment where " starlighting " was in operation.

Representations were made to the Ministry by the I.M.E.A. Council that materials were required not for post-war lighting but to enable the authority to comply with the amelioration of the lighting restrictions. It was thought that no distinction should be made between towns with " starlighting " and those without. The Ministry has now stated that its decision was made in the light of conditions prevailing in May last. Applications for materials for street lighting are now being considered by the Ministry of Home Security to whom applications by any undertaking should be sent.

South Shields Test Case

Arising out of the South Shields income tax test case decisions have been given by the Board of Inland Revenue in the various types of cases which have been submitted to them and local tax inspectors are now in a position to deal with such cases. Each case will be determined on the merits of the particular local Act provisions with regard to the disposal of electricity profits.

Plan for India

Electricity and Irrigation

SPEAKING at New Delhi last week Sir William Stampe, Irrigation Adviser to the Indian Government, outlined an unofficial scheme of electrification with irrigation which he has prepared. He described it as " A Plan for the Electrical Federation of India." He proposes to use power from the Himalayan rivers to pump water over great areas, and at the same time supply electricity to villages at a maximum price of one anna per kWh.

The scheme will be tried in the Punjab where it is proposed to harness the upper Jhelum canal to supply the power for pumping out a waterlogged area and at the same time make power available to the villages in the area. Similar schemes are planned for some Rajputana states, Kota, Bundi, Jodpur, Kolhapur and Deccan. Sir William said that emergency irrigation schemes would increase the foodcrop area by about 3,800,000 acres.—*Reuter*.

Machine-Tool Driving

Hydraulic and Electrical Methods

IN a paper prepared by MR. H. C. TOWN (Keighley Technical College) for the Manchester Association of Engineers the advantages of fluid (oil) power transmission over electrical driving for machine tools are claimed to be the wide range of speeds obtainable and the fact that greater torque is exerted at reduced speeds (constant HP), although the efficiency is generally less than that of a geared drive. If a moderate speed range is all that is required, the alternative of a four-speed pole-changing motor with a few mechanical changes should be considered.

The influence of hydraulics on the design of standard centre lathes has been practically negligible. There is big scope for its application to turret lathes because it offers the advantage of a separate and independent feed for each face of the turret. It has not greatly influenced ordinary workshop drilling and boring machines (radial or upright) because of the ease with which pole-changing and reversing motors can be built into them.

Large Composite Equipment

In the large composite lay-out developed by Morris Motors, Ltd., for machining cylinder blocks the jigs were moved by hand so that operators had to cover a distance of 2½ miles at the rate of 2 miles per hour, which is not a great hardship, but is rendered unnecessary by hydraulic operation. For example, the Greenlee design for automatically machining cylinder heads comprises a series of individual multiple spindle units arranged on each side of an automatic conveyor with 71 " stations "; 33 of the latter are machining positions and the remainder simply bridges or gauging positions. On the front heads 46 operations are performed with 70 tools, together with 37 operations by means of 61 tools on the rear heads, in a 48-sec. cycle for each movement from one " station " to another. Forty electric motors totalling 190 HP are started at two-second intervals and all functions of the machine (electric and hydraulic) are interlocked and controlled by limit switches so that each cycle must be completed before further action can take place.

For locating failures to function properly there are three sets of coloured lamps, numbered to correspond with the machine's " stations " and set to various limit switches. If a lamp does not glow within a certain time it indicates that a limit switch is not closing; the number of the lamp indicates the particular " station " involved.

The first cost of the machine was £50,000; apart from the increased output it makes possible, 39 standard and special purpose machines would otherwise be needed to complete the same set of operations. Only ten men are required to operate it as against 30 normally engaged; of those ten men, only one needs to be fully trained. The machine has reduced the production time from 59 to 8 minutes and decreased the floor space occupied from 7,448 to 2,890 sq. ft.

Milling machines have not been influenced, because a fairly complex hydraulic system costs more than an electrical circuit comprising a small feed-motor with a drop worm or clutch and end-switches.

Electro-hydraulic operation is coming to the forefront, with a marked effect on design, because only light contact with the trip dogs suffices to actuate the solenoids which, in turn, operate valves.

Domestic Appliances

Review of Post-War Designs

HOUSEHOLD appliances for the post-war era were dealt with on November 20th by MR. E. G. BATT (chairman, Post-war Housing Committee of B.E.A.M.A.) in a paper presented before the Birmingham Electric Club. Mr. Batt said that the electrical industry was planning on a large scale for the adequate equipment of homes and taking definite action to put those plans into effect as soon as possible. Meanwhile (and for a period of about two years) it would probably be possible only to make 1939 models. Some time must elapse between the conception of new appliances and their appearance on the market.

In the past too many installations had fallen short of the needs because of defective relations between the engineering and building industries. Co-ordination of the work should be the responsibility of one person; the author suggested that this should be the architect. E.D.A. and the R.I.B.A. had already formed a joint committee and electricity was to be included as a subject in the R.I.B.A.'s future examination papers.

Properly planned standardisation would reduce costs and would be in the interests of the community at large. Mr. Batt thought that BS.562 (connectors) should be used by all manufacturers; if it needed to be reviewed, this should be treated as a matter of urgency. He did not favour the " proving house " idea, and said that manufacturers should not under any circumstances supply domestic appliances in parts for assembly at home.

Simplicity and interchangeability were very important from the maintenance point of view. Negotiations were proceeding to secure the interchangeability of essential parts of cookers of different makes, including boiling plates, grill-boilers and grill pans. Mr. Batt then referred to the new horizontal type cooker and refrigerator which had been evolved by manufacturers (see *Electrical Review*, November 17th, p. 709). He said that the vertical type would continue to be available for cases in which the new model

could not conveniently be accommodated. At the outbreak of war British-made electric cookers were entering homes at the rate of 200,000 a year and at least two million were now in daily use.

Mr. Batt suggested that, until the price of electricity for water heating was drastically reduced in many parts of the country, electric heaters should be used in conjunction with solid fuel boilers. A new electric "Two-in-One" storage type heater had been designed to heat 7 gal. with 500 W; when a greater quantity of hot water was needed an extra 2·5 kW could be switched in to provide 9 gal. per hour at 150 deg. F.

Other points dealt with were the use of fans in connection with ventilating, clothes-drying, convectors and self-contained kitchen units. He thought that the industry should get together before it was too late and agree upon a common design and arrangement of kitchen unit.

Electric Houses at Hull

Tenants' Emphatic Preference

THE preference of Hull people for electric cookers as evidenced by the Council's decision to make the first hundred Portal bungalows to be erected in the city all-electric (*Electrical Review*, November 24th, p. 744) dates back to before the war.

When the North Hull Housing Estate was in course of erection the gas people seem to have got on to the job in the early stages for it was stated by the National Gas Council in March, 1936, that in the first 134 completed houses 130 tenants had asked for either a gas cooker or a gas hot-plate. And yet by June of the following year Mr. J. N. Waite, then general manager and engineer of the Electricity Department, was able to report to the Council that in 501 of the 640 houses erected the tenants had expressed a desire for electric cookers.

He asked that his memorandum on the subject should be forwarded to the Ministry of Health "in order that they may be acquainted with the final position and to establish definitely the preference shown by tenants in favour of electricity."

In a later summary (1939) the position in relation to three housing estates was set out. It was shown that on the North Hull estate 865 tenants out of a total of 1,034 (83·7 per cent.) had decided in favour of electric cooking; on the Marfleet estate the figure was 169 out of 176 (96·0 per cent.); and for the Bilton Grange estate 571 out of 608.

On the East Hull estate originally gas and solid fuel only were available and yet to-day in 2,380 houses there are 2,179 consumers of electricity of whom 1,456 have electric cookers and 289 electric wash boilers. This means that much additional work has had to be done on account of initial shortsightedness. And it has to be emphasised that no further development has been possible during the past five years.

These figures leave little room for doubt as to the tenants' preference and fully justify the Council's decision in the matter of the Portal houses. The effective price of electricity in Hull for cooking and water heating, *i.e.*, the rate after making due allowance for lighting and other small appliances, is ¼d. per kWh. Gas costs 11¼d. per therm.

Forthcoming Events

Saturday, December 2nd.—*London.* — At Royal Institution, Albemarle Street, W.1, 2 p.m. Institute of Physics (London and Home Counties Branch). Conference on "Selection and Training of Personnel for Industry."

Manchester.—At Engineers' Club, Albert Square, 2.30 p.m. I.E.E. North-Western Centre. "Standardisation and Design of AC Turbo Type Generators," by G. A. Juhlin.

Monday, December 4th.—*Birmingham.* — At James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "Standardisation and Design of AC Turbo Type Generators," by G. A. Juhlin.

Tuesday, December 5th.—*Leeds.* — Great Northern Hotel, 6 p.m. I.E.E. North Midland Centre. "Design and Performance of Domestic Electrical Appliances," by W. N. C. Clinch and F. Lynn.

Coventry.—Coventry Electric Club. High tea and film show.

Wednesday, December 6th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. "The Measurement of Balanced and Unbalanced Impedances at Frequencies near 500 Mc/s and its Application to the Determination of the Propagation Constants of Cables," by Dr. L. Essen.

Thursday, December 7th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. "Standardisation and Design of AC Turbo Type Generators," by G. A. Juhlin.

Friday, December 8th. — *Manchester.* — Engineers' Club. Albert Square, 6 p.m. I.E.E. North-Western Centre Radio Group. "Theory and Performance of Corner Reflectors for Aerials," by Dr. E. B. Moullin.

Birmingham. — Crescent Theatre, 6 p.m. Illuminating Engineering Society (Birmingham Centre). "Design and Lighting of a Post-War Civic Theatre," by L. G. Applebee.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.30 p.m. I.E.E. North-Eastern Students' Section. "Brains Trust" meeting.

Saturday, December 9th.—*London.* — Lysbeth Hall, Soho Square, W.1, 6-10 p.m. I.E.E. London Students' Section informal dance.

London.—Lighting Service Bureau, Savoy Hill, W.C.2, 2.15 p.m. Association of Supervising Electrical Engineers. "P.V.C. in Practice," by P. H. Barton.

London.—39, Victoria Street, S.W.1, 2.30 p.m. Junior Institution of Engineers. Presentation of awards and induction of new president.

Bristol.—At Merchant Venturers' Technical College, 3 p.m. I.E.E. Bristol Students' Section. "Power System Operation and Maintenance," by K. H. Hope and W. A. Storey.

Monday, December 11th. — *Bristol.* — At Merchant Venturers' Technical College, 5 p.m. I.E.E. Western Centre. "Influence of Maintenance Requirements on the Design of Electrical Installation Equipment," by Hamlyn Drake.

Newcastle-on-Tyne.—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Restriking Voltage as a Factor in the Performance, Rating and Selection of Circuit-Breakers," by J. A. Hartle and R. W. Wild.

RECENT INTRODUCTIONS

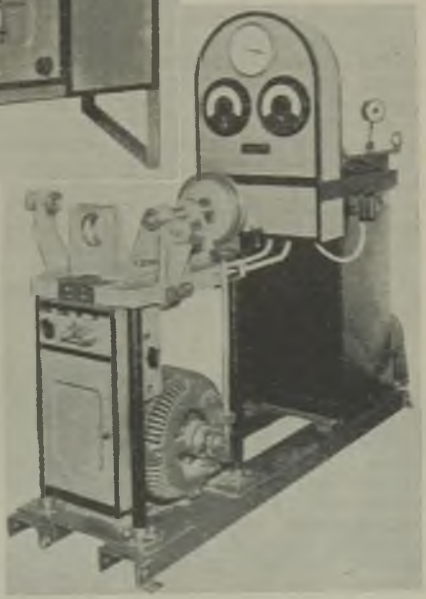
Notes on New Electrical and Allied Products

Garage Testers

A SELF-CONTAINED, transportable cabinet-type outfit for testing magnetos announced by the CITY ELECTRICAL Co., Emerald Street, London, W.C.1, has a driving motor suitable for coupling direct to any type of magneto, with control gear designed for a stable range of speed infinitely variable between 50 and 11,000 RPM. An electric speed transmitter is connected to a long-scale indicator and adjustable ball-type spark gaps are mounted above the bench level with all high-voltage leads enclosed below. Many variations have been built to suit individual needs, for energisation from AC or DC mains.

An outfit for testing the starting motors of aero engines is also made. It is energised from three-phase mains and provides a DC output of 1,000 A at a voltage variable between 7 and 26 V.

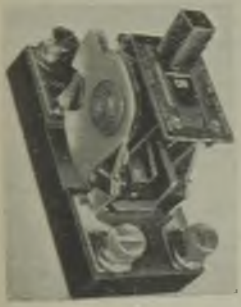
An adjustable bracket accommodates the starter to be tested and a brake is included for making torque tests. The instrument panel is fitted with long-scale ammeter and voltmeter as well as an electric clock for timing test periods.



Magneto testing bench and aero-engine tester (right)

New 60-A Switch

To meet the requirements of the combined kitchen unit to be installed in the Portal houses, and for similar purposes, ARROW ELECTRIC SWITCHES, LTD., of Hanger Lane, Ealing, are now producing a 60-A double-pole heavy-duty switch. This is mounted on a moulded base 4½ in. by 2½ in., with two-hole fixing. The unit has a projection of 2⅜ in. from the back of the base to the front plate.



Arrow 60-A switch

The construction is exceptionally robust, with a quick make and break action, the contact blades being neatly shrouded in snuffers of insulating sheet, so minimising arcing. The handle of the switch is marked "on-off," in addition to which a semaphore indication may be provided when the switch is installed in an enclosed box. Large special-purpose terminals are provided and are capable of comfortably accommodating 19/·044 v.i.r. cable. A similar unit for 30 A is already on the market.

Moulded Fuse Units

The ENGLISH ELECTRIC Co., LTD., Stafford, has published details of the recently introduced moulded fuse units of the "SM" type with precision contacts. These units are available in two ratings (30 and 60 A) each in four types for busbar mounting, front or back connection, or front back connection. They accommodate the company's type "T" high-rupturing-capacity cartridge fuse links which have been certified to comply with BS.88/1939, category of duty 440AC.4 (25,000 kVA at 440 V, three-phase).

A special feature in the design of the busbar type is that the contact and fixing screw centres are common to both ratings, which enables 30-A fuse holders to be spaced so that they may easily be replaced by the larger size should occasion arise.

Welders and Power Supply

Views of the Interested Parties

THE effect of resistance welding load on electric power supply networks was discussed at the informal meeting of the Institution of Electrical Engineers on November 20th, when the attention of manufacturers was drawn to the need for rating welding machines more uniformly. An examination in the United States of 200 machines showed their actual ratings to be from 20 to 250 per cent. of their name-plate values with power-factors ranging from 0·25 to 0·9 ; in 40 per cent. of the cases the rating was not given at all, or a mere kW loading without the power-factor was stated. There was little doubt that a similar examination in this country would reveal the same state of affairs.

DR. H. G. TAYLOR, who opened the debate, remarked that while it was not difficult to arrange a tariff for all welding, it was a very different proposition in the case of resistance welding, which necessitated collaboration between the suppliers of power and the users of the machines. There was need for a peak meter that would integrate over a short period of time.

The use of condensers for improving the power-factor and reducing the voltage drop, and the advantage of the series correction were pointed out. For instance, in one case a special cable would have cost £4,000 and condensers £400. A case was also quoted in which seven 15-kVA condensers were fitted in each line for a factory having twenty-one 75-kVA and two 100-kVA welding machines, reducing the voltage drop from 16 to 2 V.

Lamp Flicker Prevention

Avoidance of lamp flicker due to resistance welders in action could be effected by (1) heavier cables ; (2) power-factor correction; (3) three-phase supply instead of single phase ; (4) 3–1 phase balancing equipment; (5) electrical storage systems; and (6) motor generators. After pointing out that the inconvenience caused by lamp flickering depended upon the individual, the background and the type of work, Dr. Taylor demonstrated how a 2½ per cent. voltage drop was very easily seen in the flicker when using a 200-W metal filament lamp, whereas the same drop when using a sodium discharge lamp was hardly discernible.

In the general discussion representatives of the supply industry contended that they often had to put up with some dreadful apparatus on their systems, often connected without notification. This was especially the case in garages and small shops where welding was done at night under conditions which produced serious flicker; if it were done in the daytime when the lights were not in use it would matter less. The bigger installations were under better control. The general view was that the supply industry was not out to place deterrents in the way of those using welders, although it claimed a right to a reasonable remuneration. At the same time an appeal was made to manufacturers to stop selling 230-V welders for connection between phase and neutral.

A welding machine user said it was quite clear that the supply industry, as yet, had no very definite ideas on the matter. Nevertheless, it was driven home to users that the supply industry was not asleep over this matter and that it was giving very careful consideration to tariffs. In the meantime tolerance was exercised, although it was recorded that in some cases welders' meters did not register. This led to remarks that it might be well not to make a kWh charge, but to assess a single charge for the use of a machine, which brought the reply that unscrupulous users would be tempted to connect other apparatus to the welder circuit. The Croydon tariff was not considered a final solution; it had certain serious objections.

Reasonable Revenue Expected

The general view on the supply side was that the authorities must have a reasonable return on the capital expenditure incurred in meeting the welding demand, but that sufficient experience had not yet been obtained to enable definite proposals to be made. The advantages of power-factor correction were discussed and their consideration was recommended to the E.R.A. in connection with any proposals for tariffs. There did not seem any hope that the consumer would incur the extra expense of condensers unless he saw compensation by way of appropriate tariffs.

A general comment was that resistance welding had been given scant attention hitherto although there had been a great deal of unwarranted criticism, faulty reasoning and incorrect deductions. A great deal of the troubles now experienced might be due to the lack of a standard specification. Another point concerning the use of condensers in resistance welders was that they had the effect of increasing the short-circuit kVA rating. The result would be that the user was asked to improve his power-factor by going to the expense of installing condensers and then he might be asked to pay more because he had increased the short-circuit rating of his machines. The lack of any satisfactory instruments for measuring welding load was also emphasised.

Aircraft Wiring System

Possibilities of Wider Application

By Reginald H. W. Cox and W. E. Hill

IT has recently been announced that a new system of wiring has now been standardised for British civil and military aircraft,* a development which reflects great credit upon the Society of British Aircraft Constructors and the Ministry of Aircraft Production. Some credit for this major advance may also be taken by the electrical industry, for it was inspired by the system for wiring aircraft developed by J. A. Crabtree & Co., Ltd., in 1941. The two are, indeed, so closely related that a description of one applies, in principle, to the other, but since the original Crabtree system has wider non-aviation possibilities the account which follows is limited to it.

Fig. 1.—Subsidiary conduit clamp

The Crabtree system marks a complete departure from aero-wiring methods. It is, in principle, the well-tried point-to-point method so familiar to electrical installation engineers, but adapted to aviation service requirements and designed to conform with modern methods of aircraft construction.

Interconnections between all points can be made with either single-conductor or multi-core cables fitted directly to the airframe structure, or housed in insulating, easily removable conduit or troughs. Any form of distribution can be achieved by fixing the main distribution and junction boxes at appropriate points throughout the aircraft. The components of the installation are individually accessible, so that modifications and replacements can be made with the minimum of disturbance to the installation. Standard Air Ministry cables are employed throughout. They are cut to the required lengths and fitted with the identification sleeves.

Conduit is extruded from a polyvinyl chloride compound and is in four standard sizes of the following internal diameters: $\frac{1}{4}$ in., $\frac{3}{8}$ in., $\frac{1}{2}$ in. and $\frac{3}{4}$ in. To enable it to be directly connected without tools to the distribution and junction boxes, each length, after being cut to size, is fitted with grooved end-bushes. The employment of p.v.c. conduit is advantageous since it permits the use of single-core cables and thus limits the disturbance of a circuit or sub-circuit occasioned by damage or breakdown. Cables may be drawn in or out as desired. The p.v.c. is tough, yet relatively light; it is a good insulator; proof against water, petrol, acids, alkalis, hydraulic fluid and glycol; and, in the event of fire, will not support combustion. It is also most flexible and can therefore be drawn behind and around such obstructions as tanks and hydraulic pipes. Repairs to the conduit can also be made quite expeditiously in the aircraft.

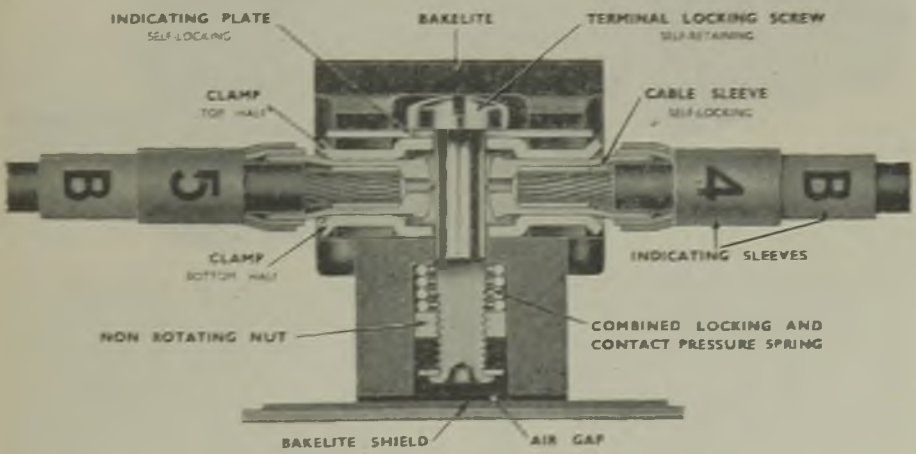


Fig. 3.—Straight-through single-tier terminal

* *Electrical Review*, November 10th, 1944, p. 669.

In certain types of aircraft the main conduit runs are enclosed in longitudinal troughs and held in position by adjustable buckles. Subsidiary conduit which runs away from the main system is secured by a clamping device consisting of two parts: an aluminium base which is screwed or riveted to the airframe; and a steel spring clip which is pushed on to the tubing in alignment with the base. One end of the clip is then inserted in the appropriate slot in the base and the other end is engaged by pushing it with a screwdriver. Where two or more conduits are supported at a common point, the requisite number of bases are carried in a bracket. Any other arrangement can also be achieved with varying sizes of conduit without recourse to special attachments. This is a particular advantage when modifications and additions are being made.

Each of the boxes consists of a shallow base, reinforced with an inner frame, and a detachable flush-fitting cover. The box, when closed, has a smooth cornerless exterior. Conduit entries are provided on all four sides and, until required, are closed by easily-removable bushes. To remove the cover, the nuts on the fastening device are unscrewed to their fullest extent. They can then be pushed inwards to release the catch and enable the cover to be pulled off. After replacing the cover, the nuts are screwed home to ensure that it is locked in position.

The inner frame is an important feature of design. Welded to the base so as to provide a double wall, it gives the assembled unit so high a degree of rigidity as to permit the box to be pressed up from very light-gauge material, thus reducing weight. At the same time, it holds and anchors the conduits, provides for the locating and locking of the cover, and seals the erected box against dust and moisture.

Particular attention should be drawn to the keyhole-type conduit entries in the frame. With the base of the box already in position, they permit the conduit to be fixed, without tools, by a simple lateral movement. It is merely necessary to compress the end-bush on the conduit between the thumb and forefinger and push it through the slot and into the circular opening. Immediately the end-bush is released, it will return to its circular shape and will then be locked firmly in position. To remove a conduit, this process is reversed.

The straight-through single-tier terminal employed for up to 37 A holds the cable sleeves between two spring-loaded clamps which are rigidly locked in position by the action of a central screw. Under its head

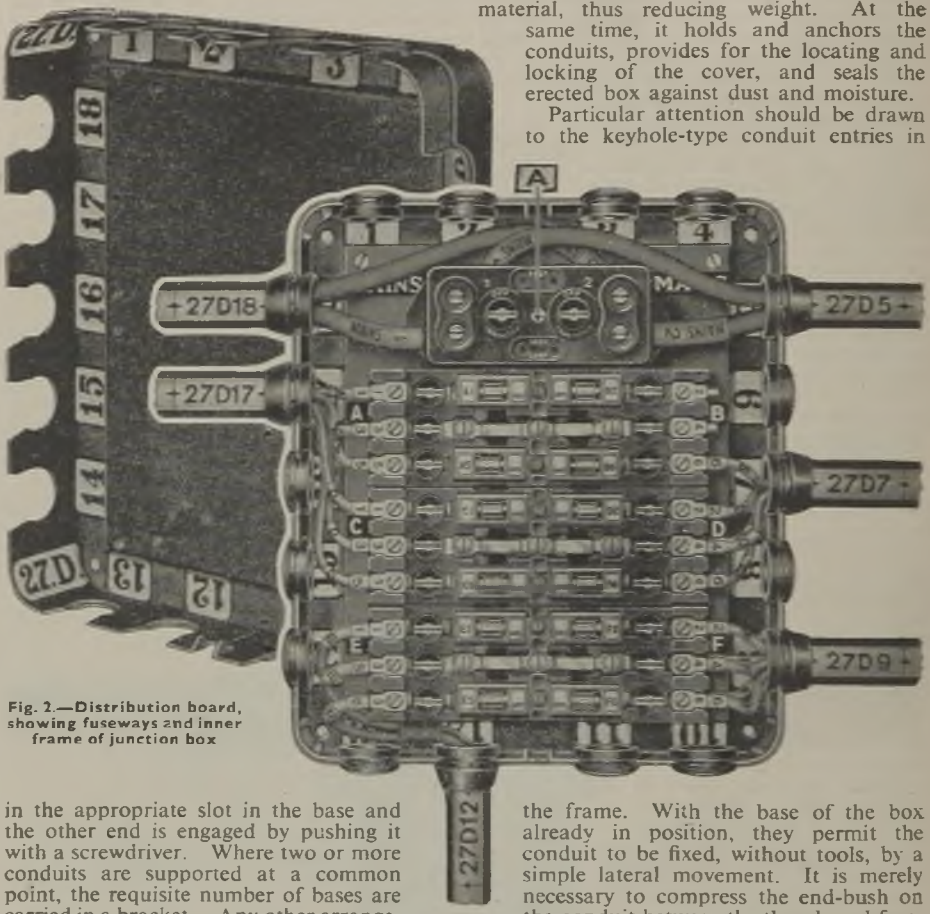


Fig. 2.—Distribution board, showing fuseways and inner frame of junction box

is a lozenge-shaped plate which serves both as a locking washer and as an identity disc, this plate carrying the number of the terminal concerned.

To connect a cable, the terminal-locking screw is slackened. The cable sleeve is next inserted in the mouth of the terminal until it has clicked into position and the locking screw is then tightened. To disconnect, the locking screw is slackened until the resistance of the retaining washer can be felt. The cable is then pulled with an outward and slightly upward movement. For service at 64 A and above the terminals are of the clamp type.

All terminals are mounted in moulded blocks and apart from variations to meet special conditions these are all arranged to accommodate five, or a multiple of five, terminals. The range embraces the straight-through single-tier, straight-through double-tier and single-end double-tier types, and all types may be mounted in a single distribution or junction box. Any adjacent pair, or pairs, of terminals may be interconnected by means of the standard link which is inserted *under* the indicating plate of each terminal. When in position these links clearly indicate the existence of interconnections.

Fusing is carried out only on the positive side, all negative links being solid. A tandem arrangement enables a pair of fuses to be supplied from a single positive feed. The

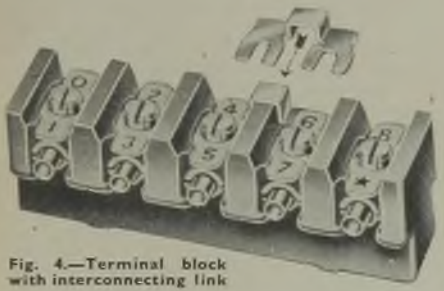


Fig. 4.—Terminal block with interconnecting link

base is a " Jacelite " moulding, through the centre of which a busbar is connected to a double set of fuse clips. On each side of the busbar there is a complete fuseway consisting of a single set of clips, each connected through an isolating switch to a wiring terminal. Each fuse unit, therefore, embodies a central positive connection for two fuses and wiring terminals, each of which may be individually disconnected from the supply by means of separate isolation switches.

Wiring terminals are exactly similar to those already described. The isolating switch is a spring-loaded push-and-turn type. To interrupt the supply to any particular fuseway, the appropriate button is turned through 90 deg. in an anti-clockwise direction and the finger is removed to allow the button to rise, the circuit being broken immediately the button starts to rise. To close the circuit, the button is depressed and then turned in a clockwise direction to lock the switch in the " on " position.

Standard Air Ministry type cartridge fuses are employed. The small tube of transparent insulating material that surrounds the element is closed by metal end-caps which provide contact between the element and the clips in the fuse box. To enable this cartridge to be easily inserted and withdrawn, it is carried in a holder having a window opening large enough to enable the condition of the fuse element to be readily observed without removal. Clearly visible from the front are the terminal identification details together with the fuse rating indicator. The latter has a matt surface to enable the rating of the fuse to be written in in pencil.

Distribution Boards

Distribution boards are single-, double- and triple-pole. In a standard distribution board an incoming unit is mounted above the fuseways to serve a fourfold purpose by providing (*a*) a convenient " through " connection, if required, for the main cables entering on one side and passing out on the other, (*b*) a terminal point for the busbars, (*c*) facilities for isolating the busbars from the supply, and (*d*) a connection point for an earth-testing set. The incoming unit in the single- and double-pole distribution boards also provides suitable connection points for an ammeter, an inspection lamp and for soldering tongs. This unit is important in the system for locating faults and in testing.

Below the incoming unit are the fuseways arranged in numbered sequence, odd numbers on the left and even on the right. In double-pole distribution boards only the positive side is fused and the negative is passed through solid links, the latter having double-tier terminals. There are thus two fused ways to each negative link. The busbars are so formed from strip copper that the main bar as well as each sub-circuit connection and terminal plate are all in one piece. There are thus no riveted or screwed parts to work loose and cause overheating.

The rating of each sub-circuit will vary according to its load. A 12-way board may embody five 1-A, two 2-A, two 3-A and three 5-A fuses, with spares of those ratings carried under clips inside the cover of the board. The rating of any particular fuseway may be ascertained either from the fuse-holder concerned or from the diagram inside the cover of the board. To make such identification easy, the fuse-holders carry two symbols: at one end is the number of the fuseway, such as " D 2," and at the other is the rating of the cartridge it should carry, such as " 3 A." Fuse-holders are thus designed to be either right- or left-handed.

The rating is printed on a matt surface so that changes can be marked with an ordinary lead pencil.

For identification purposes, all conduit entries are numbered in a clockwise direction and the number of the board, such as " 4 D,"

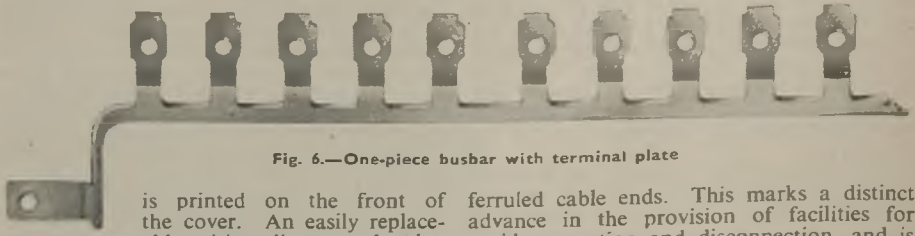


Fig. 6.—One-piece busbar with terminal plate

is printed on the front of the cover. An easily replaceable wiring diagram, showing all connections made in the board, is also mounted inside the cover.

A junction box comprises a number of terminal block units mounted upon " Jacelite " plates in the standard type box already described. They are not used extensively, being most frequently employed in the larger aircraft between sections of the fuselage. Their use enables the aircraft constructor to complete the electrical installation of each section, before it is transported for assembly, without the need for long cable runs to extend beyond the limits of the section.

In general, each terminal junction block consists of five dual-entry terminals mounted in a single moulded base. Each row of terminals, which comprises two such junction blocks, will therefore consist of ten or a multiple of ten terminals. Circuit numbering and junction block identification are carried out on a similar basis to that for the distribution fuseboards, even numbers at the top and odd numbers at the bottom. Conduit entries are numbered clockwise and entry No. 1 is always situated in the same position.

When the space available for the box is limited, the junction blocks may be " tiered," each pair of " through " terminals having another pair above it. In extremely restricted situations the box may embody a specially compact junction block in which ten terminals are provided, each with dual entry. Cable runs are therefore taken " in " and " out " at the same side of the block. Tiered terminal units are employed only when severe space limitation prevents the use of the single-tiered straight-through pattern.

Wider Possibilities

Since this new wiring system has given unfailing service under the most onerous operating and climatic conditions, its possibilities for wider service should interest designers of industrial and domestic appliances as well as installation and consulting engineers. It can be applied in its entirety to prefabricated houses and, with suitable modification, to the electrical installations of buses, coaches and railway carriages. For other forms of wiring, major interest lies in the principle introduced by the terminal block in co-operation with ferruled cable ends. This marks a distinct advance in the provision of facilities for rapid connection and disconnection, and is clearly of interest wherever a number of current-consuming devices are built into a single service and may separately require replacement or maintenance.

For example, a built-in kitchen layout could, with advantage, be provided with this type of terminal. The many connections on a machine tool would be more readily identified and disconnected for maintenance purposes if all the cable ends were fitted with the standard ferrules and fed from a common terminal block.

The principle of rapid and trouble-free disconnection may even be extended to individual household appliances, such as 2- or 3-kW heaters, washing machines, cookers and refrigerators. The influence of the new terminal on the design of switch- and fuse-gear generally cannot yet be estimated, but it is possible that it will change both the design of service entries and the technique of installation.

American Production Costs

THE appliance position in America was commented on recently by Mr. J. H. Ashbaugh, of the Westinghouse Electric & Mfg. Co., who said that it was much easier to start production of war goods than it will be to revert to the production of consumer goods. He believed it would take a concern like the Westinghouse Co. about four months to obtain material and one month to fabricate parts; production of electrical appliances for civilian use should start in the fifth or sixth month.

Prices were a problem. The increased cost of labour had averaged 41 per cent. since 1940; wholesale prices were up 32·9 per cent.; house furnishings retail had advanced 27·2 per cent.; wholesale prices were up 16·1 per cent.; and the cost of living was up 24·1 per cent. He believed that a better job had been made of price control in this war than in the last, but the true test was in the coming months. All of their civilian goods had " ceilings " on a 1940 basis placed on them when they went out of production. Since then their costs had increased by 21 per cent. but they might be reduced by improved manufacturing methods.

PERSONAL and SOCIAL

News of Men and Women of the Industry

ST. Marylebone Borough Council Electricity Committee has extended the services of **Mr. F. Selley,** its chief electrical engineer, for a further period of twelve months. He was to have retired at the end of 1940.

Mr. R. M. Muckart has been appointed engineer, Power Department (Southern Area) of the North-Eastern Electric Supply Co., Ltd., as from December 1st in succession to Mr. H. H. Mullens. As already reported, Mr. Mullens is taking up the position of assistant general manager.

Mr. Moir Mackenzie, C.M.G., O.B.E., the Empire Director of the Federation of British Industries, is now in Canada, and **Mr. C. F. I. Ramsden,** the Foreign Director, is in France to see how the Federation can re-establish its representation in that country. Similar visits of F.B.I. officials to other countries are planned.

Mr. W. H. Taylor, general manager of the Western Australian Government Tramways and Electricity Supply, arrived in London on November 13th in connection with the establishment of a new 50,000-kW power station in Western Australia.

I.M.E.A. Council Appointments.—Mr. F. W. Lawton (Birmingham) has been appointed a "Group C" member of the Council of the Incorporated Municipal Electrical Association in the place of Mr. H. C. Lamb (Manchester) who has retired. Messrs. A. Kelso (Harrogate) and E. A. Mills (Hackney) have been appointed to fill vacancies in "Group B" caused by the retirement of Messrs. C. W. Salt (Carlisle) and J. D. Spark (Willesden).

Mr. W. F. Higgins, secretary of the National Physical Laboratory, has been appointed superintendent of the physics division, in which capacity he had been acting since the death in 1941 of the late Dr. G. W. C. Kaye. He is succeeded as secretary by **Mr. E. S. Hiscocks. Mr. G. A. Hawkins** has been promoted superintendent of the engineering division.

Mr. A. W. K. Billings, a vice-president of the Brazilian Traction Light & Power Co., Ltd., has been elected president in succession to the late Sir Herbert Couzens. **Colonel Walter Gow,** K.C., another vice-president, has been elected chairman. **Mr. G. Howard Ferguson,** a director, has been elected a vice-president.

Mr. A. Miller has resigned from the board of the Brush Electrical Engineering Co., Ltd., owing to the pressure of other duties.

Mr. Dilwyn Williams has been appointed deputy to Mr. T. R. Evans, electrical engineer to the Rhondda U.D.C. He has been chief assistant and has served in the undertaking for many years.

Professor William Wilson, who has recently retired from the Hildred Carlile Chair of Physics at Bedford College, University of London, spent his student days at the Universities of London and Leipzig. In his early years he carried out much pioneer experimental work on photo-electric emission and developed a quantum theory of thermionic emission and he found an expression for the eccentricities of the elliptic orbits of electrons; thus he opened up a large field of progress in the study of atomic structure. In 1921 he introduced the concept of generalised momentum into the theory of the electromagnetic field, and has since become much interested in Kaluza's five-dimensional theory of relativity. He was elected F.R.S. in 1923.

Obituary

Mr. P. J. Robinson.—We deeply regret to record the death, at Deganwy, on November 23rd, of Mr. Percival James Robinson, who retired from the position of city electrical engineer of Liverpool in March last. Mr. Robinson was for a great many years an outstanding personality in the electricity supply industry and was connected with Liverpool during the greater part of his career. He was born at Erith, Kent, in 1879, served an apprenticeship with Johnson & Phillips, Ltd., and received his technical education at Finsbury Technical College and Prescot. While in this town he secured a position with British Insulated & Helsby Cables, Ltd., and from 1900 to 1902 was engineer and manager of the Garston & District Electric Co. When this concern was taken over by the Liverpool Corporation he became mains engineer in the city undertaking and by 1920 had reached the position of deputy city electrical engineer. He succeeded the late Mr. H. Dickinson as chief in 1927 and was subsequently responsible for the design and construction of the Clarence Dock station. He also acted as consultant for the electrical equipment of the Queensway Tunnel. Although he was due to retire in 1939 he consented to remain at his post until the end of the war but, as already stated, decided to retire in March last, when he was succeeded by Mr. J. Eccles, of Edinburgh.

The late Mr. P. J. Robinson

Mr. Robinson had been a member of the I.E.E. and E.D.A. Councils and president and hon. treasurer of the I.M.E.A. He was a member of the Institutions of Electrical and Mechanical Engineers. The honorary degree of M.Eng. was conferred upon him in 1933 by Liverpool University, and he was made a C.B.E. in the 1943 New Year Honours List. Two directions in which Mr. Robinson did good work were smoke elimination and the application of discharge lamps to street lighting. We extend our sympathy to Mrs. Robinson and her two daughters in their loss.

Mr. John Pilling, M.I.E.E., managing director, Savages, Ltd., St. Nicholas Ironworks, King's Lynn, died suddenly on November 20th at the age of seventy-six. He was a former borough electrical engineer of King's Lynn.

Will.—**Mr. P. S. Turner,** of Associated Electrical Industries, Ltd., left £85,430 (net £79,745).

Britain's War Effort

Hard Work and Sacrifices

FULL details of the war effort of the United Kingdom were released in a White Paper published on Tuesday (price 1s.). This demonstrates how widely man-power has been mobilised and organised, how women have contributed to industrial production, and how Britain has been able to supply its own needs of arms and ammunition and those of its Allies in spite of air attack, attempted blockade and the handicaps imposed by the black-out, dispersal of factories and the disruption of communications. Statistics also show the sacrifices Britain has made—the casualties incurred, houses destroyed, standard of living lowered, taxation increased, export trade abandoned and foreign investments sold.

Public utility services are shown to be carrying out their increased duties with 65,000 fewer men than before the war though 15,000 women have helped to fill their places. All the electrical equipment produced for the war effort is not detailed separately, but some idea of its extent can be gained from the fact that from September, 1939, to June, 1944, over 3,000,000 miles of communication cable, over 500,000 telephones, nearly 500,000 wireless stations and over 34,000 receiving sets were made. Although electrical exports, owing to their vital nature, have not fallen as much as most other items, exports generally have been cut to 29 per cent. of the 1938 figure. Supplies of electrical apparatus for civilian use have been drastically curtailed and the production of many articles, such as refrigerators, vacuum cleaners and aluminium hollow-ware, has been completely suspended from 1942 or earlier. Whereas in 1935 1,900,000 wireless sets were available for civilian use, only 50,000 were on sale last year, while there were no vacuum cleaners available last year compared with 400,000 in 1935.

So far war expenditure has amounted to nearly £25,000,000,000. The facts disclosed in the White Paper indicate that the total war effort of the population of Great Britain per head has been greater than that of any other belligerent.

Sawdust Drying

IN the last stages of their manufacture the balls and rollers used in bearings are treated with lime, and this has to be removed to avoid possible corrosion. In one works they are therefore treated with sawdust from which all moisture has been evaporated by passing it through the "tunnel" of a G.E.C. infra-red lamp heating plant which has been specially designed to dry the sawdust more quickly and more uniformly than hot air. In addition, the infra-red process has removed another source of trouble. In the first place, it is necessary to evaporate the moisture from the sawdust so that there is no tendency for fine wood particles to stick to the balls. Though this was achieved with varying success by the previous method, it did not remove the resinous content, with the result that tiny patches of resin still adhered to the balls after treatment. The infra-red plant volatilises the resins simultaneously with the evaporation of the moisture while the sawdust is treated on a Fraser & Chalmers "Sherwen" electro-vibrating conveyor.

The infra-red heating plant consists of six rhodium-plated troughs (in two rows of three) each containing nine "Osram" infra-red industrial lamps, the total loading being 13·5 kW. The complete equipment handles 400 lb. of sawdust in 24 hours; the proportion of moisture evaporated is 10 or 12 per cent. by weight.

Reference Books

"Electrician" Tables of Electricity Undertakings.—Despite restrictions on information, the *Electrician* "Annual Tables of Electricity Undertakings" form a valuable book of reference and their usefulness will further increase with anticipated post-war electrical development. The fifty-fifth edition, for 1944-45, has been revised as thoroughly as conditions permit and contains details not only of British undertakings but also of Dominion and Colonial undertakings. The publishers are Ernest Benn, Ltd., Bouverie House, 154-160, Fleet Street, London, E.C.4, and the price is 12s. 6d., including carriage.

"Ironmonger" Hardware Buyers' Guide.—The seventy-seventh edition which includes the *Hardwareman* "Year Book," contains forty pages of special articles and features, among the subjects covered being price control, purchase tax, the control of shops, prohibition and limitation Orders, war damage, patents and designs. In addition to the buyers' guide and a page-a-week calendar, there is a special section on trade marks and brands. The Guide is available only to regular subscribers to the *Ironmonger.*

Copper Springs.—The Copper Development Association, Grand Buildings, Trafalgar Square, W.C.2, has published a 62-page book which deals with both the design and manufacturing aspects of copper springs. It contains information about flat, helical, torsion and miscellaneous springs; the mechanical and physical properties of the commoner copper alloys used in making springs; their fatigue strength and resistance to corrosion as well as their behaviour under various conditions, showing that the special properties of copper springs makes them an economic proposition. The book (Publication No. 39) ends with a bibliography of 67 references. It is obtainable free by users of such springs.

Architects and Lighting

A JOINT meeting of the Birmingham & Five Counties Architects' Association and the Illuminating Engineering Society (Birmingham Centre) was held on November 17th, at the Society of Artists Gallery.

The chief address was on "Recent Development of the Fluorescent Lamp," by Mr. F. L. Cator, B.Sc., A.M.I.E.E., who gave some practical demonstrations of the new lamps, and showed the latest development in regard to future colour, more red being introduced in order to produce a much warmer light for post-war commercial purposes.

The meeting, which was under the chairmanship of Mr. Cyril Martin, F.R.I.B.A., expressed the opinion that to obtain the most satisfactory results in illumination, closer co-operation between the two professions, was necessary at the early stage of building construction.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

I.E.E. Examinations

MOST readers interested in technical education will be aware of the new, regulations for associate membership of the I.E.E., which come into force October 1945, and that exemption through National Certificates will only be granted on a subject-for-subject basis. So far as mathematics, mechanics and electricity are concerned, I am in complete agreement with this condition; but I emphatically protest against the subject that goes under the hybrid title of "applied heat (with light and sound)," a title that—according to the syllabus—should have included properties of matter.

The syllabus includes such items as: Equipartition of energy; agitation velocity; structure of chain and ring type organic molecules; wave theory of light; bi-prisms; double refraction. One can only conclude that the committee responsible for drafting this syllabus must have been dominated by university professors completely out of touch with part-time technical education. The great majority of students attending National Certificate courses do so with the object of qualifying for the professional status of Institution membership; but it will be extremely difficult, if not impossible, for most technical colleges to provide a course that will cover adequately the new syllabus.

The astonishing thing is that the Institution makes these highly specialised scientific subjects compulsory for every electrical engineer but ignores completely such an important subject as engineering drawing—a subject that is taken by every student following a National Certificate course. Most colleges hold a class in heat engines in their S3 or advanced course; and I would suggest that the passing of an assessed examination in such a subject should give complete exemption from the applied heat paper of the Institution.

It would be useful to have the views of other teachers concerned with National Certificate courses.

EDWARD HUGHES, D.Sc., M.I.E.E.
Technical College, Brighton.

Switch Design

YOUR abstract of my remarks in opening the discussion at the I.E.E. Installations Section on November 9th reports me to have said that as regards switches quick break was essential. I think the reporter must have been a little confused as this is completely contrary to my convictions.

The greater part of my remarks were in connection with micro-break switches for AC circuits in which I have been interested ever since Dr. Thornton introduced this question in 1937. This theory of switching shows that the quick break switch as usually known is entirely wrong in principle and what I intended to convey was that I agreed that quick make was necessary, but this should be combined with pressure after the contact was made.

Birmingham. E. A. REYNOLDS.

Fluorescent Lamps

IN his letter published in the *Electrical Review* of November 17th, Mr. T. H. Carr draws attention to the difference in characteristics between tungsten-filament and fluorescent lamps. The facts are that initially fluorescent lamps give a great deal more light than is usually quoted by manufacturers and that the light output settles down to a more constant value after about 100 hours' life. Thereafter, although the life of the fluorescent lamp is two or three times that of the tungsten-filament lamp, its candle power maintenance throughout life compares very favourably with that of the tungsten lamp.

The diagram, to which Mr. Carr draws attention, is based on the fact that the average light output throughout life for the fluorescent lamp is 2½ times that of the tungsten lamp of equivalent wattage. W. J. JONES,

London, W.C.1. *Director,*
Electric Lamp Manufacturers' Association.

Post-war Lighting

IT seems fairly obvious that the majority of post-war lighting schemes—industrial, commercial and domestic—will be based on the fluorescent lamp. New sizes will, of course, be developed, probably as small as 15 in. to 18 in. rated at 20 W. (In view of the requisite control gear for this type of lamp, any smaller size would, I think, be uneconomical.)

There is, however, one very important lighting purpose for which this lamp—up to the present—cannot be used, *i.e.*, street lighting, unless our city fathers decide to "arcade" the pavements in the main shopping centres, in which case they could be used inside the arcades. The idea of arcades is, of course, not new; in fact one well-known North-Western seaside resort has gone in for this in quite a big way. The three main objections to this Utopian idea are, of course:—(1) Expense of structure; (2) expense of lighting equipment; (3) heat in summer. The first would, I think, be met by the shopkeepers, as it would add a great deal

to the pleasures of shopping, especially to the ladies, besides reducing the number of road accidents which occur in normal times through pedestrians—especially children—stepping into the roadway. The second objection is purely a matter of finance but I think it necessary to point out that tungsten lamp lighting would clash very badly with fluorescent shop-window lighting, while as regards the third, there are comparatively few days in our climate when this should be very serious. I think this suggestion is worthy of consideration.

Hull. H. B. SCAIFE, *Manager, Lamp & Lighting Sales, Hull Area,* B.T.H. Co., Ltd.

Age Limits

IN view of my probable return to England on the conclusion of certain war work in Canada I turned to your "Situations Vacant" columns to find some indication of the prospects of employment there. Your issue of September 29th was the latest to hand and this is what I found on the first page of these announcements: (1) The Borough of Fulham wants an assistant operating engineer with quite considerable experience, who must be under 40. (2) The County Borough of St. Helens asks for a power station superintendent, also with very considerable experience, who must be not over 45. (3) The Borough of Fulham wants also a fully qualified and experienced charge engineer; this man also must be under 40. (4) The next advertisement tells that Birmingham Technical College seeks an assistant head of the Department of Electrical Engineering, with honours degree and industrial and teaching experience; no age limit is stated, but the salary offered indicates that only a young man is wanted. (5) An advertisement for an Area Officer for B.E.D.A. (of all people !): he must have a lot of experience but he must not be over 45.

I did not read any further, but the feelings aroused by these first five announcements were not too pleasant and even less hopeful. I suggest that not one of these positions requires an age limit, provided the man engaged is physically and medically fit. What, then, is the reason for these age limits ? Perhaps an incident which occurred to me before the war will furnish an explanation. The chief engineer of a very large undertaking paid me the compliment of saying that if he could give me the job he would not look at any of the 200 applications which he had received for a position he had advertised. To my obvious question as to why he did not give me the appointment, he replied that he dare not take a man over 40 on account of the provisions of his Council's pension scheme. I agreed that it would not be reasonable to expect a pension after about 12-15 years' service and expressed my willingness to be excluded entirely from the pension scheme, but he said that this would not be permitted by the Government.

Does this mean that the electrical industry is out to nullify at least one of the Allies' aims, "freedom from want" ? The younger men's jobs are to go to the young men who return from active service (even this idea has many opponents and objections). The senior men's jobs are to go to men under 40 or 45. The Beveridge plan will give a married man 35s. a week at age 65. How does he live from 40 or 45 until he is 65 ? (And after !)

This problem is being taken up in Canada by the Association of Salaried Employees and a letter just published from the president, Mr. K. G. Walters, contains the following remarks: "Hundreds of thousands of older men and women have demonstrated how capable they were in doing work which, but for the war, would in all likelihood have been limited to those who are much younger. . . . It should be made an offence to refuse to employ any person because of an age limit." On the subject of the conditions imposed by insurance companies he says: "If that is the case it is another reason for legislating against any such conditions being put into any insurance contract." He further forecasts Parliamentary action in the matter. I think much of this is equally applicable to England. What do the English associations who cater for salaried workers say on this matter ? Their own members must be directly affected.

A final question: I have no personal knowledge of the gentlemen who issued the advertisements which I have quoted, but I will hazard a guess that they, or those who authorised them to publish these advertisements, are all over 40. If this is the case, has any of them considered the question that he should be retired forthwith solely on the grounds that he is, on his own showing, too old to take and therefore to hold, a responsible position ?

Montreal, Que. E. ARTHUR PINTO.

Electricity in the Navy

THE article entitled "Colour Bar" in your issue of September 29th reminds me of an incident in my own career which has some historic interest. Somewhere about 1900, the Admiralty decided to give a trial to a system of power supply from 100-V 500-A compound-wound dynamos in parallel instead of connecting each one to feed its own circuits. Siemens and Ayrton were appointed to carry out this experiment in H.M.S. *Kent*. All boiler-room and engine-room fans, previously always steam driven, were made electric and so were the 6-in. mountings.

I happened to be working on the switch-

board in the dynamo room whilst the trials were in progress, and observed that one dynamo at least was burnt out and that the fuses gave trouble. At that time I was a shipfitter apprentice with ambitions to become an electrical man.

In due time I realised this ambition, and in 1914, when this ship returned from the China Station after twelve years' service, I was sent aboard to make a rough sketch of the dynamo system, as the ship's drawings had inadvertently been left behind. On assembling my sketches, it seemed that I had either made a very bad mistake or else I had stumbled across a horrible blunder in installation.

I then found that all the circuit-breakers in the equalising system were fitted with little machine-made wedges, supported by cords, and that double fuses were fitted on the main supply circuits from the dynamos. There was also evidence of these having blown, apart from the information given by the last ship's company that the dynamo often threw out the solder from the risers, and I have since found that throughout previous commissions these dynamos were a "nightmare."

Actually, the ammeters, which had been installed between the equaliser bar and the series fields instead of on the other pole, were no guide at all to the load carried by each machine, and, generally, one machine was always taking the greater burden. The ship's staff stated that in trials, without the breakers wedged in, a load of 100 A suddenly applied would throw off the machines one after the other until one only took the load, its fuses blowing finally if the load was above its capacity.

There was some opposition to my suggestions for remedying the fault, but after five months' persistence my point was proved and the error was corrected, which meant the rewiring of the 500-A cables. On the trials at the completion of the refit, the wedges were thrown away, single fuses were replaced in the dynamo circuits, and trials were carried out. The most severe was with three machines running and a general load of up to 400 A and both boat-hoist motors (each taking 540 A) started at the same moment. Only a slight dip of the lights was observed, whereas previously most circuits were shut down and one motor only was started at a time.

After the last war, the warrant electrician of the ship sought me out and emphasised that in the opinion of the torpedo lieut.-commander and himself had not this alteration been carried out the ship would not have distinguished herself as she did in the action against Von Spee's squadron off the Falkland Islands, as the famous burst of speed and firing which was accomplished depended directly on the continuous running of all the electric ventilating fans in the boiler and engine rooms.

It would nowadays appear unbelievable that so simple an electrical error could have persisted for twelve years without detection, but in those days, of course, electrical knowledge was not so general as good workmanship.

South Africa. R.N.

Electrical Instruction for Children

I HAVE noted with surprise that a committee of the E.A.W. has suggested to education authorities that electrical instruction for children from 11 to 14 years should be included in the curriculum. If boys and girls leaving school to-day could read, write and spell correctly, the foregoing suggestion might be in order, except that as the average boy is naturally venturesome I deprecate such instruction being given to irresponsible youngsters. As I have been training apprentices for many years I have had some experience of boys.

Glasgow. ALEX. MILNE.

[The E.A.W.'s suggestions are dealt with in a note in this issue.—Editors, *Electrical Review*.]

Registration of Contractors

I AM informed that only about half of the E.C.A. membership are now on the voluntary register. This seems to indicate that the remainder are unfit or unwilling to fulfil the conditions of safe wiring.

Should Parliament ever grant licences to people who for twenty years could not get on to the N.R.E.I.C. list and would need compulsion to carry out rules?

Scotland. REGISTERED.

Books Received

Steel Manufacture Simply Explained. By Edwin Gregory and Eric N. Simons. Third edition. (Pp. 205; figs. 53.) Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 12s. 6d.

Metallurgical Experiments. By F. Johnson, head of the Metallurgical Department, Central Technical College, Birmingham. Second and revised edition. Pp. 80. Paul Elek (Publishers), Ltd., Africa House, Kingsway, London, W.C.2. Price 5s.

Electric Power Stations.—Vol. II. By T. H. Carr. Second edition, revised and enlarged. Pp. 549; figs. 456. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 32s.

Radio Technique. By A. G. Mills. Pp. 170; figs. 301. Chapman & Hall, Ltd. Price 12s. 6d.

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COMMERCE and INDUSTRY

Supplies of Domestic Equipment. Accounts Ban Lifted.

More Electrical Appliances

SPEAKING at Leicester last week Captain Waterhouse, Parliamentary Secretary to the Board of Trade, referred to the position regarding the production of household equipment. He said that arrangements were being made to give the trade as much aluminium as it could use for the making of aluminium hollow-ware, always provided that its manufacture did not interfere with any war contracts. Licences were being given more freely for the production of electrical appliances, such as kettles, irons, water heaters and cookers, but, said Captain Waterhouse, the supply must still remain short and it could not be hoped that it would anything like meet the dammed-up demand for these appliances. For some years wholesalers had not been allowed to sell their stocks of heating apparatus which were held for emergency users. As from December 1st this restriction would be removed and they might freely sell whatever stocks they had.

Publication of Accounts

The Minister of Fuel and Power on November 21st made the Accounts (General) Direction and Order, 1944 (S.R. & O. 1944 No. 1299) which revokes the 1942 Order of the same name (S.R. & O. 1942 No. 2631). The prohibition imposed by the latter on the publication of the accounts, or of information contained in the accounts, of *inter alia* statutory electricity undertakings, accordingly ceases to apply as from December 1st, 1944. The Electricity Commissioners, in a memorandum to undertakings, also refer to their circular letter of January 30th, 1940, in which they indicated that undertakings should not publish any information of the stocks of coal which they held, or any information from which the stocks could be deduced, and prescribed a modified form of accounts to enable this to be complied with. It has now been decided to withdraw this prohibition also, and particulars of such stocks are again to be given in the accounts.

Lead-covered Cables

The Cable Planning Organisation of the Ministry of Supply has removed the restrictions upon the manufacture and use of lead-covered cables and in future the policy of employing alternatives to lead-covered v.i.r. cables may be abandoned. Restrictions upon the manufacture of lead-covered p.v.c. cables, in certain special exceptions, remain in force.

Trolley-bus Regulations

The Minister of War Transport has informed the Public Transport Association Incorporated that, while he cannot agree to proposed increases in the maximum permissible length and width of public service vehicles and trolley vehicles, he is prepared to accept the suggestion that the maximum height for both single and double deck vehicles should be 15 ft. (with an appropriate addition for trolley vehicles); no modification is, however, made in connection with the provisions for stability. The Minister is also prepared to amend the Regulations to allow maximum laden weights of 12 tons for four-wheeled and 14 tons for six-wheeled public service vehicles, with an additional ½ ton in each case for trolley vehicles. In each case, however, he considers a limit of 8 tons necessary on the axle load. He further proposes to abolish the special additional weight allowances for built-in gas producer plant.

Reciprocal Lend-Lease

In a White Paper containing the second report on inter-Allied mutual aid some particulars of the services and supplies afforded by Great Britain to her Allies are given. Reference is made to the public utility services such as power, communications and transport, by which the Americans have been served in this country. A great quantity of sparking plugs has been provided for American aircraft—558,500 had been requisitioned up to June 30th last and a further 600,000 had been shipped to the United States.

Information regarding plant supplied to Russia has already appeared in the *Electrical Review*. The White Paper mentions, *inter alia*, that the supplies have included 6,135 miles of cable.

Electrical Education in Schools

The Scottish Council of the E.A.W. has drawn up a memorandum which has been sent to the Secretary to the Scottish Advisory Council on Education. The opinion is expressed that in view of the hydro-electric development scheme, every effort should be made to ensure that adequate instruction in the use of domestic electrical appliances is given to every boy and girl as part of the curriculum in all Scottish schools.

It is suggested that from the age of 11 instruction upon the following lines should be included in the school curriculum of both boys and girls: 1. How electricity works. 2. The installation in the home—steps to be taken for safety and efficiency. 3. Fuses—why and how they blow and how to replace them. 4. How to read a meter. 5. How to calculate running costs. 6. Care and maintenance of household equipment. 7. Electric bells and how they work. Students taking domestic science courses should be made familiar with electric cooking, refrigeration, laundry work, etc.

Tungsten Ores

The Minister of Supply announces that the purchase of tungsten ores on Government account will continue for the first six months of 1945, but as from January 1st the normal price will be reduced to 75s. per long ton unit of WO_3 f.o.b. for Empire producers and f.o.r. for producers in the United Kingdom. Only concentrates of the normal saleable grade will be accepted and the quality specification will be revised to impose heavier penalties for low WO_3 content and arsenic and penalties for

copper, molybdenum and scheelite in wolfram. Any inquiries should be addressed to the Director for Ferro-Alloys, Iron and Steel Control, Steel House, Tothill Street, London, S.W.1.

Equipment of Temporary Houses

"Temporary Accommodation: Memorandum for the Guidance of Local Authorities" has been issued by the Ministries of Health and Works (Stationery Office, price 6d.). In it are given a summary of the Housing (Temporary Accommodation) Act, 1944, and particulars and drawings of the four types of temporary bungalows available.

In some notes on the arrangements for the erection of the bungalows it is stated that the work to be done by the local authority will include the provision of roads and services (including electricity) up to the point of junction with the house connections. The authority will also provide plans and information as to the electricity supply to the Ministry of Works, which places and supervises the contracts for the erection of the bungalows. It will also furnish "information as to whether gas or electricity is to be used for the cooker and wash boiler. Both should be served by the same supply. All houses on one site must have either gas or electricity for these purposes: individual variations cannot be allowed. The Ministry of Fuel and Power will be prepared to assist the local authority with advice." Internal services (again including electricity) will be carried out by the Ministry of Works to the point of connection with the main services.

All four types of bungalow will be equipped with the M.O.W. kitchen and bathroom unit which includes a gas or electric refrigerator, a gas or electric wash boiler, a gas or electric cooker and "lighting and kettle points and an electric control and fuse panel."

Girl Apprentices

In our issue of October 27th last we reported that the Brush Electrical Engineering Co., Ltd., had expanded its apprentice training programme to include girl student apprentices of School Certificate standard. Mr. A. J. Nicholas, director and general manager of South Wales Switchgear, Ltd., tells us that his company has such an apprenticeship scheme in operation and that it is proving very successful. The first two girl apprentices, Miss Muriel Michel and Miss Beryl Metters, have both matriculated; they came from Caerphilly Secondary School. They are allowed one day off per week, with wages, to attend a commercial school in Cardiff. In view of the success of the scheme and its importance in solving the difficulty of obtaining good-class and well-trained secretaries the company has decided to apprentice all its girl staff for better-class positions.

The company also has a very extensive general engineering and trade apprenticeship training scheme, and has taken on boy apprentices for cost accountancy in order to give them a practical knowledge of the general production side.

All-steel Kitchen Equipment

After the war Moffats, Ltd., are proposing to manufacture all-steel kitchen cabinets, and the accompanying picture shows a model electric kitchen planned and designed by the company. All the cupboards and drawers, etc., are of steel, in an ivory or white baked synthetic enamel finish, and the lower units have stainless-steel tops. Due to the unit principle of construction, there is much flexibility in the planning of these kitchens, not only for the new houses, but also for those which are being renovated to meet the various requirements of the housewives and the different sized kitchens. The various units, which are made in three sizes, include an electrically heated towel-rail. Prices will compare very favourably with those of any standard wood cabinet, and the cost of installation will be very low.

Moffat model all-steel kitchen

Generating Plant Requirements

In a contribution to a series of statements by leading industrialists published in the *Financial News* Mr. V. Z. de Ferranti, chairman and managing director of Ferranti, Ltd., estimates that during the next decade the demand for generating plant in this country will be at three times the rate in 1928-38. The reason he gives is that in the latter period orders for new plant were reduced, following the inauguration of the grid, until the absorption

of spare plant had taken place. At the same time, he points out that the Central Electricity Board has made a long-term plan to give the required service to the public with the minimum amount of disturbance to the manufacturing side of the industry.

With regard to exports, he expresses the view that, apart from a short-term demand for certain plant in Europe, the export market for British electrical plant would be materially the same as before the war, when 80 per cent. went to Empire countries.

Manufacturers and E.P.T. Credits

The National Union of Manufacturers has asked the Chancellor of the Exchequer to give consideration in framing future legislation to the many cases of hardship suffered by businesses with a low pre-war standard of profits for E.P.T. purposes. It is urged that in the interests of future employment and export trade every assistance should be given to such cases to assist their post-war equipment and organisation. In view of the probable easing of Government requirements for machinery, they suggest that an immediate release of some portion of the Excess Profits Tax credit should be made for the purchase of additional machinery by manufacturers for post-war requirements.

"Marconi Review" Revived

Sixteen years ago the *Marconi Review* first appeared as a monthly publication, but it was suspended on account of the war, No. 74, July-September, 1939, being the last issue. Secrecy regulations still prevail, but the resumption of its publication (quarterly) under the editorship of Mr. L. E. Q. Walker, will nevertheless be welcomed. The editor requests readers to pass on their copies to others desiring to see them. The size remains as before, but the type is now more condensed and the number of copies per issue must necessarily be limited.

Measuring Instrument Exhibition

An exhibition of measuring instruments and gauging devices at the Manchester Municipal College of Technology was opened in November when the chairman of the College Committee, Alderman Wright Robinson, formally accepted gifts of equipment made to the Department of Mechanical Engineering. The display of gifts was inaugurated by Mr. Loris E. Mather, Regional Controller, Ministry of Production, who explained that the co-operation of the Manchester and District Engineering Employers' Association with his Department had made possible what was probably the best equipment of instruments for engineering measurements that any technical college in this country possessed. The display included the following:—

Ferranti, Ltd.: electrical equipment for the quick gauging of small components by means of six electromagnetic bridges for determining three dimensions in duplicate by change of inductance. A pivot forming and burnishing machine with shadowgraph for viewing in relation to a standard diagram. Electro-dynamic balancing machine for small rotors, the phase and extent of out-of-balance being measured by electrical pick-ups connected through a potentiometer and valve amplifier to a stroboscopic lamp illuminating the end of the rotor under test. Escapement timing by "Neostron" periodical illumination (special neon lamp) whereby it appears to be stationary when correctly set. An electrical setting indicator which shows a machine-tool operator the amount by which his work is oversize when taking finishing cuts, the deviation being magnified by an electrical bridge and shown on a dial. An inductance bridge set for indicating the presence of magnetic materials.

Salford Electrical Instruments, Ltd.: Magnetic bridge for sorting ferro-magnetic materials; layer thickness meter for measuring coatings (paint and spray) on magnetic bases; radio-frequency crack detector; fatigue tester; miniscope and miniature oscilloscope for either battery or mains operation.

The Metropolitan-Vickers Electrical Co. demonstrated how simple optical projectors can be used instead of a multiplicity of gauges to check small parts made in moderately large quantities.

Contract Price Adjustment Formulæ

The latest figures for the B.E.A.M.A. contract price adjustment formulæ are unchanged. They are as follows:—(a) "Rates of Pay": the rate of pay for adult male labour at November 18th shall be deemed to be 90s. 6d.; (b) "Costs of Material": the index figure for intermediate products last published by the Board of Trade on November 18th is 176·2 and is the figure for the month of October, 1944.

Wage Claims Unsettled

A conference lasting nearly 2½ hours was held in London last week between the Engineering Employers' Federation and the engineering unions. No agreement was reached on the question of an immediate advance in apprentices' wages and there was also failure to agree on the further claim for an increase in the extra amount paid to some skilled grades engaged on maintenance work. Both questions will now be reviewed by the Engineering Joint Trades Movement.

Indian Electrical Imports

The *Board of Trade Journal* states that the imports into British India of electrical apparatus during the fiscal year 1942-43 were valued at 16·3 million rupees (about £1,224,000).

E.C.A. Correspondence

We are informed that all communications to the Electrical Contractors' Association and allied bodies should again be addressed to Africa House, Kingsway, W.C.2, instead of to Winchester.

Trade Announcements

Falk, Stadelmann & Co., Ltd., have acquired large warehouse premises at 34, Queen Street, Cheapside, E.C.2 (near Mansion House underground station), which will give greatly improved service in the execution of orders. The trade counter will also be at this address. The head office will remain at 91, Farringdon Road, London, E.C.1, to which all correspondence should continue to be addressed (telephone number of both addresses: Holborn 7654).

Until further notice Vacuums, Ltd., are operating from a temporary address at 15, Beacon Road, Sutton Coldfield (telephone: Sutton Coldfield 3959).

Condensers and Feed Heaters

Erosion Causes and Preventive Measures

By Vernon Walker, A.M.I.E.E.

EROSION of tubes in the upper bank where steam enters a condenser is due principally to moisture in the turbine exhaust, steam being thrown off the last stage wheel either directly on to the tubes or collected along the edge of the exhaust flange and then re-entrained and blown against the tubes below.

Four factors have contributed to this type of erosion becoming more noticeable in modern practice. The first is that the reduced number of stages in some turbines does not provide so many opportunities for the ejection of moisture from the expanding steam, and more moisture is therefore carried through the last stage to the condenser. Secondly, the use of partial admission control instead of steam by-passing on overload results in an appreciably greater moisture content at high loads than with earlier designs. A third factor is that high steam velocity through the condenser neck increases the pounding effect of the water drops against the tube, and a fourth that longer hours of operation at high loads causes the exhaust to the condenser of more steam having a high moisture content.

Details of the preventive measures taken by the Detroit Edison Co. to minimise condenser tube erosion are given in a recent report by the Prime Movers Committee of the Edison Electric Institute. In this it is stated that gradual erosion of the upper row of tubes appears to have taken place over a number of years and that only recently have some tubes been actually punctured. Erosion is caused not only by the moisture thrown off the last wheel directly on to the tubes but also by leakage from the water seal of the low-pressure end of the turbine shaft. It occurs directly below the last stage wheel and also below the rear edge of the turbine exhaust flange.

The provision of drainage and moisture catchers was deemed to be essential for preventing further loss of tubes. Three systems have been installed. In one, drains are led from the low-

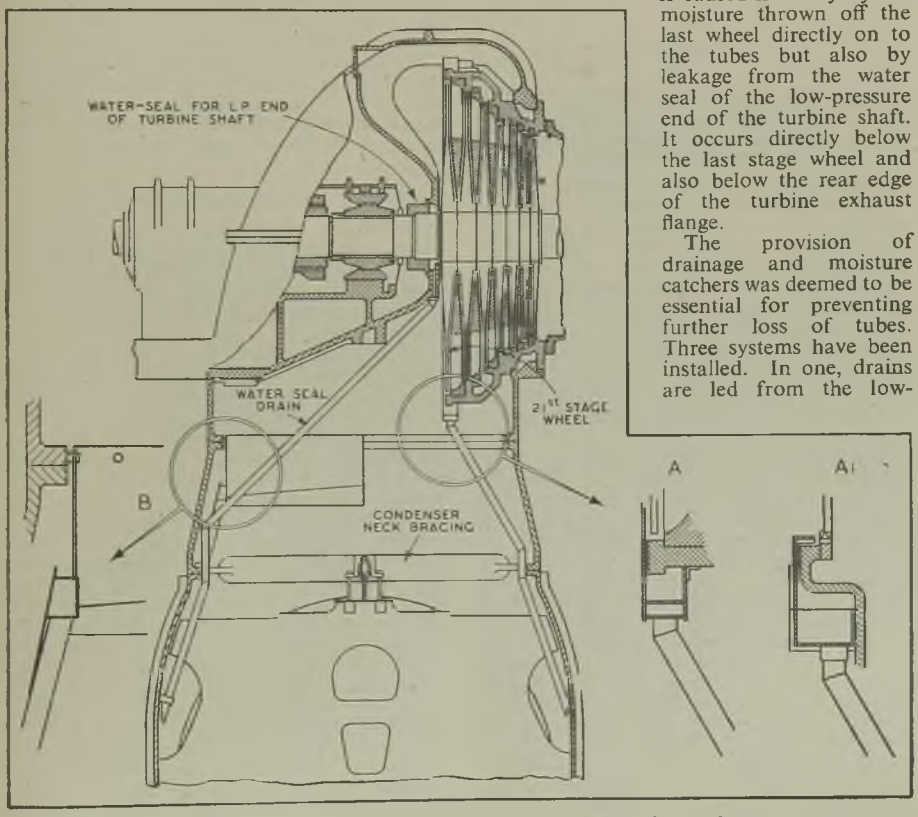

Fig. 1.—Moisture catchers for minimising condenser-tube erosion

pressure water seal to the condenser wall to clean the tubes; in another a horseshoe trough is constructed around the rear half of the turbine exhaust flange, B in Fig. 1, which is likewise drained to the condenser wall. An improved and preferred system consists of a catcher plate fitted completely around

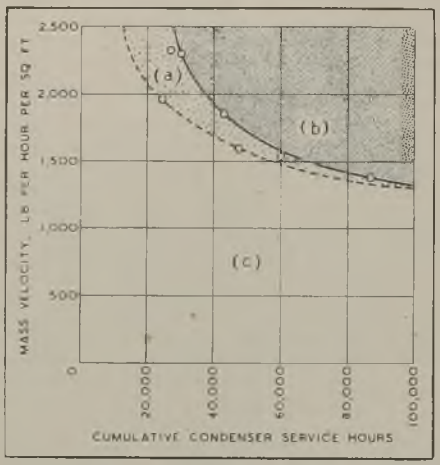

Fig. 2.—Condenser without moisture catchers: (a) tubes showing signs of severe erosion plugged or replaced; (b) tube failure by complete erosion penetration; (c) condenser tube eroded, but penetration incomplete

the periphery of the last turbine wheel, A or alternatively A_1, so placed as to deflect moisture thrown off the last stage wheel into a circular trough, without appreciably impeding the steam flow. An exhaust flange trough is deemed desirable though not essential if a periphery catcher is installed.

The trough and catcher are fabricated from copper-bearing steel. The peripheral catcher is modified where feasible by welding an internal rim or flange to the plate to skim moisture off the circumference of the exhaust stream.

The relationship between average mass velocity of the exhaust steam (average condenser steam flow divided by area inside condenser flange), which is probably the principal factor in tube erosion, and the cumulative condenser service hours for seven condensers not equipped with moisture catchers is shown in Fig. 2. Six of the seven condensers were tubed with 70 30 brass and the seventh with Admiralty metal.

High pollution of water with organic matter, including sewage, has necessitated the use of Admiralty metal for condenser tubes in the Cedar Rapids Station of the Iowa Electric Light and Power Co., Muntz metal having been found to fail within a year, though the bronze impellers of the circulating pumps were not attacked.

Ordinary chemical analyses failed to explain the high rate of tube deterioration and a bacterial oxygen demand determination, such as that used as a measure of pollution in sewage disposal, was made. This indicated that the water had an oxygen demand of approximately four times that of the freshest water available, namely, the main channel of the Cedar River.

Corrosion attributed to ammonia concentration in the condensate water has taken place in a number of cases but does not appear to be widespread. The maximum concentration generally occurs in the air ejector after the condenser drains and NH_3 is normally not more than from 4 to 6 parts per million. To minimise contamination the drain water from the ejector after condenser is often put to waste.

The maximum amount of ammonia reported in the Detroit Edison plants is 2 ppm. The ability to maintain a normal ammonia concentration of about 1 ppm. is attributed partly to the use of reciprocating dry vacuum pumps for most units. Where steam ejectors are in use, ammonia withdrawn from the condenser is re-dissolved in the steam jet, returns to the feed water circuit *via* the ejector drains (unless they are discarded to waste) and accumulates in the system. On the other hand, through the use of a reciprocating vacuum pump, ammonia gas is definitely separated from the feed water circuit and rejected to the atmosphere.

De-aerating Heaters

Open-type de-aerating heaters are commonly used in feed-heating systems in the United States, and some difficulty has been experienced in maintaining adequate suction pressure on the boiler feed pump where the pump takes its water directly from the storage compartment under the de-aerator heater section. These conditions occur on a loss of station load, in general from maximum to approximately two-thirds load. It has been found that the quantity of water in the storage compartment has a pronounced effect on the suction pressure available at the pump when dropping load, presumably due to the regenerative heat capacity in the storage section of the heater. A storage capacity of 60,000 lb. was found insufficient for a 50,000-kW installation and capacity has been added in parallel with the existing tank. Very severe water hammer has been experienced in tray-type de-aerating heaters, which were arranged with a vent condenser above the de-aerator and several connections from the vent condenser outlet to a water sealed distributing pan in the de-aerator. This was corrected by the installation of a spring-load check valve in each connection to the de-aerator, which keeps the connections full of water and under pressure greater than that of the steam in the de-aerator.

Coal Clauses

Combining Tariff Prices and Costs of Production

By H. Peace, A.M.I.E.E.
Chief Assistant Engineer, Scunthorpe Borough Electricity Department

SINCE 1935 the price per ton of fuel used in generating stations has more than doubled,[1] and the Government's reluctance to allow appropriate compensating tariff increases during the war to meet a general rise of approximately 15s. per ton has compelled many undertakings to draw from reserves to meet their consequently higher costs.[2] Reserve funds, which are accumulated for the purpose of taking the shock from abnormal financial conditions of comparatively short duration, are not intended to provide against sustained price increases in the essential raw material of production.

Basic fuel prices adopted in the tariffs for the eight areas of the Central Electricity Board average 14s. per ton, which is fairly typical of conditions for bulk-supply agreements throughout the country. When these figures were adopted, in the C.E.B.'s case about 1933, there was every reason to believe they would remain stable for a considerable time, but, in view of present trends in the coal mining industry, there does not appear to be any sound argument for retaining basic figures which are now far below the average.

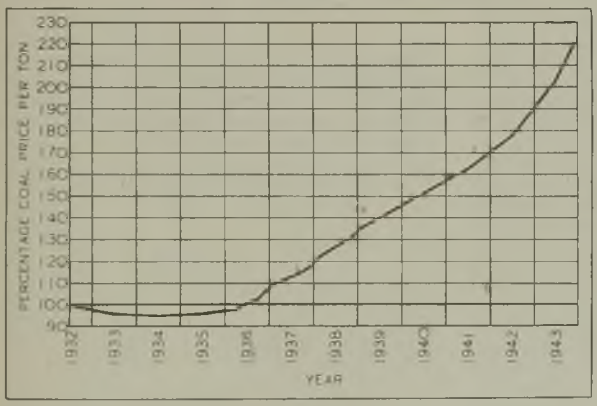

Fig. 1.—Average price of coal delivered for grid power stations (extension of curve by J. N. Waite)

The present high cost of coal cannot be regarded as altogether due to the war, since "mining coal becomes more and more onerous—and expensive—as the easier seams run out, leaving the more difficult ones for the future."[3] Further, the increases in miners' wages in recent times largely represent a permanent general uplift in social status, which the war has only accelerated, rather than temporary cost-of-living additions. This tendency towards an improved social status will be further emphasised as increased mechanisation attracts a more skilled class of artisan to the mining industry.

The present method of adjusting the running charge to meet variations in the price of coal is based on the assumption that all costs of production vary in proportion to the price of coal. This assumption is sound only so long as the quality of coal and the coal consumption per kWh remain practically constant and all costs of production, other than fuel cost, vary in proportion to the cost of coal. Otherwise, the method is fundamentally unsound and, when all coal price variations are in one direction, it is inequitable.

Some means of adjustment for varying fuel price is, of course, essential, but it should be related to the actual fuel consumption per kWh and should apply only to the fuel component of the total cost. All other running costs associated with generation and transmission, not being liable to such extreme fluctuations as fuel, should be subject to periodic adjustment in the light of actual ascertained cost.

The following example illustrates the effect of the usual form of coal clause on costs of bulk supply. Assuming 50 million kWh per annum to be purchased on a two-part tariff, the running charge of which is 0·186d. per kWh, subject to plus or minus 0·001d. per kWh for each 1d. variation from 13s. per ton, the cost (ignoring fixed charges) would be £38,750. An increase in the price of coal to 30s. per ton would bring the kWh price to 0·39d. giving a total cost of £81,250, thus adding £42,500 to the energy cost.

Coal at 13s. per ton is equivalent to 0·06965d. per lb. and the amount allowed under the above conditions works out at 2·24 lb. costing 0·156d.

This leaves 0·03d. for all other running costs associated with generation and transmission. Unless these costs vary in the same ratio as the coal price it is unfair to increase them at the same rate. Moreover, while coal prices have increased, the amount used per kWh has decreased.[4] The average fuel consumption

for all stations in Great Britain during the financial year 1937–38 was under 1·5 lb. per kWh.[5] Data published in 1936[6] show an average for twenty-eight major stations of 22·68 per cent. thermal efficiency and 1·346 lb. of coal per kWh generated, ranging in individual cases from 28·59 to 20·2 per cent. and 0·96 to 1·75 lb.

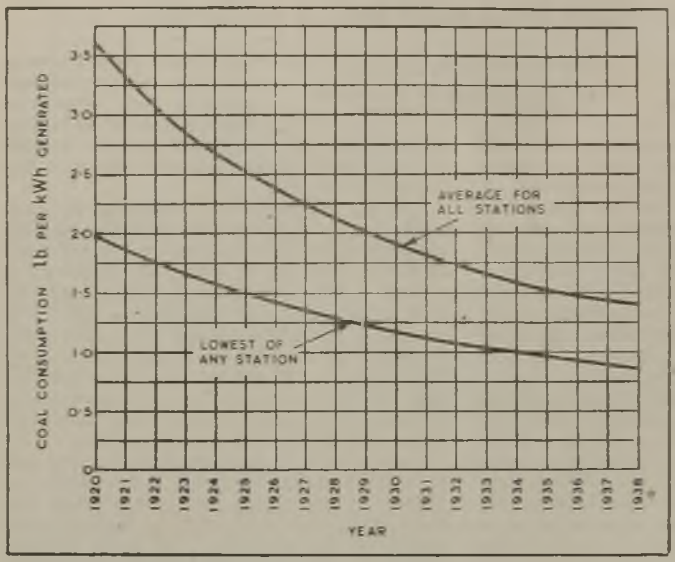

Fig. 2.—Coal consumption of British steam stations (based on curve of Hunter and Mountain)

There can surely no longer be any justification for using 2·24 lb. in calculating the increased price of energy due to inflated coal prices. A figure of 1·5 lb. would be much more reasonable.

If in the hypothetical example given above the additional cost due to a rise in the price of coal by 17s. per ton (0·09105d. per lb.) were based on 1·5 lb. per kWh, the resulting figure would be 0·1366d. per kWh. Allowing, for the sake of illustration, an increase of 30 per cent. on the original 0·03d., *viz.* 0·009d. for other costs, the total calculated cost with coal at 30s. per ton would be 0·3316d. per kWh. The difference in cost for 50 million kWh between this and tariff prices would be £81,250 – £69,083 = £12,167.

The buyer is thus penalised to the extent of 0·0584d. per kWh over and above the legitimate increase levied on account of the higher cost of coal and, in many cases, the amount this represents in total cost would enable the undertaking receiving the bulk supply to meet the present situation without either increasing tariffs to consumers or making withdrawal from reserve funds.

It may be argued that costs other than fuel have swollen to a greater extent than the 30 per cent. arbitrarily taken but, if such is the case, should not the suppliers, in common with those who are bound to take supplies from them, be called upon to bear a proper proportion of added war costs, after being recompensed for actual increases in fuel cost?

In an addendum to his address as chairman of the Scottish Centre of the Institution of Electrical Engineers in December, 1933 ("The Costing of Production at Selected Stations"), Mr. N. C. Bridge pointed out that[7] "when coal is cheap the purchaser will gain, and when coal is dear the Board will gain. The apparent gain one way or another will increase as efficiency improves and, in fact, a balance of advantage at any price for coal is only shown with the stations using collectively 2·24 lb. of coal per unit. . . . This is inconceivably high for any group of modern stations, but factors other than actual cost of coal enter into any such adjustment, and it must remain a matter of speculation as to whether the clause will operate quite

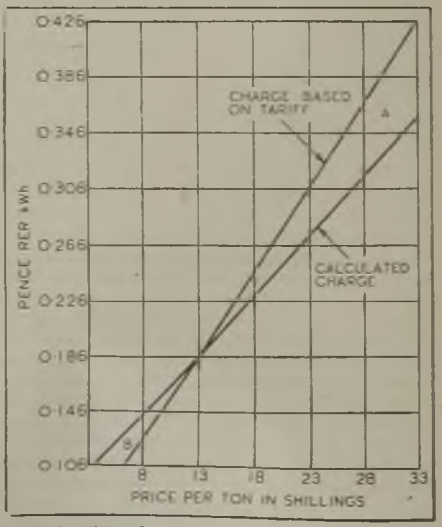

Fig. 3.—Effect on bulk supply charges of large fluctuations in price of coal. A, apparent gain by seller; B, apparent gain to buyer

equitably under the conditions with which we may be faced in the future."

These arguments have even greater substance to-day, when coal prices are well over double most agreement basic prices, and when technical and practical improvements in power station operation have reduced the average coal consumption appreciably.

The graph based on a diagram included in this address, but drafted for higher prices, shows very clearly that the present method of coal clause adjustment is intended to function on a reciprocal basis with coal prices fluctuating slightly in either direction. Under any other conditions the method is obviously unsound and inequitable.

The apparent fortuitous gains in revenue consequent upon the extended operation of coal clause adjustments cannot have been predicted and hence cannot be claimed as the result of a predetermined financial policy. Further, the enormously increased outputs due to wartime industrial expansion must have substantially added to them, quite apart from their effect in reducing generating costs—again, in favour of the producer.

It is suggested, therefore, that the time is opportune for a general revision of two components in bulk supply tariffs, namely the basic coal prices, to bring these more into line with the present-day cost of fuel, and basic kWh prices (and their associated coal clause adjustment figures) so that these bear a definite relationship to the actual cost of production.

Failure to establish an efficient method of linking the actual cost of production to the prices which are charged per kWh will be tantamount—in peacetime, at any rate—to ignoring one of the most powerful incentives to the further development of the electricity supply industry.

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Engineers and Town Planning

Co-operation in Dealing with Services

IN a contribution to a series of lectures on the position of the engineer in relation to planning at the Institution of Civil Engineers in London MR. J. PATON WATSON (city engineer and surveyor, Plymouth) complained of the lack of progress in planning underground (electricity, water, gas and Post Office) utility services with the result that every municipal engineer encountered many difficulties.

Distribution engineers had largely contributed to the problems they now had to face by keeping themselves aloof from surface planning. They must now become part of the town-planning team and keep the best possible records for simplifying each other's development.

Mr. Watson suggested the centralisation of all records in one office from which copies could be provided for each department, the work and staff to be co-ordinated by a technical advisory committee composed of the city surveyor and the utility services engineers. Such an organisation could also deal with the standardisation of plans, sizes, permits, etc.; it might improve reinstatement methods, should watch costings and help to amend building bye-laws for facilitating the provision of utility services.

Legislation in the past had conferred certain absolute rights upon water, gas and electricity undertakings, but the recently passed Town and Country Planning Bill would enable local municipal authorities to treat on equal terms with bodies that had hitherto been practically inviolate.

The highways seemed to be the only workable and economic routes for utility service mains in urban areas of distribution, but they should not be under carriageways. They would be more suitably placed under wider verges or pavements, all highway crossings to be at the same places in ducts or subways. Incidentally, an indication of additional future requirements was that 484 of the 993 applicants for business premises in the city centre of Plymouth had expressed their desire for a central heating scheme.

Inquiries made in fifteen towns over a period of ten years showed that gas and electricity services were responsible for the greater number of road openings, with water following closely. The telephone service appeared to demand very few street openings, possibly because much detailed distribution was overhead and also indicating the value of the duct system. For these four services the cost of road reinstatement seemed to average £40 per thousand of the population per annum, to which must be added the cost of repairs, excavation and refilling at high rates due to having to contend with traffic. Could better results be obtained, even at the expense of higher installation cost? There was as yet no general acceptance of the basic principle of subways shared by all utility services. An authoritative investigation would be of great value.

ELECTRICITY SUPPLY

Scottish Water Power Charges. New Nottingham Plant.

Ashton-under-Lyne.—SCHEME AMENDED.—The C.E.B. has adopted without modification the North-West England and North Wales Electricity (Alteration) Scheme, 1944. The amended Scheme provides for the " de-selection " of the Ashton station.

Croydon.—NEW GENERATING STATION.—The first section of the Corporation's new generating station is estimated to cost £3,644,600.

Horncastle. — ELECTRIC STREET LIGHTING PROSPECT.—At present the street lighting system in the town is by gas, but the Urban District Council has accepted a suggestion of the Mid-Lincolnshire Electric Supply Co., Ltd., that a representative should discuss with the Street Lighting Committee the question of changing to electric lighting.

Kingston-on-Thames.—NEW POWER STATION.—The Central Electricity Board asks us to correct a slip in its reference to the new Kingston-on-Thames power station in the table of new plant published in our last issue. The owners of the station are the Kingston Corporation, not the London and Home Counties J.E.A.

London.—LIGHTING IN ISLINGTON.—At a meeting of the Borough Council last week it was announced that full lighting to the extent permitted would be in operation within three weeks. It was proposed to replace by electric lamps some 150 gas lamps which had been destroyed.

POWER STATION EXTENSIONS. — Woolwich Borough Council has approved proposals to carry out extensions at the generating station estimated to cost £636,455.

North Scotland.—HYDRO-ELECTRIC QUESTIONS. —The Executive Committee of the Local Authorities' Hydro-Electric General Committee met at Perth on November 21st. Mr. P. Ferguson (convener, Argyllshire) presided, and Sir Murdoch Macdonald, M.P., Sir Thomas Hunter, M.P., and Mr. McNair Snadden, M.P., were among those present.

On the motion of Major Caldwell (Inverness County Council) it was agreed to ask the North of Scotland Hydro-Electric Board whether it would give particulars of the approximate retail prices, approximate date when electricity would be available and where the substations would be situated.

Several speakers were concerned about the export of power. One of them, Provost Murray, in a memorandum said there was a danger of too much of the capital allocated to the scheme being frittered away in structural costs so that the Board would have to look for a return elsewhere than in the north of Scotland. As much money as possible should be earmarked now for a proper distribution of power to points in the Highlands able to absorb it. Local authorities should proceed at once, in conjunction with the Board, to map out such suitable centres of distribution and canvass the residents upon well-defined conditions. Failing that, the North of Scotland Hydro-Electric Scheme might become no more than a cloak with which to disguise cheaper power for existing industrial areas and so become a further handicap upon the Highlands.

On the other hand the chairman said he did not agree with those who seemed to think it wrong to produce electricity in the Highlands and export it to another area and make a profit. Bailie Macpherson also did not mind power being exported so long as this did not interfere with domestic water and other purposes in the Highlands.

PROPOSED DOMESTIC TARIFF. — Mr. A. E. MacColl, deputy chairman of the Board, in an address at Edinburgh on November 23rd declared that if the Board did not export power to the Central Electricity Board in order to draw major revenues, then it would be absolutely impossible to sell at the domestic tariff which it had in mind. The tariff would require to be increased so substantially that it would cease to be attractive, and would be quite useless for the purpose of creating a domestic demand. The tariff available to domestic consumers would be:—First 30 kWh per annum per room, 5d. per kWh; nine times this consumption at ¾d. per kWh, and all in excess at ½d. per kWh. For large-scale industry the Board had given an assurance without defining the exact tariff, that it would be low enough to make location within the area attractive. The Board's power to distribute and sell directly to domestic consumers was limited to a defined area which was outside the area of the various companies and local authority undertakings which operated in the North of Scotland. Its domestic tariffs did not apply to these areas.

Nottingham. — £2,000,000 EXTENSION SCHEME.—The City Council at its December meeting will be asked to approve a scheme for a big extension to the North Wilford power station. This is being done on the instructions of the Central Electricity Board. The proposals are to install two 30,000-kW sets, similar to those already in commission, but embodying all the latest improvements, one 50,000-kW set and six new boiler plants using pulverised fuel. The new plant will raise the total capacity of the station to 197,500 kW and the cost of the extensions, which are scheduled for completion by September, 1947, will be over £2,000,000.

Portland.—W.V.S. PREFER ELECTRICITY. — Members of the U.D.C. Housing Committee have discussed with the W.V.S. the internal planning and cooking arrangements of new Council houses. The ladies expressed the definite opinion that cooking should be by electricity.

STREET LIGHTING CHANGE-OVER. — At a meeting of the Urban District Council the surveyor reported that, with the electrical engineer, he was considering the best methods of converting the present street lamps to electricity.

Ruthin.—FURTHER CONCESSIONS.—Last July, in announcing the abolition of the remaining 10 per cent. war addition to tariffs Councillor J. M. Edwards, chairman of the Electricity Committee, said that further reductions were

under consideration. He has now announced that, as from October 1st, the fixed charge for domestic consumers (Part 2) is being reduced by 10 per cent. and meter rentals are being halved.

Sedgley.—SERVICES IN COUNCIL HOUSES.—In connection with the housing schemes, the Urban District Council, which owns the local gas undertaking, has been recommended by its Housing Committee to install electric lighting and power plugs as well as gas appliances for cooking and heating.

Wellington (Somerset).—LIGHTING AT WIVELISCOMBE.—At a meeting of the Parochial Committee of the Rural District Council it was decided to accept the tender of the Wellington District Electricity Co., Ltd., for street lighting at Wiveliscombe, previously served by gas.

Westerham.—SUPPLIES FOR PUMPING.—The Metropolitan Water Board has arranged terms with the Sevenoaks & District Electricity Co., Ltd., for electricity supply for the new pumping plant at Westerham. The Board will contribute £480 towards the cost of providing cables, transformer, switchgear and measuring equipment.

Overseas

Canada.—BRITISH COLUMBIAN SCHEME.—Announcement is made by Mr. W. G. Murrin, president of British Columbia Power Corpn., Ltd., of a broad plan for improvement and expansion of the company's services over a ten-year period. A total of $50,000,000 would be spent as follows: $17,000,000 for completion of initial units of the Bridge River hydro-electric project; $16,000,000 for improvements in transmission and distribution services to Vancouver; $14,000,000 for remodelling the tramway system on the lower mainland and Vancouver Island, including provision for trolley-buses; and $3,000,000 for improvements to the gas systems. The Bridge River hydro-electric plant would have an ultimate capacity of 650,000 HP and would serve the city of Vancouver by a 220-kV transmission line extending over a distance of 130 miles.

New Zealand.—LARGER ELECTRICITY VOTE.—In this year's estimates of expenditure tabled in the House of Representatives the electricity supply account vote is substantially greater than last year—£4,250,000 against £2,391,953. The extra expenditure is almost wholly for the North Island hydro-electric system (£3,700,000 against £1,730,372).

TRANSPORT

Bridgnorth.—LIFT RAILWAY ELECTRIFIED.—The lift railway, which has been closed for eighteen months, has been officially re-opened by the Mayor (Councillor T. C. Pembro). The railway, formerly operated hydraulically, has been electrified.

South Shields.—TROLLEY-BUS EXTENSION.—The Town Council has decided to promote a Parliamentary Bill to extend its trolley-bus services. The last tram service to the Cleadon Park estate is to be discontinued. The Bill will also seek to obtain powers for the Council to acquire compulsorily land for electricity and transport services.

Wartime Electrical Exports

IN our issue of October 27th we were able to give statistics of electrical exports from the United Kingdom in 1942 and 1943. The gap between this period and 1938 has now been filled by the publication of "Accounts Relating to the Export Trade of the United Kingdom for the Years 1939, 1940 and 1941" (Stationery Office, price 1s.). We accordingly give below the total values of the various items for the three years stated:—

DESCRIPTION	1939	1940	1941
Submarine telegraph and telephone cables	105,464	106,784	63,983
Telegraph and telephone wires and cables (not submarine)	732,594	961,604	800,068
Other rubber-insulated wires and cables	1,291,678	1,793,579	805,780
Wires and cables, insulation other than rubber	1,695,496	2,348,117	2,185,668
Radio receivers, not radiograms (excluding valves)	354,647	399,878	473,689
Radio transmitters (excluding valves)	265,877	158,955	204,851
Radio valves	348,610	344,720	297,933
Other radio parts and accessories	362,506	289,680	391,263
Telegraph and telephone apparatus (other than radio)	2,156,215	1,917,350	1,439,445
Electric lamps	531,169	739,677	792,791
Other lighting apparatus	614,811	754,543	724,643
Primary batteries	141,532	179,861	150,416
Accumulators, portable	222,281	294,110	298,841
Ditto, stationary	39,079	97,066	60,444
Ditto, parts and accessories	268,494	353,432	404,262
Electric cooking and heating apparatus, including industrial	339,087	418,702	331,571
House service meters	242,003	303,980	257,729
Other electrical instruments	264,872	265,956	252,762
Insulating materials not elsewhere specified	206,778	338,942	305,537
Unenumerated electrical goods	1,070,169	1,115,486	1,111,789
Electric generators up to 200 kW	365,452	437,813	427,007
Ditto, over 200 kW	1,184,236	938,932	689,476
Electric motors	1,402,494	1,235,103	1,291,366
Converting machinery	48,179	44,877	87,635
Transformers	850,131	823,955	792,755
Rectifiers for power-house use	44,079	60,480	53,607
Starting and controlling gear for motors	408,784	410,072	399,314
Switchgear	1,482,782	1,236,026	1,254,928
Other electrical machinery	152,814	154,730	91,766
TOTALS	17,192,313	18,524,410	16,441,319

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The General Electric Co., Ltd., raised funds on a temporary basis four years ago to finance a large expansion of activities. The company now proposes to put this on a permanent basis in the form of 2,000,000 new 4½ per cent. "C" cumulative preference shares of £1. The Treasury has consented to the issue which will be privately placed. The new shares will raise the preference capital (authorised and issued) to £5,600,000, the existing issues being £180,000 each of 6½ per cent. "A" and 7½ per cent. "B" cumulative preference stock. The amount of authorised ordinary stock is £6,000,000 of which £4,198,372 has been issued.

Falk, Stadelmann & Co., Ltd.—After providing for pensions £6,957 (£6,733), N.D.C. £4,259 (£4,500) and income tax £24,824 (£31,341), the company reports a net profit for the year ended March 31st last of £76,950, as against £80,703 in the previous year. Added to this is £579 (£1,764) profit, etc., on sale of securities. The ordinary dividend is maintained at 7½ per cent. and £5,000 (nil) is transferred to the staff fund, leaving £50,594 (£52,878) to be carried forward. Mr. Gustav Falk, the chairman, points out that the cash, stock, debts, etc., amount to £596,164, whereas the total liabilities are only £258,332. Recently the company acquired the goodwill, trade marks and patents of a manufacturing company engaged in the lighting industry.

The British Electric Resistance Co., Ltd.—Although the directors, due to circumstances beyond their control, were unable to submit the report and accounts for the year ended July 31st at the annual general meeting which was to be held yesterday (November 30th), sufficient is known regarding results to permit a dividend of 20 per cent. (same). The directors state that for the year under review the turnover has exceeded that of any previous year. The subsidiary, the British Power Transformer Co., Ltd., has also had a very satisfactory year and order books at present are well filled.

British Rola, Ltd.—In the course of his speech at last Saturday's annual meeting, Mr. R. W. Cotton (chairman and managing director) said that arrangements had been agreed for the manufacture of additional electronic and engineering products and for the acquisition of the necessary plant as soon as permission could be obtained from the Government. The indications were that their post-war export trade would exceed the pre-war figure. The company had obtained the sole agency for the sale of the most modern American kitchen equipment.

The Perak Hydro-Electric Power Co., Ltd.—Mr. William Shearer, chairman, in his statement submitted with the report referring to the annual service of the 5 per cent. stock guaranteed by the Treasury, says that an arrangement in the nature of a moratorium has been made with the Treasury whereby the latter has assumed responsibility for the payment of the sinking fund for the year under review and of both interest and sinking fund as from the beginning of the current financial year. This arrangement, he points out, should leave the company with a sum in hand on re-entering into possession of its properties to meet the cost of preliminary surveys, and first-aid repairs. The company will ultimately be able to repay all amounts advanced, with interest. The accounts put net interest receivable at £1,427, and profit on realisation of investments at £2,142. After providing for expenses and fees and £31,510 for interest on guaranteed debenture stock, there is a loss of £34,526, increasing the debit balance brought forward to £35,682. The preference dividend is in arrears since August, 1941.

Drake & Gorham, Ltd., report a trading profit, including part of profit to date on work in progress, and interest, etc., amounting to £83,218, as compared with £71,587 in the previous year. After providing for general charges, depreciation, etc. £45,460 (£43,284), taxation £24,800 (£14,357), directors' fees £1,000 (same) and debenture interest £1,785 (£1,928), there is a net profit of £10,173 (£11,018). The dividend is maintained at 5 per cent., the carry-forward being increased from £17,662 to £21,585.

Calcutta Tramways Co., Ltd.—It is reported from Calcutta that the Bengal Government has refused to sanction the proposal by the Corporation of Calcutta to purchase the Calcutta Tramways Company's undertaking in the manner proposed by the Corporation.

Max Stone, Ltd., report a profit for the year ended June 30th totalling £54,233, as against £52,215 in 1942-43. An ordinary dividend of 10 per cent. is again to be paid and £5,021 (£5,961) is carried forward.

Sydney Bird & Sons, Ltd., are maintaining their dividend at 30 per cent. The net profit for the year ended September 30th last was £10,735, as compared with £8,370 in the previous year.

John Shaw & Sons (Wolverhampton), Ltd., are paying a dividend of 7½ per cent. for the past year (same).

Birmid Industries, Ltd., have again declared a dividend of 10 per cent. for the past year but the bonus is raised from 7½ to 10 per cent.

The Chloride Electrical Storage Co., Ltd., is maintaining the interim dividend on its "A" and "B" shares at 5 per cent.

The Telephone Manufacturing Co., Ltd., is again paying an interim dividend of 2½ per cent

J. Stone & Co., Ltd., are paying an interim dividend of 10 per cent. (nil).

The East African Power & Lighting Co., Ltd., is again to pay an interim dividend of 3 per cent.

New Companies

Green Electrical Industries, Ltd.—Private company. Registered November 17th. Capital, £2,000. Objects: To carry on the business of electricians, radio and mechanical engineers, etc. Subscribers: S. Green, 82, Osbaldestone Road, N.16; and L. Gorden, C.A., 29, Linten House, W.11. S. Green is the first director Solicitors: Montague Adler & Arnold, W.1.

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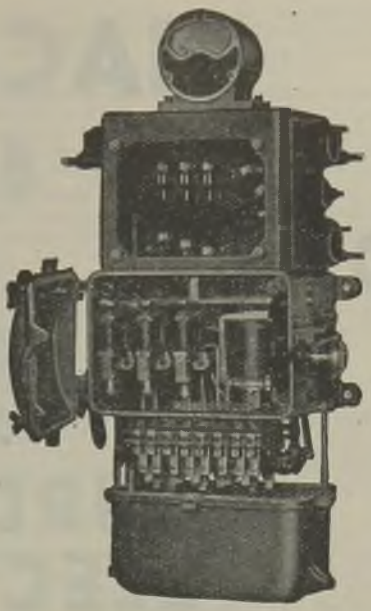

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Sales Headquarters : BRETTENHAM HOUSE, LANCASTER PLACE, W.C.2

Smith's Signs, Ltd.—Private company. Registered November 15th. Capital, £1,250. Objects: To carry on the business of manufacturers and repairers of neon signs, glass blowers, glass tube manufacturers, electrical contractors, etc. Directors: H. A. Smith, 7, Zetland Avenue, Gillingham, Kent, and three others.

Companies Struck off the Register

The following companies were struck off the Register on November 24th and were thereby dissolved:—Flexolite Distributors, Ltd.; Great Eastern Electric Co., Ltd. (old company, registered March 30th, 1939); Battery Supplies (Electrics), Ltd.; Diamond Lamp Shade Co., Ltd., and Notley Power Units, Ltd.

Companies' Returns

Statements of Capital

Wellington District Electricity Co., Ltd.—Capital, £70,000 in £1 shares. Return dated July 6th. 65,000 shares taken up. £65,000 paid. Mortgages and charges: Nil.

Key Engineering Co., Ltd.—Capital, £12,000 in £1 shares. Return dated July 6th. 11,746 shares taken up. £11,746 paid. Mortgages and charges: Nil.

Electrical Power Fitting Co., Ltd.—Capital, £500 in £1 shares. Return dated July 24th. 305 shares taken up. £218 3s. 10d. paid. £86 16s. 2d. considered as paid. Mortgages and charges: Nil.

Increases of Capital

Ultra Electric, Ltd.—The nominal capital has been increased by the addition of £50,000 in 50,000 ordinary shares of £1 each beyond the registered capital of £200,000. To July 14th, 180,000 shares of £1 had been issued, of which Ultra Electric (Holdings), Ltd., held 179,997.

O'Connor Electrical Industries, Ltd.—The nominal capital has been increased by the addition of £5,200 beyond the registered capital of £4,800. The additional capital is divided into 5,200 redeemable cumulative preference shares of £1 each.

Waygood Radiovision, Ltd.—The nominal capital has been increased by the addition of £900 beyond the registered capital of £100. The additional capital is divided into 800 ordinary shares of 10s. each and 500 preference shares of £1 each.

Reeds Electrical (Southall), Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 shares beyond the registered capital of £1,000.

Mortgages and Charges

Gardners Radio, Ltd.—Satisfaction in full on October 24th of charge dated January 4th, 1940, and registered January 8th, 1940, securing all moneys due or to become due from the company to Barclays Bank, Ltd.

North Eastern Electric Supply Co., Ltd.—Satisfaction (1) to the further extent of £28,785 on October 31st of trust deed dated August 1st, 1935, originally securing £1,500,000 3½ per cent. consolidated debenture stock, registered August 13th, 1935, and (2) to the further extent of £67,399 on November 7th, of trust deed dated December 30th, 1933, originally securing £2,500,000 3½ per cent. consolidated debenture stock, and registered January 17th, 1934.

Waygood Radiovision, Ltd.—Satisfaction to the extent of £300 on November 1st of series of debentures authorised December 12th, 1940, and registered January 21st, 1941, securing £500, of which only £300 have been issued.

R. J. Kemp & Co., Ltd.—Assignment of proceeds of contract dated November 1st to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £2,000.

Stokes Appliances, Ltd.—Assignment of proceeds of contract dated November 2nd to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Dissolution of Partnership

C. W. Phillips and **A. A. Newbury**, carrying on business as electrical engineers at Broadstone, Dorset, as the Auto Electrical Service Station, have dissolved partnership. Mr. Phillips will attend to debts and carry on the business.

Winding-up Petition

Victor Battery Co., Ltd.—A petition for the winding-up of the company presented by Currys, Ltd., will be heard on December 4th at the Royal Courts of Justice, Strand, W.C.2. Anyone intending to appear must notify Mawby Barrie & Letts, the solicitors of the petitioning creditor, 55-61, Moorgate, London, E.C.2, by December 2nd.

Liquidations

Barlborough Electric Supply Co., Ltd.—Meeting December 14th at the School House, Barlborough, to receive an account of the winding up by the liquidator, Mr. J. E. Bird.

Llansilin Electricity Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. C. Pym, The Cross, Oswestry.

Day's Radio, Ltd.—Liquidator, Mr. C. B. Latham, 185-188, High Holborn, London, W.C.1, released September 15th.

Bankruptcies

W. H. Axworthy, electrical contractor, John Lane, Cobourg Street, Plymouth, lately of New Town Chambers, Old Town Street, and previously 106, Tavistock Road.—Order for discharge made October 18th subject to debtor's consenting to judgment being entered against him by the Official Receiver for £98 10s. and £1 10s. costs payable by instalments of £10 per quarter, first payment November 1st, 1944.

G. A. Weston, electrical contractor and engineer, 5-6, Roman Wall House, Crutched Friars, London, E.C.3.—Further supplemental dividend of 4d. in the £ payable December 8th at Bankruptcy Buildings, Carey Street, London, W.C.2.

L. R. Williams, electrical contractor, 1A, Angel Street, Bridgend, Glam.—Proofs for dividends by December 6th to the trustee, Mr. R. Betts, Official Receiver, Government Buildings, 10, St. Mary's Square, Swansea.

STOCKS AND SHARES

TUESDAY EVENING.

THE Central Electricity Board has announced a huge programme of post-war development. The amount of money involved is expected to run into nearly £100,000,000. The Board looking well ahead, has already completed arrangements for meeting requirements in the winter of 1946, in addition to which the winter demands in 1947 and 1948 have also been taken into account. The scheme arrests attention by reason of its scope and scale. It will provide, for at least some years to come, employment for thousands of workers, and, incidentally, it justifies the prices to which shares of the front-rank manufacturing and equipment companies have been raised during the past few months.

The Rising Tide

A number of further improvements occurred this week. Amongst others, British Insulated advanced to 113s. 9d. and Callender's to 111s. 3d. Christy Brothers and Consolidated Signals are 2s. 6d. higher at 77s. 6d. and 6¾ respectively. De la Rue shed a similar amount, reacting to 9¾. Crompton Parkinsons at 33s. 6d. are 1s. 6d. higher. Crabtrees are 6d. higher at 41s. 6d. the figures and the report being considered decidedly satisfactory. Murex went back to 101s. 3d. Reyrolle at 71s. 3d. have put on a florin: Mather & Platt rose to 56s. 3d. and Greenwood & Batley to 46s. 9d. Walsall Conduits advanced to 52s. and brisk demand led to a rise of 9d. to 8s. 9d. in Allen Wests. Associated Electrical Industries, British Vacuum Cleaner, and Ever-Ready are all better. Ultra Electric old shares at 8s. 10½d. and the new shares at 1s. 10½d. premium are a trifle harder.

Miscellaneous Matters

Investment inquiry is evident in rises of a point in London Passenger Transport "A" and "B" stocks; two of the Central Electricity issues are 10s. up and Cable & Wireless stocks have hardened. Southern Railway 5 per cent. preference, a trustee security, is 2 points up at 119. Amongst other traction stocks, British Electric preferred ordinary, after being quoted for several months at the same price, 180, moved up ten points. Thomas Tilling shares again are 1s. higher at 62s.

Nigerian Electrics at 35s. are 1s. 6d. better, the recent rise of 2 per cent. in the dividend to 10 per cent. serving to bring in buyers. East Africans tied with Nigerians. Kalgoorlie Electrics are a dull spot at half a guinea. The list of Home electricity supply shares shows little variation; Electric Supply Corporation are 1s. to the good at 2½. A rise of 9d. to 15s. is the feature in Philco shares. Optimism looks for a dividend announcement in the near future. Cossor shares and E.M.I. have gone back 6d.

Lifting a Ban

The war ban imposed upon the publication of public utility accounts has now been lifted. For reasons of national security, this ban was imposed upon electricity, gas, harbours, docks, etc. The hope was recently expressed here that, in view of the great improvement in the war situation, electricity companies might be allowed to publish more informative accounts than they have been doing of late years, in order to give the shareholders a better understanding of the manner in which their undertakings have progressed. The Ministry of Fuel and Power is naturally set against publication of any information which might be of value to the enemy, but, as contended here, the provision of more detailed accounts to shareholders would do the enemy no good and would give proprietors some of the information to which they are entitled in normal days.

General Electric Preference

In September, 1939, at the time of the outbreak of war, the General Electric Co. had in contemplation big business extensions. The outbreak of war brought with it the imposition of a veto upon new capital issues. The company borrowed £2,000,000 from outside sources. This loan is now to be repaid, it is suggested, by the creation and allotment of 2,000,000 4¼ per cent. "C" preference shares of £1 each. These it is proposed shall be subscribed at 20s. and privately placed. The shareholder in the General Electric Co. has already voiced a protest against the issue being made to outside sources instead of the shares being offered to the proprietary. If he wants to buy any of these new shares, he will most probably have to pay a premium for them when they come to be dealt in. The ordinary are 1s. 6d. higher at 96s.

Ferranti

Ferranti, Ltd., ordinary shares are privately held. Of these, there are £300,000 in issue and of 7 per cent. preference stock there is £500,000 the £1 units of which are quoted at 31s. 3d. At the latter price, the yield is practically 4½ per cent. on the money. The company came out about forty years ago. Subsidiary companies are operating in Canada and the United States. The profit for the year ended June 30th last was about £17,400 up and the improvement in net came to £96,000, in consequence of a decrease in the allocation for depreciation. The ordinary shares receive 6 per cent. tax free. In July last year, the directors were authorised to raise or borrow any sum not

(*Continued on page* 798)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Nov. 28	Rise or Fall	Yield £ s. d.
Home Electricity Ordinary					
Bournemouth and Poole	12½	12½	62/6	..	4 0 0
British Power and Light	7	7	33/–	..	4 4 10
City of London	7	5½	30/–	..	3 13 4
Clyde Valley	8	8	42/–	..	3 16 0
County of London	8	8	43/–	..	3 14 5
Edmundsons	6	6	31/–	..	3 17 5
Elec.Dis.Yorkshire	9	9	45/6	..	3 19 6
Elec. Fin. and Securities	12½	13½	60/6	..	4 9 0
Elec. Supply Corporation	10	10	50/–	+1/–	4 0 0
Lancs. Light and Power	7½	7½	37/–	..	4 1 1
Llanelly Elec.	6	6	26/6	..	4 10 7
Lond.Assoc.Electric	3	4	26/–	..	3 1 6
London Electric	6	6	30/6	..	3 18 8
Metropolitan E.S.	8	8	43/–	..	3 14 5
Midland Counties	8	8	41/6	..	3 17 0
Mid. Elec. Power	9	9	44/–	..	4 1 10
Newcastle Elec.	7	7	32/–	..	4 7 6
North Eastern Elec.	7	7	34/6	..	4 1 2
Northampton	10	10	50/–	..	4 0 0
Northmet Power	7	7	41/–	..	3 8 4
Richmond Elec.	6	6	26/–	..	4 12 4
Scottish Power	8	8	40/6	..	3 19 0
Southern Areas	5	5	23/–	..	4 7 0
South London	7	7	30/–	+6d.	4 13 4
West Devon	5	5	24/–	..	4 3 4
West Glos.	4½	3½	25/–	..	2 16 0
Yorkshire Elec.	8	8	43/–	..	3 14 5
Public Boards					
Central Electricity :					
1955–75	5	5	115	+½	4 7 0
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	104	..	3 7 4
1974–94	3½	3½	100½	+½	3 4 8
London Elec. Trans.	2½	2½	98½	..	2 10 9
London & Home Counties 1955–75	4½	4½	112	..	4 0 4
Lond.Pass.Trans.Bd.					
A	4½	4½	122½	+1	3 13 6
B	5	5	122½	+1	4 1 8
C	3	3¼	68	..	4 15 7
WestMidlandsJ.E.A. 1948–68	5	5	106½	..	4 14 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	7/3	..	—
Calcutta Elec.	6*	6*	46/–	+6d.	2 12 2
Cawnpore Elec.	10	7	40/3	+6d.	3 9 4
East African Power	7	7	35/–	+6d.	4 0 0
Jerusalem Elec.	7	5	29/–	..	3 9 0
Kalgoorlie (10/–)	5	5	10/6	–1/–	4 15 3
Madras Elec.	Nil	4	32/6	+3/6	2 9 4
Montreal Power	1½	1½	23	..	—
Nigerian Elec.	8	10	35/–	+1/6	5 14 5
PalestineElec."A"	5*	5*	39/–	..	2 11 3
Perak Hydro-elec.	6	7	13/6	..	—
Tokyo Elec. 6%	6	6	28	..	—
VictoriaFallsPower	15	15	86/3	..	3 9 7
WhitehallInv.Pref.	—	6	26/–	..	4 12 4

Company	Dividend Previous	Dividend Last	Middle Price Nov. 28	Rise or Fall	Yield £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord.	15	15	61/–	..	4 18 4
Assoc. Brit. Eng.	6	7	57/6	..	2 8 9
Assoc. Elec. :					
Ord.	10	10	57/–	+1/–	3 10 5
Pref.	8	8	39/6	..	4 1 0
Automatic Tel.&El.	12½	12½	67/–	..	3 14 7
Babcock & Wilcox	11	11	53/–	..	4 3 0
British Aluminium	10	10	46/–	..	4 7 0
British Insul. Ord.	20	20	5 11	+⅛	3 10 3
British Thermostat (5/–)	18½	18½	20/–	..	4 12 6
British Vac. Cleaner (5/–)	30	30	32/6	+1/–	4 12 3
Brush Ord. (5/–)	8	9	11/–	..	4 1 9
Burco (5/–)	15	15	17/–	..	4 18 0
Callender's	15	20	5 ⅛	+⅛	3 12 0
ChlorideElec.Storage	15	15	35/–	..	3 10 7
Christy Bros.	12½	17½	77/6	+½	4 10 4
Cole, E. K. (5/–)	10	15	34/6	..	2 3 6
Consolidated Signal	24	27½	6¾	+¼	4 1 6
Cossor, A. C. (5/–)	7½*	10*	24/6	–6d.	2 0 8
Crabtree (10/–)	17½	17½	41/6	+6d.	4 4 4
Crompton Parkinson Ord. (5/–)	20	22½	33/6	+1/6	3 7 3
De La Rue	35	40	9¾	+¼	4 2 0
E.M.I. (10/–)	6	8	36/3	–6d.	2 4 1
Elec. Construction	10	12½	57/–	..	4 7 9
Enfield Cable Ord.	12½	12½	64/–	+1/–	3 18 4
English Electric	10	10	53/6	..	3 14 8
Ensign Lamps (5/–)	25	15	21/3	..	3 10 8
Ericsson Tel. (5/–)	22*	20*	53/9	..	1 17 8
Ever Ready (5/–)	40	40	42/–	+6d.	4 15 3
Falk Stadelmann	7½	7½	34/6	..	4 7 0
Ferranti Pref.	7	7	31/3	..	4 9 7
G.E.C. :					
Pref.	6½	6½	33/3	..	3 18 4
Ord.	17½	17½	96/–	+ ⅛	3 13 0
General Cable (5/–)	15	15	15/–	..	5 0 0
Greenwood&Batley	15	15	46/9	+1/–	6 8 0
HallTelephone(10/–)	12½	12½	31/6	..	3 19 4
Henley's (5/–)	20	20	26/6	..	3 15 6
4½% Pref.	4½	4½	24/–	..	3 15 0
Hopkinsons	15	17½	71/9	..	4 17 9
India Rubber Pref.	5½	5½	23/–	..	4 15 9
Intl. Combustion	30	30	6½	..	4 12 4
Johnson & Phillips	15	15	74/–	–6d.	4 1 1
Lancashire Dynamo	22½	22½	100/–	..	4 10 0
Laurence, Scott(5/–)	12½	12½	13/3	+3d.	4 14 2
London Elec. Wire	7½	7½	38/–	+6d.	3 19 0
Mather & Platt	10	10	56/3	+ ⅛	3 11 2
Metal Industries (B)	8	8½	50/6	..	3 7 6
Met.Elec.CablePref.	5½	5½	21/3	..	5 3 6
Mid. Elec. Mfg.	25	25	7½	..	3 10 3
Murex	20	20	5 ⅛	– ⅛	3 19 0
Newman Ind. (2/–)	20	20	7/3xd	..	5 10 0
Philco (2/–)	—	—	15/–	+9d.	—
Power Securities	6	6	29/–	..	4 2 9
Pye Deferred (5/–)	25	25	32/6	..	3 17 0
Ransome & Marles	20	20	87/6	..	4 11 4
Revo (10/–)	17½	17½	43/–xd	..	4 1 4
Reyrolle	12½	12½	71/3	+2/–	3 10 3

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Nov. 28	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing (*Continued*)					
Siemens Ord. ..	7½	7½	36/3	..	4 2 9
Strand Elec. (5/–)	10	12½	12/–	..	5 4 2
Switchgear & Cowans (5/–) ..	20	20	19/6	+1/–	5 2 7
T.C.C. (10/–) ..	5	7½	23/9	..	5 3 2
T.C. & M. ..	10	10	56/–	..	3 11 6
TelephoneMfg.(5/–)	9	9	12/–	..	3 15 0
Thorn Elec. (5/–)	20	20	28/6	..	3 10 0
Tube Investments	20	22½	5	..	4 10 0
Vactric (5/–) ..	Nil	22½	17/6	..	6 8 6
Veritys (5/–) ..	7½	7½	8/3	..	4 11 0
Walsall Conduits(4/–)55	55	52/–	+1/6	4 4 7
Ward & Goldstone (5/–)	20	20	30/6	..	3 5 8
WestinghouseBrake	12½	14	75/–	..	3 14 8
West, Allen (5/–)	7½	7½	8/9	+9d.	4 5 9
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	8	+½	—
Brit. Elec. Traction :					
Def. Ord. ..	45	45	1205	–10	3 14 8
Pref. Ord. ..	8	8	190	+10	4 4 3
Bristol Trams ..	10	10	57/–	..	3 10
Brazil Traction..	1½	2	26¼	–⅜	7 9 7
Calcutta Trams	6½	7½	70/–	–4/6	2 2 10
Cape Elec. Trams	5	6	26/–	..	4 12 4
Lancs. Transport	10	10	47/6	..	4 4 3
Southern Rly. :					
5% Prefd. ..	5	5	77	+½	6 9 9
5% Pref. ..	5	5	119½	+2	4 3 9
T. Tilling ..	10	10	62/–	+1/–	3 4 6
West Riding ..	10	10	47/6	+1/6	4 4 2
Telegraph and Telephone					
Anglo-Am. Tel. :					
Pref.	6	6	123	..	4 17 7
Def.	1½	1½	30	..	5 0 0
Anglo-Portuguese	8	8	27/6	..	5 16 6
Cable & Wireless :					
5½% Pref. ..	5½	5½	116½	+½	4 14 5
Ord.	4	4	82½	+½	4 17 0
CanadianMarconi	$1 Nil	4cts.	9/–	..	—
Globe Tel. & Tel. :					
Ord.	8½*	5*	39/6	..	2 10 8
Pref.	6	6	31/–	..	3 17 5
Great Northern Tel. (£10)	Nil	Nil	28	..	—
Inter. Tel. & Tel.	Nil	Nil	19	..	—
Marconi-Marine..	7½	7½	36/6	..	4 2 4
Oriental Tel. Ord.	16	10	49/6	..	—
Telephone Props.	Nil	6	21/3	..	5 13 0
Tele. Rentals (5/–)	10	10	12/3	–3d.	4 1 8

* Dividends are paid free of Income Tax

Stocks and Shares (*Continued from page* 796)

exceeding £3,000,000. These powers have been exercised to the extent of £427,000. The dividend on the preference shares is amply covered, and the shares take rank as a good industrial investment.

Aron Electricity

A few years ago the price of Aron Electricity Meter ordinary shares stood at 15s.; to-day the price is 61s. In the year ended 1940, the company made a loss, and paid no dividend, but in the following year the ordinary received 10 per cent., and since then the dividend has been 15 per cent. per annum. The net profits in the accounts recently issued came to £19,000, and as the dividend required £11,400, the reserves and carry-forward were again strengthened. At the present price of 61s. the yield on the money is a little under 5 per cent. The shares are regarded as being a sound investment of their class.

Falk Stadelmann

The annual meeting of Falk Stadelmann was called for the Wednesday in this week, November 29th, when the chairman had a satisfactory report and accounts to lay before the shareholders. The net profit of £76,950 is about £4,000 less than that of a year ago, but the dividend is maintained at 7½ per cent. on the ordinary shares, for the fourth consecutive year. The floating assets of £596,000 are more than double the company's total liabilities. In the early war years, 1939 and 1940, the dividends on the ordinary shares were 6 per cent. and 7 per cent. respectively, but in the three preceding years the company paid 10 per cent. annually on the ordinary.

The company's ordinary shares are quoted at 34s. 6d. at which the yield on the money, as will be observed by reference to our price-lists, is £4 7s. per cent. The present price is the highest reached since 1937, when the shares touched 42s. The black days of 1940 saw the price down to 12s. 6d.

Madras Electric Acquisition ?

Following upon the negotiations in connection with Calcutta Tramways, the Madras Corporation has passed a resolution for taking over, as soon as possible, the Madras Electric Supply Corporation and the Madras Electric Tramways. The former company holds all the ordinary shares of the Madras Electric Tramways. The local authority has the right to buy the Electric Supply Corporation in August, 1947, and thereafter at ten yearly periods. The matter is in its preliminary stages, but following the example of Calcutta, the transaction is thought likely to go through, unless the proposal should be vetoed by the Madras Government. The price of the shares has risen 3s. 6d. to 32s. 6d. at which the yield on the money is a modest 2½ per cent. The Madras Electric Supply Corporation paid 4 per cent. last year, against nothing in the previous year.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AGA-BALTIC Aktiebolaget. — "Electro-magnetic course-indicating navigation instrument." 1153/43. April 21st, 1942. (565351.)

Aircraft Screw Products Co., Inc.—"Device for inserting wire coils in tapped holes." 7255/43. June 16th, 1942. (565418.)

W. H. Allan.—"Moving-coil cone loud-speakers and microphones." 5996/42. May 4th, 1943. (565367.)

F. Aughtie.—"Electric circuits incorporating resistance strain gauges." 6517. April 22nd, 1943. (565378.) "Electrical peak strain meters." 9842/44. April 22nd, 1943. Divided out of 565378. (565461.) "Combining circuits for electrical strain gauges." 9843/44. April 22nd, 1943. Divided out of 565378. (565462.)

N. C. Barford.—"Frequency modulation of oscillations generated by velocity-modulation discharge devices." 7094. May 5th, 1943. (565413.)

British Thomson-Houston Co., Ltd.—"Electric snap-action switches." 21903/43. January 2nd, 1943. (565450.)

J. W. Dalgleish and Pye, Ltd.—"Process and apparatus for insulating electric wires and cables." 18259. December 23rd, 1942. (565344.)

English Electric Co., Ltd., H. S. Carnegie and R. J. Welsh.—"Electric supply systems." 9097. June 7th, 1943. (565388.) "Electric supply systems." 9096. June 7th, 1943. Addition to 528404. (565422.)

Hellermann Electric, Ltd., and A. C. Anselmi.—"Device for stretching rubber and other flexible tubing or hollow members for binding, insulating, marking and other purposes." 21806. December 29th, 1943. (565449.)

W. T. Henley's Telegraph Works Co., Ltd., and E. Moor.—"Gland for the packing of an aperture containing an electric cable or other member." 11080. July 8th, 1943. (565393.)

H. W. K. Jennings (Micro Switch Corporation).—"Electric snap-action switches." 19118. November 16th, 1943. (565363.)

Kodak, Ltd.—"Devices for producing stepped intensity light beams." 7150/43. June 5th, 1942. (565416.)

E. O. Lakey.—"Street or town's lighting." 8794. June 1st, 1943. (565390.)

Machlett Laboratories, Inc.—"X-ray tubes." 16578/42. January 26th, 1942. (565369.)

W. A. McNeill and Ferguson, Pailin, Ltd.—"Air or gas blast electric circuit-breakers." 6905. May 1st, 1943. (565410.)

Mavor & Coulson, Ltd., and J. B. Mavor.—"Apparatus for mining." Cognate applications 17263/42, 5376/43, 9189/43 and 16783/43. December 4th, 1942. (565342.)

Mullard Radio Valve Co., Ltd., and C. E. G. Bailey.—"Phase modulators." 1985. February 5th, 1943. (565403.)

F. Porter.—"Electric conductors." 7167. May 6th, 1943. (565434.)

G. R. Shepherd (Westinghouse Electric International Co.)—"Electric overload responsive circuit interrupters." 21934. December 31st, 1943. (565451.)

Small Electric Motors, Ltd., P. Adorjan, J. E. Nash and E. W. Rogers.—"Controlling automatically the speed of dynamo-electric machines." 16640. December 24th, 1941. (565430.)

P. A. Sporing and Telegraph Condenser Co., Ltd.—"Electrical condensers." 4251. March 16th, 1943. (565375.) "Electrical condensers." 13960/44. March 16th, 1943. Divided out of 565375. (565397.)

Standard Telephones & Cables, Ltd.—"Cathode-ray tube plate assemblies." 4050/43. July 8th, 1942. (565374.) "Radio landing guide system for aircraft." 6855/43. May 11th, 1942. (565379.) "Manufacture of electric vacuum tubes." 8127/43. May 29th, 1942. (565486.)

Standard Telephones & Cables, Ltd., and S. J. Powers.—"Manufacture of electric vacuum tubes." 6354. April 21st, 1943. (565485.)

Stone & Co., Ltd., and L. R. Nixon.—"Automatic voltage regulators for dynamo-electric machines." 2885. February 22nd, 1943. (565355.)

A. V. Tomlinson (Union Switch & Signal Co.)—"Electro-magnetic relays." 15270. October 30th, 1942. (565371.)

F. R. Warbrook.—"Time control of electric circuits." 6928/43. May 18th, 1942. (565380.)

Westinghouse Electric International Co.—"Diffusion pumps." 4005/44. March 27th, 1943. (565455.)

War Risks Insurance

THE Board of Trade announces that all policies for fixed sums under the Commodity Insurance Scheme which are in force on December 2nd will be extended until March 2nd, 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 the premium on any excess of the average cover during the three months of extension over the average cover in the three months ending December 2nd. For new or additional insurance the rate of premium has been reduced to 2s. 6d. per cent. for the three months December 3rd to March 2nd (minimum 5s.).

All policies under the Business Scheme which are in force on December 31st, will be extended until March 31st, while for new or additional insurance the premium for the three months, January 1st to March 31st, will be 1s. 8d. per cent. (minimum 5s.).

Policies under the Private Chattels Scheme expiring on or after November 23rd and prior to April 30th, will be extended to April 30th. For new or additional insurance a premium will be payable at the reduced rates given below and policies issued at these rates on or after November 23rd, 1944, will be valid until April 30th, 1945, and no longer :—2s. 6d. per cent. up to £2,000, 3s. 9d. per cent. for the next £1,000 and 5s. 0d. per cent. for the next £7,000 (minimum 5s.).

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—VICTORIA.—April 26th, 1945. Melbourne City Council. Supply and erection of electrostatic flue gas dust collecting equipment. Spec. from City Electrical Engineer's Office (£1 1s.).

Fife.—December 6th. County Council Catering Committee. Various works, including electrical, at central kitchen, Rosyth. Specifications and schedules from C. R. Douglas & Son, surveyors, 15, East Port, Dunfermline (£1 per schedule).

Linlithgow.—Town Council. Electrical work in the completion of 20 partly built houses at Captain's Park. N. S. Main, town clerk.

Manchester. — December 8th. Electricity Department. Electric cranes with trolley wires and switchgear. (November 24th.)

Orders Placed

London.—ISLINGTON.—Electricity Committee. Accepted. 250 electric lamp standards (£5 3s. 7d. each if ordered in quantities of 50 and £4 18s. 2d. each in quantities of 100).—Bromford Tube Co. 50 to 75 mercury-vapour discharge lanterns (£9 9s. 7d. each).—Engineering & Lighting Equipment Co.

Metropolitan Water Board. Accepted. Petrol driven electric arc welding set (£309).—Murex Welding Processes.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Post-war plan for new housing estate, houses, seven schools, shopping and community centre: city architect.

Bromsgrove.—Houses. Cobnall Road estate, for U.D.C.; Gadd & Porter, architects, Town Hall Chambers.

Cheshire.—Maternity home, Crewe (£25,000); E. M. Parkes, county architect, The Castle, Chester.

Clackmannan.—Communal kitchen, dining room, etc., at Alva for County Council; Education Committee.

Coventry. — Home for crippled children; secretary, Crippled Children's Guild, Allesley, Coventry.

Community centres, Hen Lane, Holbrooks, and at Bell Green; D. E. E. Gibson, city engineer, 1a, Warwick Row.

Darlington.—Office and garage, Holly Street; H. W. Andrew, builder, Kendrew Street.

Dumfries. — Additions, Dumfries and Galloway Royal Infirmary; medical superintendent.

Houses (20); burgh surveyor.

Dundee.—Proposal to build 700 houses for transitional period; secretary, Scottish Special Housing Association, Ltd., Edinburgh.

Durham. — Central kitchens at Ford, Medomsley and South Church; county school architect, 34, Old Elvet, Durham.

Felling-on-Tyne.—Central kitchen; D. Glen & Co., builders, Queens Road, Jarrow.

Flixton.—Ten flats, Western Road (electrical work); J. Maunders & Sons, Ltd., builders, 544, Barton Road, Stretford.

Glasgow.—Works additions, Redan Street; Mavor & Coulson, Ltd.

Buildings, Barfillan Drive; J. Gibson & Co.

Huddersfield.—Central kitchen and boiler house, Woodhouse Hall, Sheepridge; education architect, Education Offices, Peel Street.

Hyde.—Central kitchen, Flowery Fields; T. A. Higson, borough surveyor, Town Hall.

Inverness-shire. — Refrigerating plant at Mallaig for fishing industry (post-war scheme); J. W. McKillop, county clerk.

Lincoln. — Extensions, City Maternity Home, Goldsmith Walk, St. Giles; city engineer, Silver Street.

Llanelly. — Proposed reconstruction of hospital premises, Llanelly and District General Hospital; secretary.

London. — LEWISHAM. — Workshop, Howson Road; F. Matthews (Brockley), Ltd.

Mexborough.—Extensions to nurses' quarters and new outpatients' and casualty departments; secretary, Montagu Hospital, Adwick Road, Mexborough, near Rotherham.

Middlesex.—Erection of kitchen and dining room at Pinner Park School, Harrow; county architect.

Montrose.—Shipyard, Rossie Island; town clerk.

Newcastle-on-Tyne. — Extensions to the City Mental Hospital at Coxlodge; city architect.

Extensions to St. Peter's Works; R. & W. Hawthorn Leslie & Co., Ltd.

North Riding.—School canteens and dining centres (£3,230); county architect, County Hall, Northallerton.

Nottinghamshire. — Extensions at Ransom Sanatorium; county architect, Shire Hall, Nottingham.

Scarborough.—Reconstruction of Olympia Buildings; borough surveyor, Town Hall.

Skegness.—Erection of conference hall on site of Tower Gardens Pavilion; surveyor, Council Offices, Skegness, Lincs.

Stockport.—Packing factory; Connell & Bailey, Ltd., printers, St. Peter's Square.

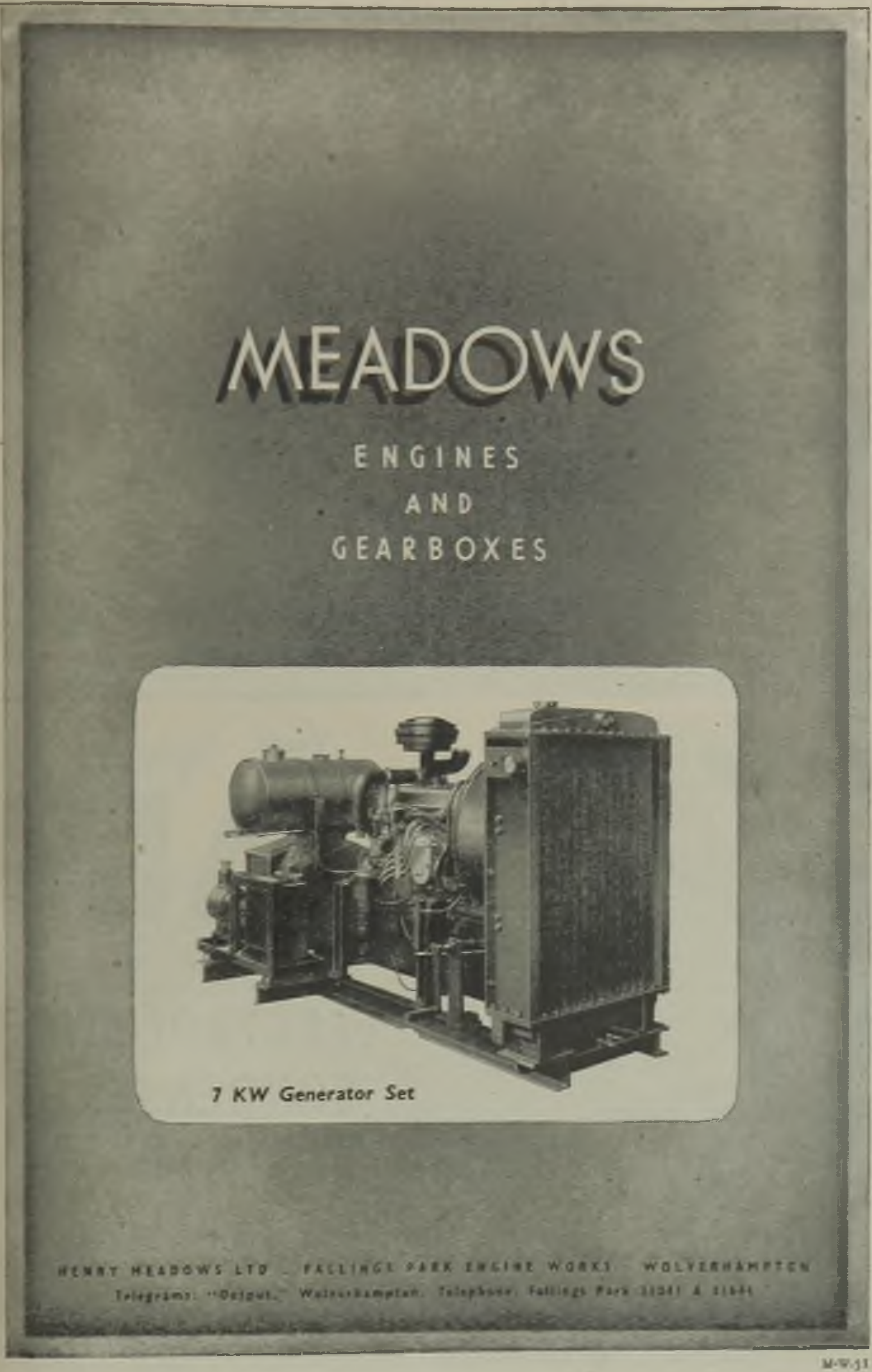
Stourbridge.—Houses for staff; G. P. Deeley, engineer to the Upper Stour Valley Main Sewerage Board, Church Street.

Watford.—Proposed extension of Isolation Hospital, Tolpits Lane; borough surveyor, 14, High Street.

Wolverhampton. — Gymnasium and classrooms; secretary, Grammar School.

FAMOUS HYDRO-ELECTRIC STATIONS.

This remarkable aerial photograph shows the complete working area taken over for the spectacular construction of the mighty Grand Coulee Dam, one of America's finest, in the state of Washington. Mason City lies in the left foreground and the Government town on the right. The dam has an ultimate capacity of 1,974,000 kw or 2,475,000 H.P. of electrical power.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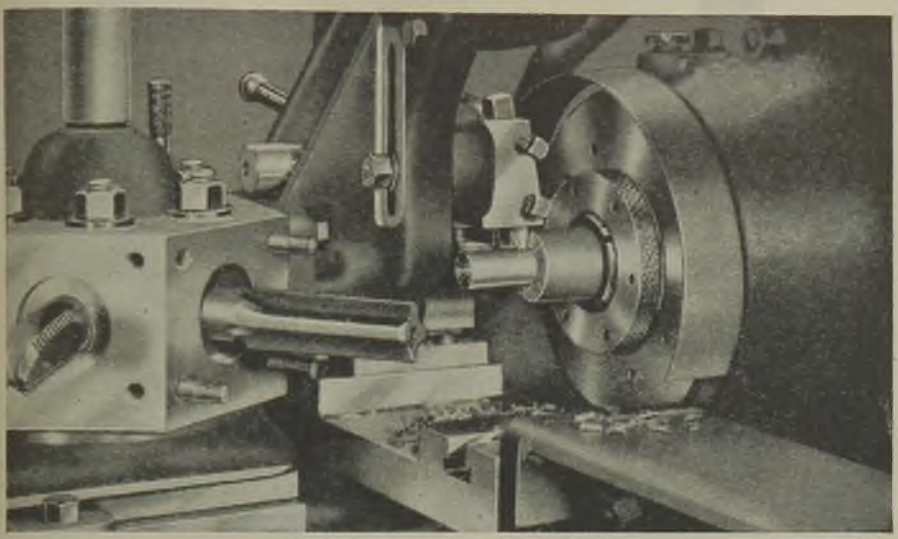
ERM high-Speed



copper for the machinist

ERM high-Speed machining copper smashes bottle-necks; it was designed to do the difficult easily; as against ordinary H.C. copper it will increase your machine output by at least 300% ● it will reduce your tool costs ● it gives you a cleaner and more accurate finish ● its electrical conductivity is 98% I.A.C.S. ● it withstands temperatures 100-150°C. higher than H.C. copper ● may we send you our technical leaflet about this alloy?

Enfield Rolling Mills Ltd

BRIMSDOWN MIDDLESEX

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Greenwood X.4

"Stability in Insulation" and how it is achieved . . .

This enlightening little work — "STABILITY IN INSULATION" — is the last word on the subject of modern insulation. It is full of facts worth noting.

Did you know, for example, that HY-MEG ensures electrical performance above reproach — even in tropical heat and after prolonged heavy duty — conditions which are normally so harmful to ordinary impregnating varnishes? It tells also how HY-MEG's efficiency is unimpaired by damp or the deteriorating action of oils, acids and alkalis; such faults as failure due to coil movement, "throwing" of the varnish; softening of wire enamel and wire breakage are prevented by the use of HY-MEG.

Evidence of the superiority of HY-MEG is abundantly contained in the booklet, a copy of which will gladly be sent to you. Please apply on Business Heading or Card enclosing 2d. to comply with the Control of Paper (No. 48) Order 1942.

INSULATE WITH **HY-MEG** TO BE SURE

'HY-MEG'
IMPREGNATING VARNISHES

V. 6738. The Supreme Impregnating Varnish for withstanding severe mechanical stress. Suitable for "heavy duty" units.

V. 6934. Made specially for enamelled wire windings, but is equally suitable for Rayon and Glass-covered Wire.

LET OUR 'BRAINS TRUST' HELP

Our "Brains Trust" deal experily with any special problem you may have. 'HY-MEG' is the outcome of their research and they are qualified to cope with particular insulation difficulties.

LEWIS BERGER & SONS LTD. (*Est. 1760*) **LONDON, E.9** ***Phone AMHerst 3321***

MANUFACTURERS OF INSULATING VARNISHES & ENAMELS

MISERABLE CURVE

All's not well with output in this factory. Operatives, plant and organization are right but some factor is wrong. Something is putting a damper on production.

It could be bad ventilation.

Unless an efficient ventilation system is installed the effects of excessive heat and bad ventilation cannot be avoided. Workers' energy will be sapped, enthusiasm damped and increased production made impossible.

Not only will an efficient system of ventilation help to increase war-time production but it will add immeasurably to health and output in the post-war years too.

★ VENTILATION IS A VITAL FACTOR THAT WILL MAKE OR MAR ANY PRODUCTION CHART. SO CONSULT THE G.E.C. WHOSE VENTILATION ENGINEERS GIVE EXPERT ADVICE ON VENTILATION EQUIPMENT ESPECIALLY DESIGNED FOR INDUSTRY.

CONSULT THE G.E.C. ON VENTILATION with GENALEX EXHAUST FANS

Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2. Gen. 15

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS for insertion in the following Friday's issue are accepted up to **First post on Monday**, at Dorset House, Stamford Street, London, S.E.1.

THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, minimum 2 lines 4/-, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number there is an additional charge of 6d. for postage of replies.

SITUATIONS WANTED. — Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES TO advertisements published under a Box Number if not to be delivered to any particular firm or individual should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Letters of applicants in such cases cannot be returned to them. The name of an advertiser using a Box Number will not be disclosed. All replies to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1. Cheques and Postal Orders should be made payable to ELECTRICAL REVIEW LTD. and crossed.

Original testimonials should not be sent with applications for employment.

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 and 41 unless such woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

BOROUGH OF HESTON AND ISLEWORTH

Electricity Department

Shift Charge Engineer

APPLICATIONS are invited for the position of Shift Charge Engineer to the above Undertaking. Applicants must have a sound theoretical knowledge and considerable practical experience in the operation, running and maintenance of water tube boilers, reciprocating and turbine D.C. and A.C. generating plant, E.H.T. and L.T. switchgear, motor converters, rotary converters, rectifiers, 3-wire D.C. balancers, large secondary batteries, booster charging equipment, etc.

Applicants must be capable of carrying out running repairs, tests and overhauls to all station plant.

The salary will be in accordance with Grade 8, Class E, of the National Joint Board Schedule. The commencing salary at present is £379 1s. per annum.

The appointment is subject to the Local Government and Other Officers (Superannuation) Act, 1937, and the successful candidate will be required to undergo a medical examination. The person appointed will be required to carry out such duties as may be assigned to him, to devote his whole time to the duties of his office, and to reside within the Borough.

Form of application may be obtained from Mr. S. H. Fowles, M.I.E.E., M.I.Mech.E., M.Inst.B.E., Borough Electrical Engineer and Manager, Electricity Offices, 11, Staines Road, Hounslow, Middlesex, and must be forwarded, together with copies of not more than three recent testimonials, enclosed in a plain sealed envelope endorsed "Charge Engineer," to me at the Council House, not later than 12 noon on Wednesday, 13th December, 1944.

Canvassing any member or officers of the Council, either directly or indirectly, will be deemed a disqualification.

HAROLD SWANN,
Town Clerk.

Council House,
Hounslow.
1032

WALSALL EDUCATION COMMITTEE

Walsall Technical College

REQUIRED, as soon as possible, full-time Lecturer in Electrical Engineering. Applicants should possess a University degree or equivalent, and have had industrial experience in Electrical Engineering. Teaching experience to Higher National Certificate standard is desirable. Salary in accordance with the Burnham Scale for Technical Teachers.

Applications (no forms) should be sent to the Principal, Technical College, Bradford Place, Walsall, not later than 9th December, 1944.

V. J. MOORE,
Director of Education.
1030

BOROUGH OF BRENTFORD AND CHISWICK

Electricity Department

Appointment of Deputy Borough Electrical Engineer

APPLICATIONS are invited from suitably qualified and experienced candidates for the post of DEPUTY BOROUGH ELECTRICAL ENGINEER at a salary in accordance with Grade 1, Class D, of the N.J.B. Schedule of Salaries, which at the present time is £674, rising to £703 per annum.

Candidates, not exceeding 45 years of age, should possess an Engineering Degree or its equivalent and must be Corporate Members of the Institution of Electrical Engineers. Extensive experience with a modern and progressive undertaking with sales development and commercial experience is also essential.

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

Applications, stating age, details of training and experience, present position regarding liability for service with H.M. Forces, and accompanied by copies of not more than three recent testimonials, must be delivered not later than Monday, the 11th December, 1944, to A. E. Jeans, Esq., M.I.E.E., Borough Electrical Engineer, Electricity Showrooms and Offices, 197/199, Chiswick High Road, London, W.4.

Canvassing, directly or indirectly, will be deemed a disqualification.

JOHN SKINNER,
Town Clerk.

Town Hall,
Chiswick, W.4.
15th November, 1944.
1016

CORPORATION OF THE CITY AND COUNTY OF NEWCASTLE-UPON-TYNE

Transport & Electricity Undertaking

Electrical Foreman

APPLICATIONS are invited for the position of Electrical Foreman from persons who must possess good initiative, organising ability, and are between the ages of 35 and 45 years. They must have served an apprenticeship, and have first class qualifications in electrical engineering as applicable to the maintenance of tramcars, trolley vehicles and motor omnibuses, together with a sound administrative experience of workshop practice.

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

The salary will be £6 0s. 6d. to £7 5s. 6d. per week including War Bonus (at present 25s. 6d. per week), according to qualifications and experience.

Applications, stating age and full particulars of qualifications and experience, together with copies of not more than three recent testimonials, must be delivered to the undersigned not later than the first post on the 9th December, 1944. The envelope should be marked "Electrical Foreman."

H. C. GODSMARK,
General Manager.

Newcastle Corporation Transport and Electricity Undertaking,
Manors,
Newcastle/Tyne, 1.
1057

CITY AND ROYAL BURGH OF EDINBURGH

Electricity Department

Technical Assistant

APPLICATIONS are invited for the above position from persons available now or immediately after the war in the West.

Preferred qualifications: Honours degree or the equivalent in electrical or mechanical engineering; apprenticeship with one of the larger electrical manufacturing companies, one of the main-line railway companies, or one of the large-scale chemical or petroleum industries. The applicant's subsequent experience should have been concerned with the development of electric power generation and distribution in these industries or in the electric power supply industry.

Salary according to National Joint Board Schedule, Class J, Grade 4 (£642-£657-£673 p.a.).

Applicants should mention names of professional engineer referees under whom they have worked. Testimonials may also be submitted if available.

J. F. FIELD,
Engineer and Manager.

1 Dewar Place,
Edinburgh, 3.
17th November, 1944. 1021

NORTH WEST MIDLANDS JOINT ELECTRICITY AUTHORITY

Shift Charge Engineer

APPLICATIONS are invited for the position of Shift Charge Engineer, as a war-time appointment, at the Stafford Generating Station.

Candidates must have had a good practical and technical training in mechanical and electrical engineering and experience in the operation of boiler and turbo-alternator plants.

The salary and conditions of service will be in accordance with the N.J.B. Schedule, Class E, Grade 8, at present rising from £361—£378 per annum.

Applications, stating age and giving full particulars of experience and training, accompanied by not more than three testimonials, are to be endorsed "Shift Charge Engineer," and sent to the undersigned.

F. FAVELL, Esq., M.I.E.E., M.I.Mech.E.,
Chief Engineer & Manager,
North West Midlands Joint Electricity Authority,
York Chambers,
Kingsway,
Stoke-on-Trent.
8th November, 1944. 989

ELECTRICAL contractors, with head office in London, require Area Manager for Birmingham with knowledge of all classes of power and lighting installations, preferably with a connection in the district. Details of experience, age and remuneration in confidence to—Box 916, c/o The Electrical Review.

ELECTRICAL Engineer required as Works Manager, approx. 200 hands; must have had a thorough and practical training and have knowledge of mains transformers and chokes, up to 25 kVA, instrument and small electro-mechanical manufactures. Must be capable organiser and disciplinarian. State experience, connection, age, and salary required in confidence. Permanent and progressive position to right man. Employment subject to Ministry of Labour restrictions.—Box 1028, c/o The Electrical Review.

ELECTRICIAN wanted, with good general experience, preferably with a small supply undertaking or similar class of work. Present rate 2s. 0½d. per hour. Permanent and superannuated post for suitable applicant. Apply—Chief Engineer, Corporation Electricity Department, Ladeside Street, Rothesay. 1055

JUNIOR Shift for small station. Diesel and bulk supply. A.C. and D.C. switchgear. Salary, N.J.B. schedule, Class B, Grade 8b, at present £267 p.a. The appointment will be of a temporary nature to replace man serving with H.M. Forces, and will be terminable by one month's notice on either side. Travelling and other reasonable expenses will be paid, but in the case of the successful candidate these expenses will be paid upon taking up the duties. Applications, with full particulars of experience, reference and age, to—The Clerk, Horsham Urban District Council, Council Offices, Horsham Park, Horsham, Sussex. Mark the envelope "Junior Shift." 1006

MANAGER required by North London manufacturers of small electrical apparatus (employing 800/900). Must have had extensive inspection experience—organisation and controlling. Capable of dealing with inspection control at all stages of manufacture—raw materials to finished product. Write in confidence, giving full particulars of experience and salary required, to—Box 1051, c/o The Electrical Review.

OFFICE Manager, London district, capable of dealing with technical correspondence, enquiries and contracts. Electrical training essential. Knowledge of measuring instruments an advantage. Salary £350-430, according to qualifications and experience.—Box 1046, c/o The Electrical Review.

PUBLIC Lighting Expert required by manufacturers of street lamps to assist in design of equipment, promote post-war public lighting business, prepare schemes, estimates, etc. Salary according to qualifications. Applicants should state age, qualifications and experience. Write—Box 967, c/o The Electrical Review.

SALES and Wiring Superintendent required by an electricity supply undertaking in the Midlands. Applicants must have had practical experience in industrial power and domestic installations. Applications should state age, particulars of training and experience, salary required, and be accompanied by three recent testimonials addressed to—Box 956, c/o The Electrical Review.

SALES Manager required by Transformer Company manufacturing special types of great importance for industry, as well as standard H.V. and L.V. transformers up to 1,000 kVA. Applicant must have good connections to consumers and supply companies and should be capable of developing sales throughout the country from head office, and also visiting and instructing representatives.—Box 1022, c/o The Electrical Review.

STOREKEEPER required for warehouse of electrical wholesalers. This is a permanent position with good prospects for the right man.—Box A11657, Samson Clarks, 57-61, Mortimer Street, W.1. 1044

STORES Clerk required by electrical wholesalers. Good knowledge of electrical material essential. Apply—London Electrical Company, 92, Blackfriars Rd., S.E.1. 25

THE management of an old-established firm (West End, London) have an opening for an energetic and live representative of character. The company seeks and endeavours to maintain the friendly support of its clientele throughout the country. This calls for a contacting representative possessing acumen, combined with integrity and loyalty. Adequate remuneration will be paid to the right man. Write—Box 118, c/o Phillips Advertising Ltd., 15, Wilton Road, London, S.W.1. 1035

VACANCY occurs for a Shift Charge Engineer in industrial power station. Salary according to E.P.E.A. schedule, Class E, Grade 8. Write—Box 998, c/o The Electrical Review.

WORKS Manager required for electrical repair works, Birmingham area. Applicant must be good disciplinarian and fully conversant with all classes of electrical machines, and capable of issuing design details. Age, qualifications and salary required.—Box 1034, c/o The Electrical Review.

APPOINTMENTS FILLED

Dissatisfaction having been so often expressed that unsuccessful applicants are left in ignorance of the fact that the position applied for has been filled, may we suggest that Advertisers notify us to that effect when they have arrived at a decision? We will then insert a notice free of charge under this heading.

SITUATIONS WANTED

A Sales Engineer, for large manufacturing co., age 48, at present acting outside sales engineer (North England area), handling all classes switchgear, motors, etc., desires post as Branch Manager.—Box 6499, c/o The Electrical Review.

ADVERTISER (50) desires change, 14 years employed by supply undertaking operating in rural area, conversant with hire, H.P. maintenance, showroom, contracting and change-over. Employed at present as sales foreman.—Box 6494, c/o The Electrical Review.

ELECTRICAL Engineer. Diploma of Faraday House. British, single, age 42, seeks appointment with prospects. Several years' experience electricity supply industry, principally on the distribution side. Extensive experience installation, operation and maintenance of underground cables, overhead lines, substations and their equipment, consumers' services and installations, also contracting experience. Salary not less than £600 per annum.—W. Mitchell, 31, Graham Road, Weston-super-Mare, Somerset. 6510

ELECTRICAL Engineer desires position, experience including electric furnace design, nickel chromium and molybdenum element types.—Box 6505, c/o The Electrical Review.

ELECTRICAL Engineer (29 years) requires situation overseas, release can be obtained. Fully experienced in A.C., D.C. and general engineering, including combustion engines.—Box 6526, c/o The Electrical Review.

ELECTRICAL Engineer (38), seeks post-war job as Installation Inspector. Eight years with Supply Co. on similar, including change-over D.C.-A.C., war post 4 years supervising and maintaining large government installations (member A.S.E.E.).—Box 6503, c/o The Electrical Review.

ELECTRICAL Engineer (42), 23 years with leading lamp manufacturers in a technical capacity, requires executive position in a lamp factors' business. Modest capital available.—Box 6508, c/o The Electrical Review.

ELECTRICAL Instructor (32), 16 years' electrical experience on aircraft and automobiles, requires change. Position acceptable offering post-war possibilities. Sales organisation, production, staff control or training.—Box 6502, c/o The Electrical Review.

ENGINEER (45), good technical education and long experience in manufacturing electrical measuring instruments, communication and radio apparatus, F.H.P. motors, in all branches of the trade, also metallurgy. 15 years' administration as foreman, superintendent and manager, tactful disciplinarian, desires position with go-ahead firm as works manager or chief engineer. Four-figure salary required.—Box 6536, c/o The Electrical Review.

FOREMAN Electrical Engr. desirous of a change, supervisory capacity, conversant with all systems of electrical installation and maintenance.—Box 6528, c/o The Electrical Review.

FOREMAN Electrician seeks appointment. Competent, large lay-outs, power, lighting, estimating, labour control, good organizer.—Box 6529, c/o The Electrical Review.

MECHANICAL Designer, Engineering graduate (B.Eng.) with 8 yrs.' engineering experience, including jig and tool design and assembly of light mechanical and electrical products, and with good electrical knowledge, seeks position as mechanical designer with firm South of England. No objection to combining jig and tool design with mechanical design in a small firm. Post-war prospects of paramount importance. Age 27.—Box 6522, c/o The Electrical Review.

PLUMBER Cable Jointer, 10 years' experience on E.H.T. and L.T. network, seeks permanent position.—Box 6525, c/o The Electrical Review.

PURCHASING Official requires post of responsibility in provinces. Twenty years' experience with important group electricity supply and transport undertakings. Thorough knowledge of these markets and highly experienced in organisation and control of central purchasing department with large turnover and staff.—Box 6492, c/o The Electrical Review.

REPRESENTATIVE or Agent with wide technical sales and engineering experience, prepared to negotiate for London and South with F.H.P. and/or non-ring motor makers, with present or post-war programme. Willing to consider allied or domestic engineering equipment. Many excellent contacts. Car.—Box 6531, c/o The Electrical Review.

TECHNICAL Electrical Engineer (33), B.Sc.(Hon.), A.M.I.E.E., 14 years' practical experience, last 8 years executive capacity, planning, installation and maintenance industrial power plant, H.T./L.T. subs. and mains, electro-chemical applications and equipment design. Free short notice, present department closing down.—Box 6539, c/o The Electrical Review.

FOR SALE

Traders buying and selling hereunder must observe the Restriction of Resale Order, S. R. & O. 1942 No. 958.

A consignment of Motor Pulleys, 2"-25" dia., abt. 300 in total. Sold at any reasonable offer for quick clearance.—J. Gerber & Co. Ltd., Wembley. 1041

A large stock of surplus Carbon Rods, Ebonite, Fibre, A.I.D. Turnbuckles, etc., also Searchlights (sale or hire), Mirrors, Lenses, also Winches of our well-known self-sustaining types. Hundreds of thousands supplied during the last 40 years to Govt. depts., corporations and innumerable traders.—London Electric Firm, Croydon. 42

COUNTY BOROUGH OF WARRINGTON

Electricity Department

Plant for Sale

ELECTRICITY Committee invite offers for:—

1 18/21-h.p. Diesel Locomotive, 2 ft. Track.
12 2-cu. yd. Tipping Wagons, 2 ft. Track.
432 yds. 2-ft. Jubilee Track.

Full particulars and form of tender may be obtained on application to Norman T. Smith, Borough Electrical Engineer, Electricity Works, Warrington, where the plant may be inspected by appointment.

Offers for the above plant, addressed to the Chairman of the Electricity Committee, Town Hall, Warrington, must be sealed with wax and endorsed "Tender for Plant" and delivered not later than 12 o'clock noon on Monday, December 11th, 1944.

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

W. E. E. LOCKLEY,
Town Clerk.

Town Hall,
Warrington. 1031

GEORGE COHEN, SONS & CO. LTD.

for

GUARANTEED ELECTRICAL

PLANT.

MOTORS, GENERATORS,

SWITCHGEAR,

etc.

WOOD LANE, LONDON, W.12.
Telephone: Shepherds Bush 2070
and
STANNINGLEY, NEAR LEEDS.
Telephone: Pudsey 2241.
Established 1834.

27

MODINSTAL ELECTRIC COMPANY LIMITED

INDUSTRIAL INFRA-RED APPARATUS FOR PAINT DRYING.
COMPLETE EQUIPMENTS OR SINGLE UNITS PROVIDED.
GUARANTEED HEAT GENERATORS.

OLDHAM WORKS, OLDHAM TERRACE, ACTON, W.3, LONDON.
Telephone: Acorn 3504/5.
M.E.C. APPARATUS, DULL EMITTER SYSTEM.

59

ARC WELDING MACHINES FROM STOCK

WE offer our latest type No. 2 Max-Arc Welder for immediate delivery, 15/250 amperes. Operates off any A.C. supply voltage. Send for details.

MAX-ARC WELDERS LTD.,
190, THORNTON ROAD, CROYDON.
THOrnton Heath 4276-8.

35

BURDETTE & CO. LTD.

Stock

Reconditioned A.C. and D.C. Motors and Starters Equal to New.

STONHOUSE STREET, CLAPHAM, S.W.4.

Day and night service. MACaulay 4555.

17

REBUILT MOTORS AND GENERATORS

LONG deliveries can often be avoided by purchasing rebuilt secondhand plant. We can redesign or replace surplus plant of any size.

SEND US YOUR ENQUIRIES.

OVER 1,000 RATINGS ACTUALLY IN STOCK HERE.

DYNAMO & MOTOR REPAIRS LTD.,
Wembley Park, Middlesex.
Telephone: Wembley 3121 (4 lines).

Also at Phœnix Works, Belgrave Terrace, Soho Road, Handsworth, Birmingham.
Telephone: Northern 0898.

26

MODERN SQUIRREL CAGE GEARED MOTOR UNITS

BY English Electric Co., horizontal feet fixing, 400/440 volts, 3-phase, 50 cycles, ball and roller bearings throughout.

One	5 h.p.	1,415/236 r.p.m.
One	12 h.p.	1,450/500 r.p.m.
One	12 h.p.	1,444/249 r.p.m.
One	12 h.p.	1,440/196 r.p.m.
One	12 h.p.	1,400/196 r.p.m.
One	12 h.p.	1,440/250 r.p.m.
One	15 h.p.	1,440/720 r.p.m.
One	15 h.p.	1,440/250 r.p.m.
Two	15 h.p.	1,445/250 r.p.m.
Four	20 h.p.	1,440/248 r.p.m.
One	20 h.p.	1,400/250 r.p.m.
Five	30 h.p.	1,445/250 r.p.m.

GEORGE COHEN, SONS & CO. LTD.
Stanningley, near Leeds. 1047

WATER TUBE BOILERS IN STOCK

Four	25,000 lbs.	evaporation,	175 lbs. W.P.
Three	20,000 lbs.	,,	175 lbs. ,,
One	15,000 lbs.	,,	175 lbs. ,,
One	12,000 lbs.	,,	175 lbs. ,,
One	12,000 lbs.	,,	200 lbs. ,,
One	12,000 lbs.	,,	160 lbs. ,,
One	9/10,000 lbs.	,,	200 lbs. ,,

We install complete, including brickwork. Economisers, Pumps, Piping Valves, Generating Sets and Motors in stock. Please send us your enquiries; we can give immediate delivery.

BURFORD, TAYLOR & CO. LTD.,
Boiler Specialists, Middlesbrough.
Telephone: Middlesbrough 2622.

32

ELECTRIC MOTORS AND DYNAMOS

WE hold one of the largest stocks of New and Second-hand Motors. Secondhand machines are thoroughly overhauled. Inspection and tests can be made at our Works.

For Sale or Hire. Send your enquiries to:—

BRITANNIA MANUFACTURING CO. LTD.,
22-23, BRITANNIA STREET,
CITY ROAD, LONDON, N.1.

Telephone: 5512-3 Clerkenwell. 13

ENQUIRIES SOLICITED
for
BRASS & STEEL B. A. NUTS.

Sizes stocked for immediate delivery:
Brass: 0, 2, 4, 6, 8 and 10 B.A. Full and Lock.
Steel: 0, 2, 4, 6, 8 and 10 B.A. Full.
,, 0, 2, 6. Lock.
Also Stocked: Brass & Steel Washers, Brass & Steel Studding.

APEX SALES,
6, Leaside Rd., London, E.5. STA. 7131.

6441

PINION WIRE

7,000 lengths in Brass and Steel for sale. Various lengths from 12" to 21" and small to large diameters, all at 1s. per length. Suitable for clock, instrument or toy makers. Samples gladly on request.

APEX SALES, 6, Leaside Road, London, E.5.
STA. 7131. 6509

ECONOMISERS IN STOCK

TWO Green's Economisers, 208 tubes, 250 lbs. W.P.

Guaranteed re-insurable and first-class condition only, low prices. Quotations per return. Installations delivered and erected complete.

BURFORD, TAYLOR & CO. LTD.,
7, Commercial Street, Middlesbrough. Telephone 2622.

65

A.C. and D.C. House Service Meters, all sizes, quarterly and prepayment, reconditioned, guaranteed one year. Repairs and recalibrations.—The Victa Electrical Co., 47, Battersea High Street, S.W.11. Tel. Battersea 0780. 19

A.C. and D.C. Motors, all sizes, large stocks, fully guaranteed.—Milo Engineering Works, Milo Road, East Dulwich, S.E.22 (Forest Hill 4422). 6463

A.C. Motors, 1/50th h.p. to 3 h.p., from stock, for essential work only.—The Johnson Engineering Co., 5, Spencer Street, Leamington Spa. 57

ALTERNATOR, 500 kVA, 3-p., 50 c., 400/440 v., 750 revs., direct coupled exciter, 2 brgs., on bedplate. —Stewart Thomson & Sons, Fort Road, Seaforth, Liverpool, 21. 58

BATTERIES (B class only), all types, Torch Cases. Cycle Rear Lamps, Lease-Lend and Empire Bulbs. Household Lamps, Plugs and Socket, Switches, Soldering Irons, Flat-iron Elements, Fire Spirals, and other electrical accessories. Write for list.—Brooks & Bohm Ltd., 90, Victoria Street, London, S.W.1. (Vic. 1441.) 1038

BELT Grinders or Sanders, 4" wide belt, £5 5s.; 6" wide belt, £10 10s.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 52

EXHAUST Fans, new, 14", 1-phase, 200/250 v., 1,900 cu. ft./min., £11 15s.—Southern Ignition Co. Ltd., 190, Thornton Road, Croydon. 75

FOR sale ex site, one first-class, 200-h.p., 970-r.p.m. Brush slip-ring Motor, 400 volts, 3-phase, 50 cycles, with switchgear, all new 1937. Available immediately.—Newman Industries Limited, Yate, Bristol. 1049

FOUR identical 150-kW. "Weir Sulzer/E.C.C." Diesel-driven Generating Sets, 220 volt D.C.—Stewart Thomson & Sons, Fort Rd., Seaforth, L'pool, 21. 74

GENERATING Sets for sale, 3 kVA, petrol, 230/1/50; 2½ kW, crude oil, 220 v. D.C.; 18 kVA, petrol, 400/3/50.—Fyfe, Wilson & Co. Ltd., Bishop's Stortford. 1058

HEAVY duty Arc Welding Plants, 200 amps. Price £31 10s. complete. Also Spot Welders, £36 15s.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 50

LESLIE Dixon & Co. for Dynamos, Motors, Switchgear, Chargers and Telephones.—214, Queenstown Road, Battersea, S.W.8. Telephone, Macaulay 2159. Nearest Rly. Sta.: Queen's Road, Battersea (S.R.). 18

MOTOR-driven Centrifugal Pump by Mather & Platt, 8" suction, 6" delivery, ball-bearing type with horizontally split casing and water-sealed glands, 57,000 g.p.h., 140' head, coupled to A.C. Motor, 62 h.p., squirrel cage, with auto-transformer starter.—Thomas Mitchell & Sons Limited, Bolton. 552

MOTOR Generator Sets and Convertors, all sizes and voltages from ¼ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, City Road, London, N.1. Telephone, Clerkenwell 5512, 5513 & 5514. 28

MOTORISED ½" Bench Drilling Machine, 13 speeds, £11 11s.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 51

NAMEPLATES, Engraving, Diesinking, Stencils, Steel Punches.—Stilwell & Sons Ltd., 152, Far Gosford Street, Coventry. 14

NO. 18, 40-s.w.g. Insu-Glass covered, Plain or Enamelled Instrument Wires, from stock.—Saxonia, Roan Works, Greenwich, S.E.10. 29

ONE oil-cooled, mining type Transformer, maker B.T.H., 600 kVA, input voltage 6,600 volts, 3-phase, 50 cycles, output 2,200 volts, 3-phase, 50 cycles.—Oldfield Engineering Company Ltd., 96 East Ordsall Lane, Salford, 5. 1036

ONE G.E.C. Generator, D.C., 200 kW, 500/520 volts, 250 r.p.m., compound wound, inter pole.—Fred Watkins, Coleford, Glos. Phone 3100. 857

PHONE 98 Staines. 250-kW Browett Steam Generating Set, 220 volts D.C.; 400-kW Belliss ditto, 440 volts D.C.; 75-h.p. National Twin Diesel; 50-kW Hindley Steam Generating Set, 440 volts D.C.—Harry H. Gardam & Co. Ltd., Staines. 60

PORTABLE Engine-driven Welding Sets, output 75/350 amps., brand new, Government licence to purchase, delivery stock.—Gladiator Welder Sets Ltd., 18, Leicester Road, Sale, Manchester. 915

PRESTCOLD Combination Refrigerator Cooker for sale. Cooker in excellent condition, refrigerator motor requires overhaul. Can be seen in London. What offers?—D. Edwards, 1, Sackville Lane, East Grinstead. 6532

QUANTITY of secondhand, 400-w., 230-250-v. Fluorescent Lamps for disposal. Guaranteed to give good service. Any found faulty will be replaced free of charge. —Box 6535, c/o The Electrical Review.

ROTARY Converters in stock, all sizes; enquiries invited.—Universal Electrical, 221, City Road, London, E.C.1. 16

SELF-Priming Electric Pumps, 300 g.p.h., £11 11s.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 53

STAFF Time Checking and Job Costing Time Recorders (all makes) for quick cash sale. Exceptional condition. Write—Box 528, Smiths, 100, Fleet Street, London, E.C.4. 31

SURPLUS Wood Blocks, 6½" × 3¼" × ½"; also 1-way and 2-way Flush Boxes. Quantities and prices from —Louis G. Ford Ltd., Eastbourne. 1029

TRANSFORMER Lead-in Wire, 7/38 and 14/38 s.w.g., Insu-Glass finished, various colours, stock.—Saxonia, Greenwich, S.E.10. 34

TRANSFORMERS, single and three-phase. All types up to 10 kVA.—Woden Transformer Co. (Phone, Bilston 41959), Moxley Road, Bilston, Staffs. 12

TWO Beresford Garvens 1" Submersible Motor-driven Pumps, about 400 g.p.h., 80/90' head, with A.C. Motors, 3/50/400 volts.—Thomas Mitchell & Sons Limited, Bolton. 953

2 Steam Turbo Sets, 20 kW, 120 v. D.C., with panel; Steam and Diesel Sets, A.C., D.C., 4 to 900 kW; Dynamo, 13 kW, 100/140 v., 725 r.p.m., shunt, single bearing, extended bed; 5-h.p. Diesel Engine.—E. Binns, 156a, Falsgrave Road, Scarborough. 6533

33-kVA, 400/3/50 Allen Alternator, Texrope drive; 48-h.p. Dorman Petrol Engine, on bases, with voltmeter, ammeter and C.O. switch.—Borough Engineer, Town Hall, Bolton. 1053

100-h.p., 400/3/50, 580-revs. S.R., E.C.C., 3 brgs., with switchgear.—Greenhalgh Bros., Burtons Field Mill, Atherton, nr. M/cr. 1048

105-kW, 250-volt, comp. wound, single-bearing Generator, £50.—Electric Machinery Co., Ancoats, Manchester. 1039

250-kVA Alternator, 400 volts, 3-phase, 50 cycles, 750 revs., with direct coupled exciter.—Midland Counties Electrical Engineering Co. Ltd., Grice Street, Spon Lane, West Bromwich. 36

ARTICLES WANTED

AFTER-War Exports. Metal Pressings, Brass Terminals, Kidney Plates, Contact Pins, wanted in huge quantities.—Box 1001, c/o The Electrical Review.

AUTOMATIC Coil Winder, with or without paper insertion attachment.—Box 6527, c/o The Electrical Review.

COIL Winding Machines wanted for essential work.—Box 979, c/o The Electrical Review.

ELECTRIC Motors from ¼ to 5 h.p., 460/230 volts D.C. —W. H. Sugden & Co. Ltd. Glenny Rd., Barking. 46

ENAMELLED Copper Wire wanted, please state quantity, make, gauge and price.—Box 977, c/o The Electrical Review.

ENGINEERING Technical Books (new or secondhand) wanted in any quantity. Attractive cash offers. Call —Third floor, 356, Oxford Street, W.1, or "Stoneleigh," St. George's Avenue, Weybridge. 62

LAMINATIONS, Scott, No. 203, wanted, state quantity and price.—Box 978, c/o The Electrical Review.

ONE 4 or 5-h.p., 420-volt D.C. Shunt or Compound Wound Motor, totally enclosed preferred, 1,400 r.p.m. or nearest, with or without control gear. Must be in perfect condition.—Young, Glenburn Works, Shrewsbury. 1056

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