ELECTRICAL REVIEW
FOUNDED 1872

Vol. CXXXVII. No. 3530 JULY 20, 1945 9d. WEEKLY

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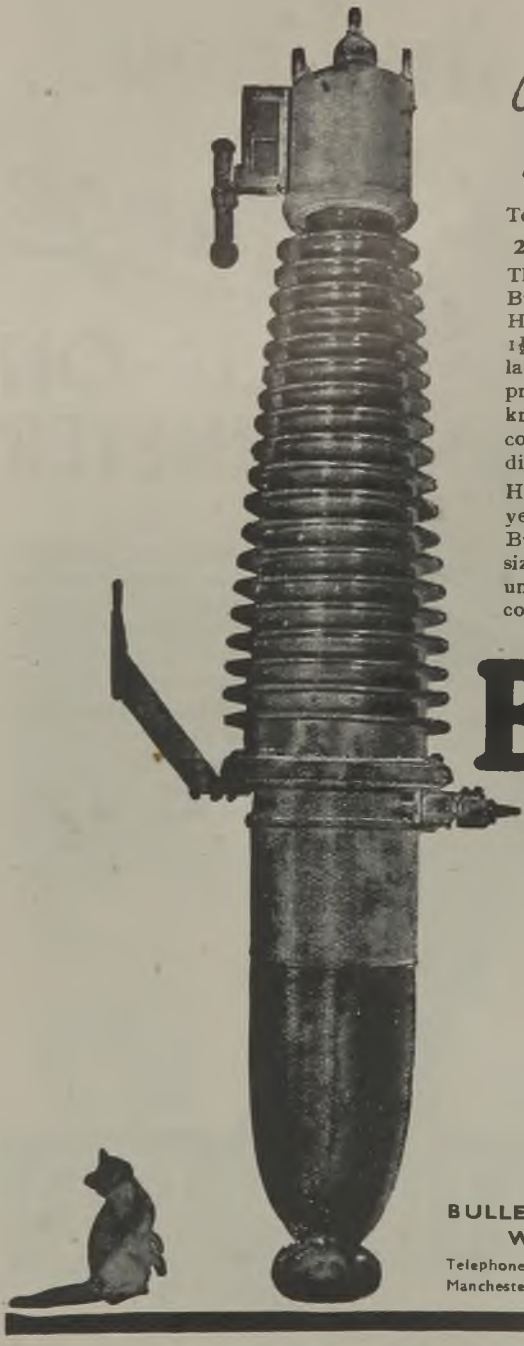

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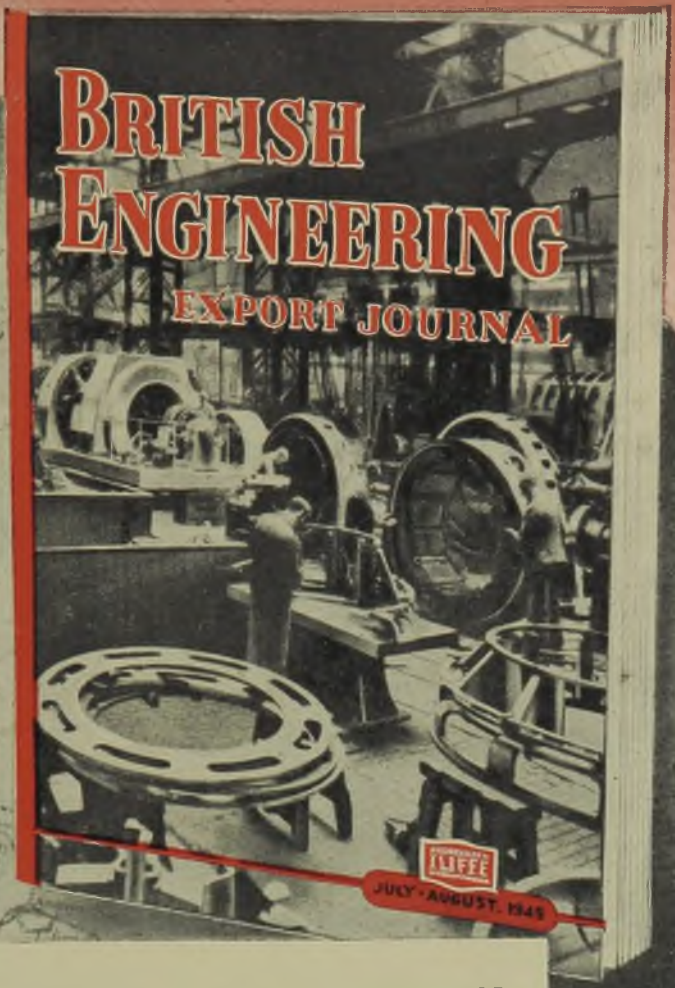

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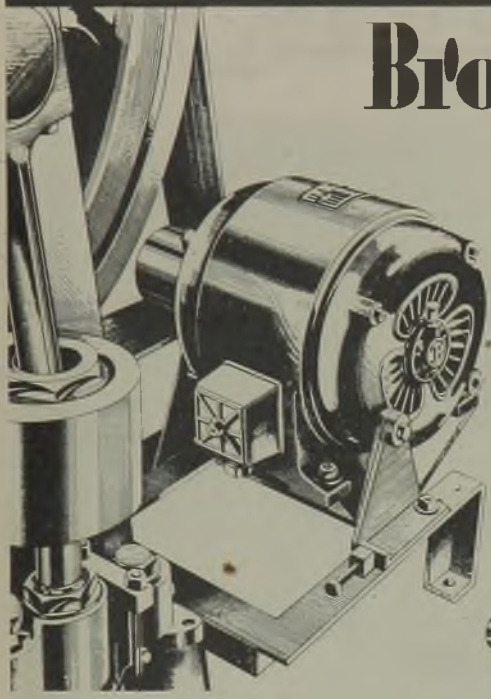

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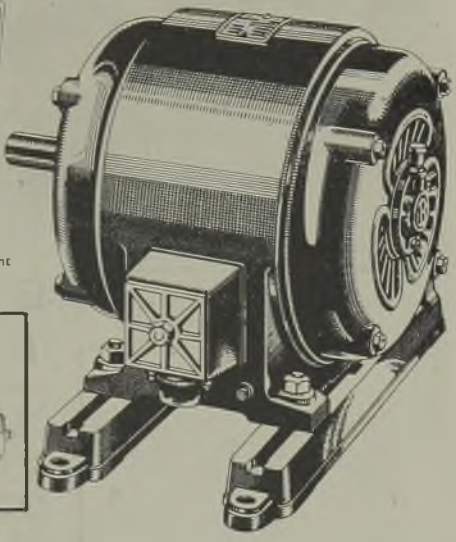

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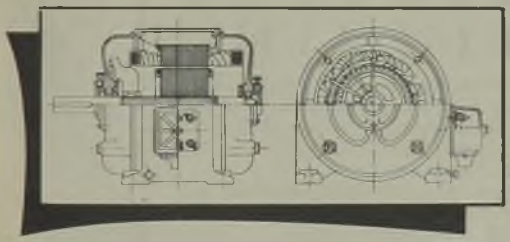

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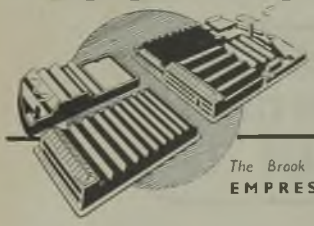

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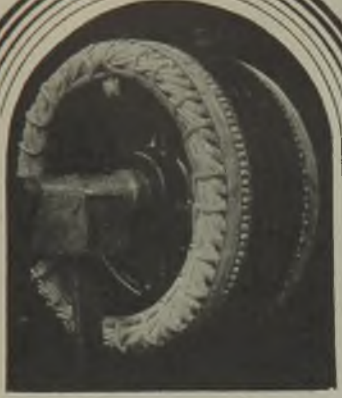

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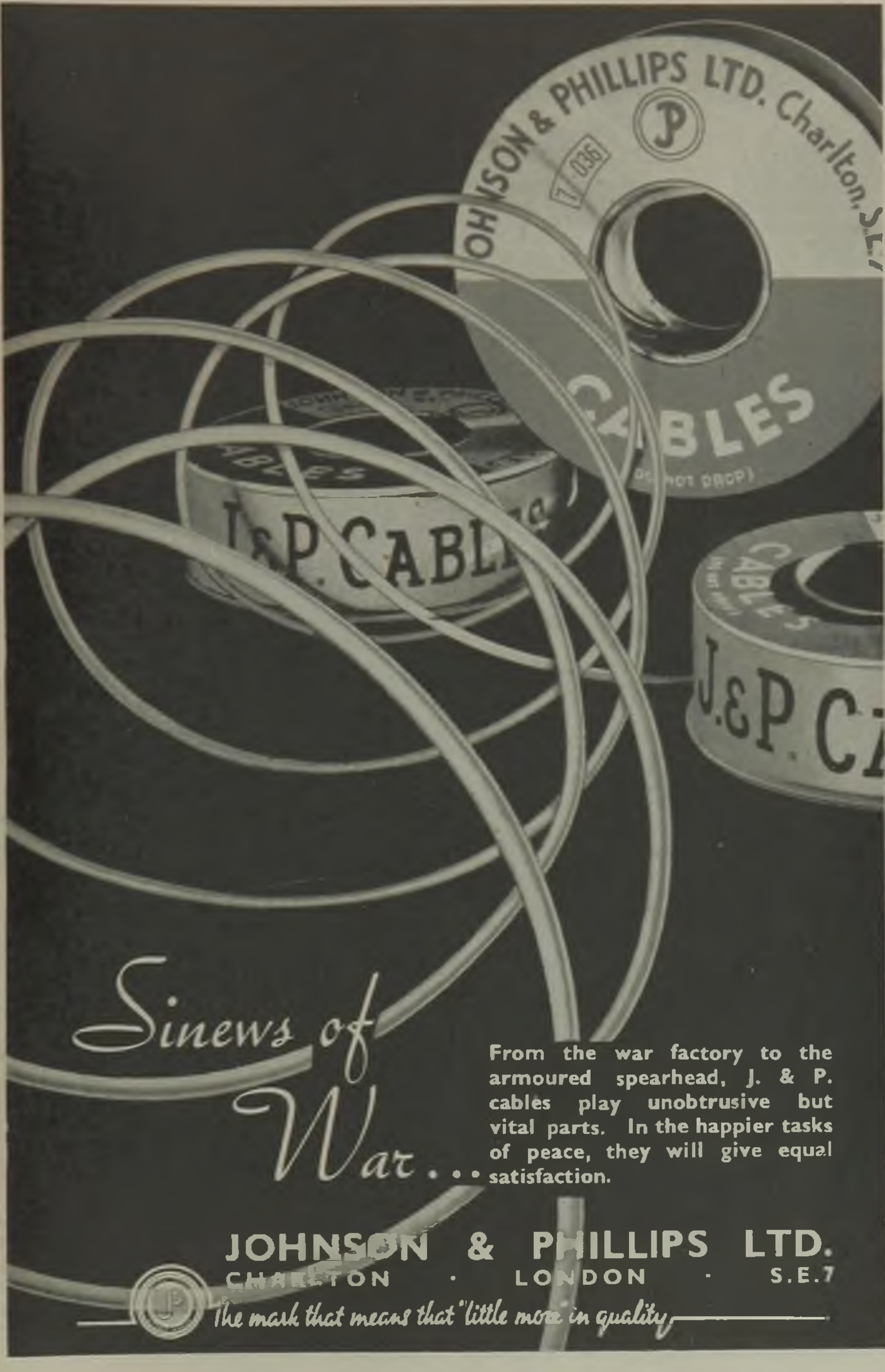
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ELECTRICAL REVIEW

July 20, 1945

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVII. No. 3530. JULY 20, 1945 9d. WEEKLY

Generation Questions

Thermal Efficiency and Coal Conditions

THREE or four years are normally required for the design, erection and commissioning of a new power station, and several more years may elapse before it reaches its intended full capacity. The impossibility of anticipating in the original plan and the difficulty of introducing at a later stage the results of experience and technical advances accruing during the intervening period were discussed by Mr. F. W. Lawton (now electrical engineer and manager of the Birmingham undertaking) in a paper he presented before the Institution of Electrical Engineers in March, 1939. His remarks principally concerned Hams Hall "A" station, but even in those days he had to report a rise of 50 per cent. in coal costs over the previous three years. That would be more than enough to upset the nicety of the balance between the value of high thermal efficiency and the cost of attaining it.

High Prices and Wide Variety

The same and other disturbing influences have been even more applicable to the "B" station, some preliminary particulars of which were given in the I.E.E. paper mentioned. Designs for this station, which is described in this issue, were laid down in 1938 on the basis of coal at 14s. per ton. With the last addition, the price is now presumably over 33s. per ton for bituminous coal of widely varying characteristics obtained from about seventy different colleries—a factor which, in conjunction with the possession of a large area for ash disposal, decided the employment of pulverised-fuel firing. The ability to achieve low generating costs with fuel of appreciably lower than average calorific value is in itself a merit that deserves more than the negative reward it received in flat-rate increases in the price per ton irrespective of heat content.

An advantage of planning a station in two sections is that it facilitates the adoption of more elevated steam conditions for the second half, if economically desirable. A change might be expected in the present instance, in view of higher fuel costs, had not reason for pause been given by the increase in capital expenditure this would entail. To raise steam conditions from 670 lb. per sq. in. and 845 deg. F. to, say, 1,200 lb. and 950 deg. would add about 26 per cent. to the first cost of the boiler plant, though only 9 per cent. in the case of turbines.

Waiting Upon Results

In this connection Mr. Lawton holds that sufficient operating data to warrant a departure from the present steam cycle will not be available until the pioneer high-pressure plants in this country have been in operation for at least two years. At the electrical end, technical progress appears to have been achieved at less cost. Instead of continuing with 33-kV transmission to the city area, 132 kV is to be employed for the second half of the station, with switching at that voltage by means of 2,500-MVA circuit-breakers.

Simplicity of plant layout, which is reflected in the pleasing contour of the main building, is no doubt responsible for the relatively small staff required which,

for the completed station, is expected not to exceed one man per 1,000 kW—rather less than half the average number. Results achieved to date, despite exigencies of wartime construction and operation, which would have given this cooling-tower station third place in the Electricity Commissioners' last thermal-efficiency tables (1938), are evidence of remarkable foresight in the initial design.

Darkness Dispelled

THE " loss " of an hour last Sunday was accentuated by black cloud in many places so that the resumption of full public lighting, permitted from that day, took place in appropriate circumstances. Most of the authorities did their best to restore their lighting to the fullest possible measure though some were handicapped by lack of equipment and others (relying mainly on gas) were prevented by lack of attendants from taking advantage of the occasion. A " high light " of this " Feast of Lanterns " was the inauguration of a system of fluorescent lighting on a five-mile stretch of the Uxbridge Road through Ealing.

Releases from the R.A.F.

AN R.A.F. officer (M.I.E.E.) complained in our issue of June 29th that officers in the Technical Branch of the Service had little hope of an early return to civil life, to the detriment of their careers. An announcement made last week appears to throw a better light on the situation. This gave details of proposed releases during August and September and it included Groups 3 to 15 for electrical engineers in the Technical Branch and Groups 6 to 15 for those in the Administrative and Special Duties Branch. It is hoped that this ruling will enable our correspondent and others in his position to resume their civil posts within a very short time.

Labour Shortage

REVERSION to normal production, particularly of domestic appliances, is being seriously retarded by lack of suitable labour, but now men and women who were taken from this work and sent to war munitions factories should be able to return. The Ministry of Labour has instituted a system by which employers in certain important groups can apply for their former employees, and if the latter are willing to return, special efforts will be made by the Ministry to see that they do so. It can well be imagined that if these employees have been receiving abnormally high wages they will not be anxious to relinquish them, but it is to be hoped that they will realise that their present employment cannot last for ever and that they will do their best to get back to their normal work. Electrical appliance makers should take immediate steps to " nominate " their former employees and the same considerations apply to the electricity supply industry.

Coil Winding and Q.C.

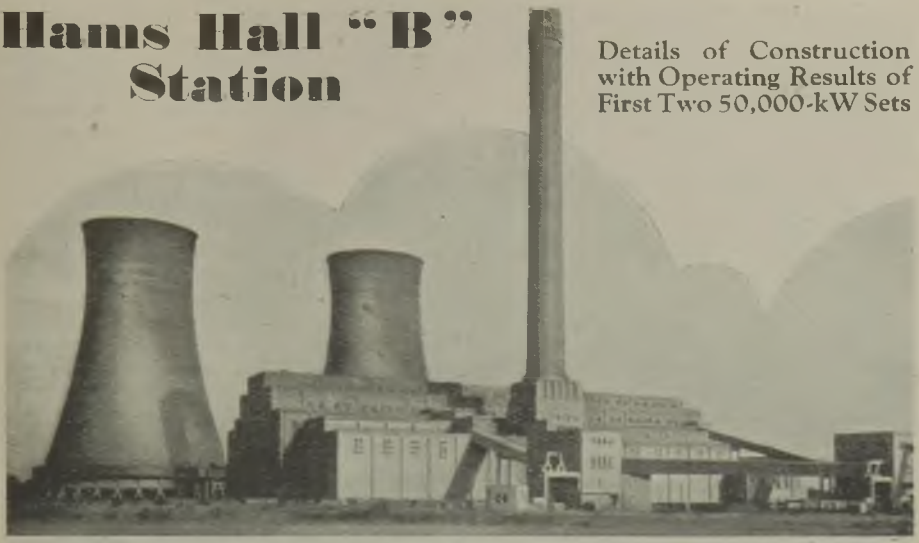
THE first application of quality control to coil winding, as far as we are aware, was recently made by an electrical concern in South-West England. According to the *Production and Engineering Bulletin* (Vol. 4, No. 29), which describes the particular method adopted, the result has been an appreciable reduction in the number of final rejects with consequent saving in labour and material. Hitherto unsuspected causes of trouble have been brought to light and the performances of different operators and different machines can be readily compared. At regular intervals five coils are taken from each winder and the resistance of each is measured. The average and range of the five readings are then plotted on the appropriate sections of the chart. The scope for quality control in this field should be very large.

Cable Testing

WHILE spark testing of cable dielectrics is probably almost as old as the water-immersion test, the necessary precision equipment has become available only in recent years, as Mr. J. H. Savage pointed out in his I.E.E. paper last May. It was mentioned only as an alternative to immersion in Government Departmental Electrical Specification No. 1 (War Emergency Edition, 1945) relating to rubber-covered cables for from 250 to 660 V to earth. In an addendum covering p.v.c. cables the opportunity is taken to recommend strongly the adoption of the spark test instead of the high-voltage and insulation-resistance test in order to save water-immersion and subsequent drying of the core. The spark test is, however, not applicable to larger cables, but in view of its advantages an extension of the present range is to be expected.

Hams Hall "B" Station

Details of Construction with Operating Results of First Two 50,000-kW Sets



The newest generating station in the Central England area, designed for an ultimate capacity of 300,000 kW, has already shown itself to be among the most thermally efficient in the country

PARTICULARS have now been released of the second cooling-tower generating station to be constructed by Birmingham Corporation on the Hams Hall site. The first 50,000-kW set of the six ultimately envisaged was put on load in April, 1942, and the second about fourteen months later. A third set now under construction will complete the first half of the station. The turbines are the Parsons two-cylinder tandem reaction type driving at 1,500 RPM 50,000-kW 33-kV main alternators and 3,500-kW 3·3-kV auxiliary alternators. Steam conditions at the turbine stop valve are 650 lb. per sq. in. and 825 deg. F. Four stages of feed heating are employed giving a final feed temperature of 340 deg. F. with an exhaust vacuum of 28·5 in. Hg., which has been found to be the most economical when cooling towers are used and the atmosphere is at 60 deg. F. and 80 per cent. humidity. Each two-pass condenser requires 40,000 gal. of cooling water per min. at 75 deg. F., which is circulated by 50 per cent. duty pumps (three for each unit) and has three steam-jet air ejectors of similar proportionate ratings.

The two ferro-concrete cooling towers are individually rated at 5 million gal. per hr.—enough to serve 75,000 kW—and are 310 ft. high and 209 ft. in diameter at the base. One effect of maximum regenerative feed heating is an appreciable reduction in the size of cooling-tower equipment required. Make-up water is pumped from the River Thames.

With each turbo-alternator are associated two tri-drum 320,000 lb. per hr. boilers generating steam at 670 lb. per sq. in. and 845 deg. F. The boiler plant was manufactured by International Combustion, Ltd., which was also responsible for the coal-handling plant.

Combustion chambers are water-cooled with fin side tubes and plain-tube screens. Automatic superheater control, steaming and non-steaming economisers and plate-type air heaters with air recirculation are other characteristics. The soot blowers are manually operated and water lancing is applied in the superheater zone and on the water-screen tubes. Pulverised fuel is used and there are three (10-ton per hr.) mills per boiler, the output from each being withdrawn by an exhauster fan and supplied to two burners. Two forced-draught and two induced-draught fans per boiler are driven by variable-speed motors of Laurence, Scott and Electromotors make.

Two 600,000 lb. per hr. Mather and Platt feed pumps, one steam and one electric are installed. All boilers are operated from

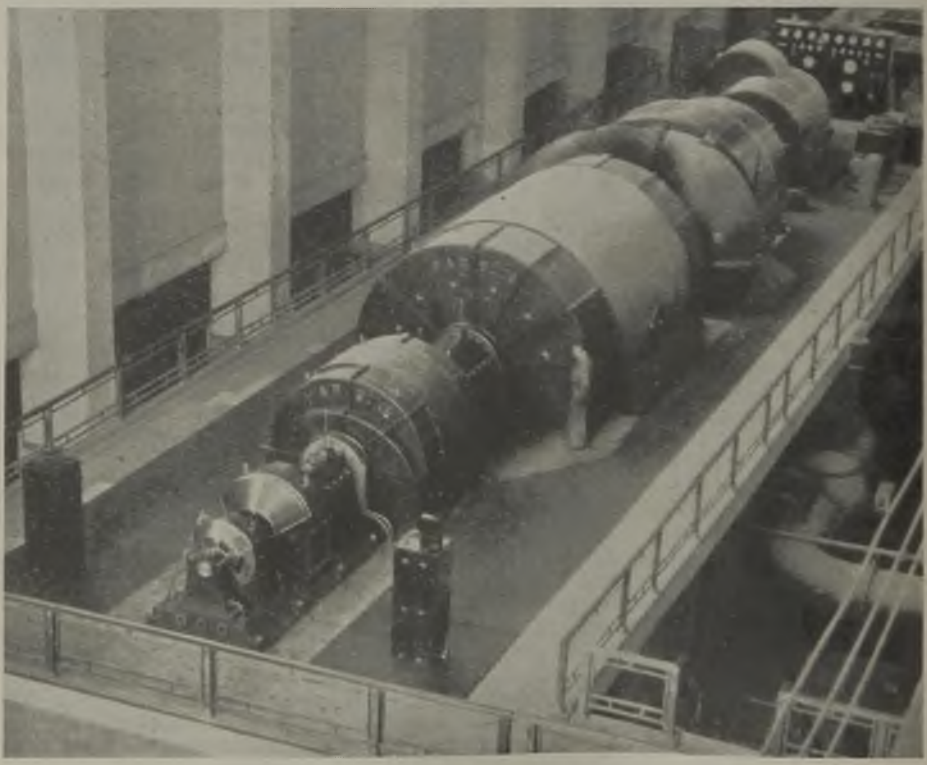
the firing floor, which is open to the turbine floor, and at this level all important motors are installed that are not in the basement.

Practically all coal is rail-borne, a maximum of 8,000 tons per day being dealt with by gyratory sidings and by three sets of duplicate inclined belt conveyors, each unit having a duty rating of 120 tons per hr. Distribution over the coal pile is by means of a travelling transportation bridge with cross-traversing telpher, which has a reclaiming capacity of 120 tons per hr. The Mitchell Engineering Co. was responsible for this plant.

Heavy ash passes from the hoppers below the boilers into a gravity water trough, sluiced by purge water from the cooling towers. Fine dust is caught by a Lodge-Cottrell 60-kV (rectified-DC) electrostatic plant and discharged by conveyors into the sluice. The water-ash is conveyed to a swirl pit from which it is elevated 65 ft. by means of pumps with rubber-lined impellers to a trough along which it flows by gravity to a 300-acre tip, 800 yd. away. Escape of dust into the boiler house is minimised by operation of the precipitation plant under negative pressure, the induced-draught fans being in its outlet. Flue gases are discharged into a lined steel duct and thence conveyed to the 400-ft. brick stack.

Works motors of 100 HP and over are wound for 3·3 kV generally supplied direct from the auxiliary alternators with stand-by from works transformers, one of which is associated with each main alternator. Smaller motors are operated at 400 V.

The main 33-kV 1,500-MVA Reyrolle switchgear of the small-oil-volume metal-clad type, which uses freon as an insulating medium, is installed in three separate houses, one for each generating set. The busbars form a ring to which seven feeders are also connected. Isolators are interposed in the busbar between each circuit breaker. The switchgear is normally operated from the control room but a duplicate control board



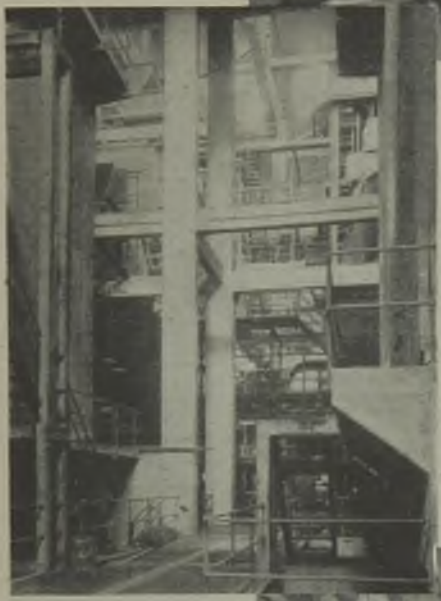
One of the 50,000-kW turbo-a ternators

is in each switch-house for emergency use. The circular control room, which is remote from the main building, contains a diagram board and the usual electrical control features, in addition to which shadowgraph instruments indicate boiler loads and steam and vacuum conditions.

In the design of the buildings Civil Defence requirements of the Electricity Commissioners had to be kept in mind and the brick walls were made 14-in. thick with no external windows below the level of the plant. Nevertheless, the natural lighting is satisfactory. A system of ultra-violet lamps in fluorescent reflectors, giving an average intensity of illumination of 0·02 ft.-candle and a maximum of 0·04 ft.-candle made it unnecessary to black out the windows. Foundations and superstructures are of ferro-concrete and all plant is supported from the ground independently of the main structure.

Boiler-house control equipment

The station is run by 19 engineers and 135 manual workers. Its capital cost for the first half comes out at £30 per kW. Transmission lines to the city will bring the total figure to approximately £5·45 million. It is estimated that with 300,000 kW installed the cost of the station will reach £10·5 million plus £1·5 million for transmission.



Above : Side elevation of 320,000 lb. per hr. pulverised-fuel boiler
Right : Basement of boiler house showing ash hoppers

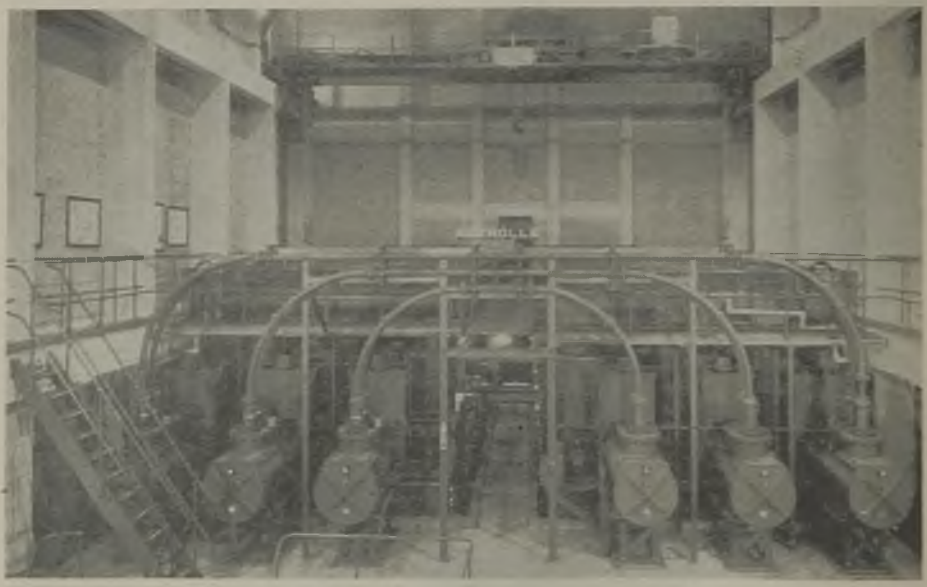
Last year, the first complete twelve months of operation of the two 50,000-kW sets, about 685 million kWh was generated at Hams Hall "B." Deducting 7·45 per cent. as works consumption, this left 634 million kWh sent out with a maximum demand of 103,100 kW. A consumption of some 384,000 tons of coal having a calorific value of 9,439 BThU per lb. gave an overall thermal efficiency of 26·7 per cent.

Other technical particulars (average values) are as follows:—Pressure (abs.) at turbine exhaust, 0·72 lb. per sq. in.; cooling water inlet, 65·6 deg. F., outlet, 77·3 deg. F.; outlet flue gas, 278 deg. F.; feed-water to economiser, 345 deg. F.; CO_2 in outlet flue gas, 13·5 per cent.; feed-water make-up 3·3 per cent. of 6,404 million lb. evaporated.

Works costs, per kWh sent out, during the same period were:—Coal, at 30s. 1·5d. per ton, 0·2188d.; coal and ash handling, 0·0099d.; oil, water and stores, 0·0016d.; salaries and wages, 0·0090d.; repairs and maintenance, 0·0102d.; total, 0·2495d. Operation of the p.f. plant cost 9·70d. per ton, made up of 1·00d. in wages, 3·86d. in repairs and maintenance and 4·84d. for power (26 kWh per ton).

As the station was run on base load the availability of the plant (expressed as a percentage of the total hours of its operation) was not restricted by external circumstances. For the boilers, excluding the survey period, the figure varied from 82·8 to 89·5 per cent. For both turbo-alternators the percentage was 89·5 per cent., but failure to achieve 100 per cent. was not owing to defects in the machines themselves.

Our thanks are due to Mr. F. W. Lawton, chief engineer and manager, City of Birmingham Electric Supply Department, for supplying the particulars on which this account is based. The principal contractors, other than those already mentioned include the following:—Main buildings, Sir Robert McAlpine & Sons; chimney stack, P. C. Richardson (Middlesbrough), Ltd.; main and auxiliary cables, Callender's Cable & Construction Co., Ltd.; low-voltage wiring, Pyrotenax, Ltd.; telephones, Standard Telephones & Cables, Ltd., Clifford and Snell, Ltd.; auxiliary motors, British Thomson-Houston Co., Ltd.; axuliaries switchgear, George Ellison, Ltd.; miscellaneous electrical supplies, General Electric Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., W. Lucy & Co., Ltd.; battery, Tudor Accumulator Co., Ltd.; cranes, Vaughan Crane Co., Ltd., Herbert Morris, Sir William Arrol & Co., Ltd.; pumps, Gwynnes Pumps, Ltd., Tangyes, Ltd., Adams Hydraulic, Ltd.; flue-gas ducting, Simon Carves, Ltd.; fire-protection



Main 33-kV switchgear

equipment, Atlas Sprinkler Co.; water screens F. W. Brackett & Co., Ltd.; air compressor and pipework, Worthington Simpson, Ltd.; steam and feed piping, Stewarts & Lloyds, Ltd.; water piping, Brightside Foundry & Engineering Co., Ltd., Whittaker Ellis, A. E. Shaw, Ltd., E. E. Jeavons & Co., Ltd.

Main control room

Birmingham Report

Basic Tariffs Maintained

IN a report on the accounts of the Birmingham Electric Supply Department (engineer, Mr. F. W. Lawton) the Committee records that out of a total of 7,143 million kWh supplied in the six years from April 1st, 1939, 4,983 million kWh went to war factories. The annual sales rose from 815 million kWh in 1938-39 to 1,353 million in 1943-44, and fell to 1,262 million in the past year. The maximum supply demanded has increased from 325,500 kW in 1938-39 to 457,500 kW in 1944-45, and the number of consumers from 283,479 to 307,318. The Department has operated under very great difficulties, but the Committee feels that these have been surmounted in an admirable manner.

In spite of higher coal costs, the increased efficiency of Hams Hall "B" station and the extensive hours during which a considerable supply has been taken have made it possible to avoid any increase in basic tariffs; certain of the larger consumers are affected by a coal clause.

Considerable and widespread damage was caused to the main transmission and distribution cable system and substations during 1940-41. Nechells generating station sustained major damage, but the two power stations at Hams Hall escaped with a small amount of damage notwithstanding their isolated position which provided a prominent target area of some 500 acres. Claims amounting to £225,750 have been submitted to the Electricity Commissioners in respect of war damage to the Department's property. The cost of protective work for the Department's plant and other air raid precautionary measures amounted to £110,000, towards which Government grants totalling £40,500 are receivable.

Revenue for the past year was £4,703,820 (against £4,674,141 in 1943-44), and the trading expenditure amounted to £3,803,279 (£3,810,019), which included £60,000 for any contribution which may be required under the special War Damage Act for public utility undertakings which it is understood will be promoted. The balance carried forward to net revenue account is £900,541 and miscellaneous credits have increased this to £950,863. After meeting capital charges, income tax, etc. (including a special payment of £100,974 to accelerate the redemption of loans in respect of Nechells Princes generating station), the surplus on the year's working is £33,130 (£42,047). To this is added £497,482 brought forward from 1943-44. After meeting certain items of a quasi-capital nature amounting to £32,899, a balance of £497,713 is carried forward. When circumstances are opportune, the work of changing over from DC to AC is being continued and during the year the sum of £1,431 was spent in this connection.

Additional loan capital raised during the year, mainly to finance extensions at Hams Hall, together with associated transmission lines, amounted to £710,922, the sum actually spent being £741,083. The total capital raised to date for the purposes of the undertaking amounts to £23,768,912, of which £10,659,685 has been redeemed. An additional £938,409 has been provided for redemption, making £11,598,094.

Electric Motor Maintenance

A Variety of Faults and their Remedies

By "Rotor"

A CASE of electrical unbalance of a rotor recently brought to my notice concerns a 120-HP 440-V three-phase slip-ring motor. Two years ago this machine began to knock and some cotton fluff in the machine smouldered, so that the starter was tripped out by hand. It was then found that one portion of the rotor had evidently rubbed on the stator, as the slot wedges and slot insulation in one section of the rotor and in about two-thirds of the periphery of the stator were so badly charred that they broke up and fell out, whilst several laminations of the cores near the teeth had turned blue through overheating.

Insulation resistance tests gave satisfactory results for both the stator and rotor and, as the motor was over twenty-five years old, it was decided not to run the risk of damaging the coils by renewing the slot wedges, but to continue to run the machine as long as possible without them. There was a certain amount of wear in the white metal bearing at the driving end and it was thought that this had allowed the rotor to pull over, so a new bearing was fitted. When the motor was returned to work, however, it was noted that the ammeter occasionally indicated a very high stator current so that further tests became necessary.

Deflected Rotor Shafts

It was then seen that one of the sliding slip-ring short-circuiting-contacts was rather burnt and distorted and the corresponding contact was also burnt, due to wear of the operating sleeve of the brush-lifting and slip-ring short circuiting gear. Apparently this contact had failed to make a proper connection at times, with the result that the resistance of the three phases of the rotor circuit became unequal, the consequent unbalanced rotor currents and magnetic pull causing the shaft to be deflected so that the rotor rubbed on the stator. The defective parts of the brush-lifting and short-circuiting gear were renewed and the machine has since run without further trouble. This failure could have been avoided by careful maintenance.

A second case concerns a 20-HP 500-V 720-RPM three-phase slip-ring motor. The overload trips, set at 42 A and provided with time lags, caused the starter to trip. The motor was dismantled and it was seen that the rotor had rubbed on the stator, causing slight damage to the core plates and the insulation of the rotor conductors. Also one of the soldered joints in the rotor conductors had thrown its solder and become open-circuited. There was about 0·010 in. wear in the driving end sleeve bearing and it was at first thought that this had allowed the rotor to rub and that the resulting excess current had melted the soldered connection. However, the records of the air-gap clearance between the rotor and stator showed that the minimum clearance had previously been 0·025 in. It was therefore evident that the faulty joint had been the cause and not the effect of the failure, this producing unbalanced magnetic pull and deflection of the rotor shaft. The cause was probably a faulty joint in the first place, although the motor had run for more than ten years without trouble.

Foreign Matter in Air Gaps

In another breakdown, a 12½-HP 440-V 1,460-RPM screen-protected squirrel-cage motor, which was supplied by the makers of the lathe that it drove, after eighteen months' service would not start when switched on; the pulley could not be turned even when the driving belt had been removed. The design of the motor did not allow of checking the air-gap clearance between the rotor and stator with feeler gauges. When dismantled the motor was found to be rather dirty and, although the ball bearings were in order, the rotor was polished and appeared to have been rubbing on the stator core for a width of about 2 in. at each end. The motor was cooled by air drawn through the ends of the machine and discharged through the centre of the periphery. It was decided that dirt drawn in with the air had accumulated in the air gap and caused the rotor to rub on this dirt and finally to jam; possibly the air gap was uneven round the stator bore and the dirt had been forced into the narrowest portion. This has been confirmed by several months of satisfactory running after thorough cleaning and re-assembly. As the stator and rotor cores cannot be cleared of such a deposit without dismantling, a totally

enclosed motor should have been used. Four holes were drilled in the motor end-shield at equal points opposite the air gap to permit of feelers being inserted to measure the air gap clearance from time to time.

In a further somewhat similar instance a ½-HP 230-V 1,425-RPM single-phase repulsion-start induction motor driving a fan was rewound but after it had run for a few hours, the fuses melted and the motor jammed. Considerable force was required to remove the rotor and the cause was then seen to be varnish which had trickled into the air gap. Apparently the motor had not been properly baked out after impregnation. It should be mentioned that the motor was mounted on a drying chamber under a glass roof and received the full effect of the sun's rays on hot days.

Faulty Drives

An example of trouble owing to faulty drives was experienced when, out of a batch of thirty 10-HP 400-V 1,425-RPM three-phase squirrel-cage induction motors driving lathes through vertical belts and fast-and-loose pulleys, two rotor shafts broke off at the driving-end ball bearing within twelve months. This type of drive requires a high belt tension in order to maintain frictional grip. In addition to this disadvantage, however, the motors were mounted on overhead girders in such a way that the belt was on the portion of the motor pulley farthest from the bearing when it was on the fast driving pulley and *vice versa*. As a result the overhung shaft was subject to maximum bending moment at the same time as it was exerting maximum twisting torque. As the motors or pulleys could not conveniently be reversed a tension pulley was fitted on each drive to increase the arc of belt contact with the comparatively small motor pulleys.

In a textile factory several ½-HP 400-V 1,400-RPM ball-bearing squirrel-cage motors were fitted on the floor to drive finishing machines. The shaft of one motor broke off on the inner side of the driving-end bearing, and a number of bearing failures occurred on other motors in a short period. The horizontal driving belts were rather heavy for such a low-powered drive and were fitted with solid metal belt fasteners. The belts were not flexible enough for the 4-in. diameter motor pulleys so that belt tension was excessive. After fitting thinner belts with lighter and more flexible fasteners there was no further trouble.

The air-gap clearance between the rotor and stator of a 100-HP 400-V 585-RPM slip-ring induction motor was found to vary appreciably from time to time. Upon dismantling the motor it was revealed that the shaft was slightly bent and that the rotor had rubbed slightly on the stator, although without causing damage. The shaft was stretched in a lathe and the air gap increased by 0·008 in. by taking a light skim off the stator and rotor cores. The motor drove a mill through worn gearing, which had probably caused undue stress on the rotor and was therefore renewed.

Defective Windings and Bearings

An example of failure through defective windings is provided by a 50-HP 400-V 580-RPM slip-ring motor, which was bought second-hand and was little used for a few years. When put into continuous operation trouble quickly developed due to rapid wear of the brushes and burning of the slip-rings. The sleeve bearings were slightly worn and there was a certain amount of vibration; also there was about 15 per cent. variation of stator current in each phase. The resistances of the stator and rotor windings were tested and found to be equal on each phase. By feeding the windings with low voltage DC and using a compass needle it was revealed that one of the stator coils was reversed. After correct connection the motor ran satisfactorily. The faulty connections must have been made at the time of some previous repair many years before.

Fifteen 20-HP 400-V 720-RPM squirrel-cage motors were installed to drive line shafts through gearing. After about eight years the machines got very noisy. It was found that the internal cooling fans on three motors were fractured and there was evidence of hammering of some of the ball bearings in their housings. It would appear that the bearings had not been a good fit in the housings when the motors left the maker's works and, as gear drives sometimes impose fairly high stresses, new end-shields and bearings were fitted.

A 30-HP motor was required in a hurry to drive a countershaft. As one was not available it was decided to use a 20-HP and a 10-HP motor, both squirrel-cage 400-V 720-RPM machines, in parallel to drive the shaft through belts. Results were satisfactory for many months until it was noticed that the smaller motor was very hot. Current tests revealed that the latter was taking

about half the total load, owing to stretching of the belt on the larger motor. This type of drive, though not ideal, is a useful expedient provided both motors are independently protected against overload and that the drive is kept under observation. The motors were controlled by a single large starter, which did not provide discriminating protection for the smaller motor, so separate starters were fitted.

A 10-HP 400-V 1,440-RPM three-phase squirrel-cage motor driving woodworking machines tripped out frequently. The motor was directly coupled to a countershaft and was very stiff to turn, even after removal of the belts. A spirit level disclosed that the countershaft was not level, owing to subsidence of the foundations on which the bearings of the shaft were mounted. This had caused a considerable stress on the motor shaft and overloading.

The air gap of an overhung exciter for a 250-kW 250-V 500-RPM DC generator was found to vary appreciably over a period of about nine months, until the clearance on the bottom side of the armature was only about one-eighth of that on the top side. Investigation revealed this to be the result of wear of the outer ball bearing of the generator, and this was renewed in time to prevent the armature fouling the field poles. This case indicates one of the benefits resulting from measuring the air gaps of machines from time to time.

A 12-HP 400-V 720-RPM three-phase squirrel-cage motor driving a conveyor belt through gearing tripped out frequently one morning and finally the motor refused to run. It was found that the motor shaft had broken off inside the driving-end roller bearing. The motor was not rigidly mounted, and there was considerable backlash in the gearing due to the motor pinion being worn; apparently the shock of frequent stopping and starting had set up fatigue of the shaft. A new motor pinion was fitted with the new shaft and the motor properly mounted, after this attention no further trouble was experienced.

From time to time the ball bearings of motors in hot and dirty positions have failed, frequently due to the breaking up of the retaining cages of the balls. Apparently the grease becomes disintegrated, dirt enters the bearings and extreme friction develops. In such positions it appears very desirable that the old grease should be washed out periodically and the bearings repacked about three-quarters full with new grease having a high melting temperature.

Exhibition at Chester

SIX electricity supply authorities (Chester, Mersey Power Co., Ltd., Mid-Cheshire Electric Supply Co., Ltd., Electricity Distribution of North Wales, Ltd., Oswestry and Mold) are this week sponsoring an " Electricity Looks Forward " exhibition in the Chester Town Hall. This exhibition recently had a three weeks' première at Manchester where it attracted 34,000 visitors. All the main exhibits including the series of model kitchens have been transferred to Chester, together with a number of additional electrical appliances.

Some of the heavy electric baking equipment seen at Manchester have been omitted but, in view of the valuable pioneering work done in farm electrification by Mr. S. E. Britton, the Chester electrical engineer, the section devoted to farm equipment has been considerably strengthened. Equipment collected from farms in the Chester rural area includes incubators, water-heating systems, steam raisers (in actual use), pumps, drilling and workshop plant, compressors and sterilising chests.

Among canteen equipment is a cafeteria set lent by " Quaintways," one of the best equipped all-electric restaurants in the country. New equipment includes a set of three convectors made by Rowe Bros. & Co., Ltd., who also show for the first time three heating or drying cabinets. Rouses show one of their newest fish frying ranges. Other exhibitors not at Manchester are E.C.D., Ltd., E.L.M.A., the Imperial Machine Co., Ltd., Jackson Boilers, Ltd., the Peerless Electrical Manufacturing Co., Ltd., Perrin Hughes & Co., Ltd., Vent-Axia, Ltd., and the Victor Manufacturing Co., Ltd.

The Deputy Mayor of Chester (Councillor K. Clarke) who presided at the opening of the exhibition said that the first temporary houses to be provided in Chester would be electrically equipped. There were now 960 farms taking electricity and last year they consumed 4,658,000 kWh for which they paid £22,500. The Corporation's supply area was one of the most intensively developed electrically in the whole of Great Britain. The municipal electricity showroom was visited by 100,000 people per annum.

Mr. V. W. Dale, general manager of E.D.A., speaking of the future of the electrical industry, referred to the possible saving of coal through main-line railway electrification.

Fostering Industrial Research

The Federation of British Industries is to hold a two-day conference in London in the late autumn or early spring on the subject of " Industry and Research." Special emphasis will be laid on the practical means by which research can assist industry and promote industrial efficiency, exports, full employment and a higher standard of living.

PERSONAL and SOCIAL

News of Men and Women of the Industry

BELFAST Electricity Committee has agreed to a suggestion by the Ministry of Commerce that **Sir Leonard Pearce**, engineer-in-chief of the London Power Co., Ltd., shall be appointed arbitrator on the question whether certain plant shall be installed at the Harbour power station or at Ballylumford.

Mr. Alfred J. Ryan is retiring from the position of borough electrical engineer and manager at Hastings, which he has held since 1927. Mr. Ryan was born in Chatham and received his technical training in that town, passing in 1895 to the Royal Dockyard there. Two years later he joined the Chatham, Rochester & District E.L. & P. Co. (predecessor of the Kent Electric Power Co.) and served as shift engineer until 1901 when he went as assistant engineer to Wimbledon Electricity Department. In 1903 he was appointed station superintendent to the Gillingham municipal undertaking and subsequently became chief assistant engineer. He went to Hastings in 1913 as deputy borough electrical engineer, becoming chief fourteen years afterwards. Mr. Ryan is a member of the I.E.E. and an associate member of the Institution of Mechanical Engineers; he has served the industry in a number of capacities including chairmanship of the E.D.A. Southern Area Committee and Electric Refrigeration Committee and membership of the B.S.I. Committee on Domestic Electric Refrigeration. He is honorary consulting electrical engineer to two hospitals.

Mr. A. J. Ryan

Mr. Ryan's successor is **Mr. James Savage** who has been his deputy for some time. The appointment, which carries a salary of £1,071, is for one year, in the first place.

Dr. B. J. A. Bard, B.Sc., D.I.C., Barrister-at-Law, who has been appointed secretary of the Federation of British Industries Industrial Research Committee and head of the F.B.I. Research Secretariat, the duties and functions of which include the encouragement of industrial and national interest in research, maintaining contact with all industrial research organisations, and providing a service whereby advice, assistance and information can be obtained and contacts made. One of the first tasks of the Secretariat will be to organise and conduct a survey of existing research facilities in Britain. Dr. Bard began his professional life conducting fuel research, under the late Professor W. A. Bone, F.R.S., in the Chemical Technical Department of the Imperial College of Science and Technology. After practising at the Bar until the outbreak of war, he worked first with the Coal Commission and, later, on various industrial production and research problems at the Ministries of Supply and Aircraft Production.

To re-establish the Federation of British Industries' contacts overseas, its foreign director, **Mr. C. F. I. Ramsden**, has visited France and Belgium and will shortly go to Norway, Sweden, Denmark and Holland, and, later, to Italy, Switzerland and Spain.

Mr. R. N. Pegg, M.I.E.E., A.M.Inst.C.E., has resigned his appointment as chief engineer to the Charing Cross and City District of the Central London Electricity, Ltd., and taken up an appointment in the Export Department of the English Electric Co., Ltd., at Queen's House, Kingsway.

We reported in our issue of July 6th the retirement of **Mr. J. A. Hunn** from the position of director in charge of marine sales to Laurence, Scott & Electromotors, Ltd. The company has now sent us a portrait of Mr. Hunn which is reproduced herewith. As was stated in our earlier note Mr. Hunn will continue to be closely associated with Laurence, Scott. He is succeeded by **Mr. R. Clarke.**

Mr. J. A. Hunn

Mr. A. J. King, M.Sc. Tech., M.I.E.E., of the Research Department of Metropolitan - Vickers Electrical Co., Ltd., Trafford Park, has had the degree of Doctor of Science conferred upon him by Manchester University. Dr. King has written a number of papers on noise and vibration and has served on several B.S.I. and E.R.A. committees concerned with radio interference, noise measurement and lightning surges. He has been in the Metrovick Research Department for the past twenty years.

Mr. Albert Kent has, due to ill-health, retired from the board of Kent Brothers Electric Wire Co. & E. H. Phillips, Ltd. He has been associated with the company since its inception.

Oldham Town Council last week approved a recommendation fixing the salary of **Mr. E. Binns**, the chief electrical engineer and manager, at £1,500, rising by annual increments of £100 to the maximum in accordance with the scale based on unit assessment. One councillor criticised this. He said the business of paying men on units sold

was bringing the position down to a piece-work basis and was degrading to officials of high standing.

When a recommendation that **Mr. J. A. Ogden** should be appointed deputy borough electrical engineer was considered by the Oldham Council it was suggested that the position should have been advertised so that Service men and some in other positions could have the chance of applying. The chairman of the Electricity Committee replied that there was a dearth of electrical engineers and Mr. Ogden had every requisite qualification. The appointment was confirmed.

Following the appointment of **Mr. G. O. Edwards** as borough electrical engineer and manager at West Bromwich, **Mr. G. R. Auchterlonie** has been promoted to the position of chief technical assistant and **Mr. P. H. Flatt** becomes chief administrative assistant.

A set of inscribed silver entrée dishes was recently presented on behalf of the staff of the Lowestoft electricity and transport undertakings to **Mr. H. H. Saunders,** who has retired from the position of general manager. The new general manager, **Mr. G. W. Steward,** presided.

Mr. L. V. Cartwright, formerly personal assistant to the general works manager of A. C. Cossor, Ltd., has been appointed personnel manager of the company's Highbury group of factories. Mr. Cartwright joined the company ten years ago, and during that period has filled many executive positions.

Mr. J. H. Aston, of Tube Investments, Ltd., has resigned from the board of Stewarts & Lloyds, Ltd. **Mr. P. G. Carew,** also of Tube Investments, Ltd., takes his place as a director of Stewarts & Lloyds, Ltd.

The Midland Electric Manufacturing Co., Ltd., recently held its first sales conference since 1939 at the head office of the company at Birmingham. The conference was presided over by **Mr. W. L. Barber,** founder and chairman of the company, and the photograph shows him with the company's representatives and members of the executive staff. Yorkshire readers will recognise Lieut.-Commander J. C. Turnbull, peacetime representative for that territory and now serving with the Royal Navy who, together with Lieut. A. J. Gardner of the London area, obtained special leave to attend the conference.

Mr. W. R. Rawlings who recently celebrated the diamond jubilee of his marriage to Mrs. Rawlings asked his friends that any presents should take the form of gifts to charity. The E.I.B.A. tells us that as one result it has received a cheque for ten guineas.

Mr. H. R. Watts, to whose retirement from the position of meter superintendent of Hammersmith Electricity Department we referred last week, has been in the service of the Council for thirty-nine not twenty-nine years as stated.

The Islington Borough Council is advertising for an engineer and general manager to succeed **Mr. A. P. MacAlister** who is retiring. The commencing salary will be about £1,683, plus £34 cost-of-living bonus.

Mr. G. A. Paisley, B.Sc. Eng. (London), A.M.I.E.E., assistant electrical engineer to the Malvern U.D.C., has been appointed chief electrical engineer as from August 1st, in succession to **Mr. E. D. Wootten,** who is retiring. Mr. Paisley, who is thirty-seven, was born at Carlisle, where he received his electrical training with the electricity undertaking. From 1931 to 1933 he was junior assistant engineer and personal engineering assistant to Kennedy & Donkin, consulting engineers. Going to Malvern in 1933 as mains assistant, he was promoted to assistant electrical engineer in 1937.

Mr. E. J. Fouracre, sales manager of the Westinghouse Brake & Signal Co., Ltd., and **Mr. D. F. Brown,** assistant to the managing director, have been appointed directors.

To mark the occasion of his retirement from the service of the London Power Co., **Mr. W. A. Mackenzie,** chief superintendent engineer at the Battersea generating station, was presented by Sir Leonard Pearce on July 5th with a

Representatives and head office staff at the recent M.E.M. sales conference

cheque and vellum scroll suitably inscribed by his colleagues. Before joining the London Power Co., Mr. Mackenzie served with the Glasgow Corporation, the West Ham Corporation and the Charing Cross Electricity Supply Co., Ltd.

Mr. W. H. Metcalfe, electrical engineer and manager at Bacup, has been appointed chief engineer of the Morley Electricity Department.

Obituary

Mr. A. M. Johnston, construction superintendent of the East African Power & Lighting Co., Ltd., was one of eleven persons who were killed when an aircraft taking off from Nairobi last week crashed and was burnt out.

Mr. S. J. L. Hardie has been appointed chairman of Electrical Switchgear & Associated Manufacturers, Ltd. (which controls Brookhirst Switchgear, Ltd.) in the place of the late Mr. J. A. Hirst.

Mr. J. E. Betts, supervisor of purchases for the British Thomson-Houston Co., Ltd., and chairman of the A.E.I. Group Purchasing Committee, died suddenly at his home in London on July 14th in his seventieth year.

Mr. W. S. Clark, chairman of the Oakham Gas & Electricity Co., Ltd., has died at the age of sixty-eight.

Will.—Sir John Ambrose Fleming, the distinguished radio scientist, left £56,651 (net personalty £53,791).

CORRESPONDENCE

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

Fluorescent Lighting

AN experiment which I recently carried out in the lighting of a billiard table with fluorescent lighting had as its aim an increase in the intensity of light over the whole table surface, with avoidance of the stroboscopic effect that fluorescent lighting tends to give with regard to moving objects. Tests were first taken with normal billiard table lighting, that is with three 100-W lamps in the usual type of shade hung lengthways over the table. A light-meter gave the following values in ft.-candles: Corner pockets, 7; centre pockets, 10; centre line of table (end), 9, (centre) 20. These tests showed that the illumination over the whole table surface was not uniform and that the corner pockets had the least amount of light.

Two fluorescent fittings with 5-ft. 80-W "warm-white" tubes were then hung across the table. After trying various heights and positions, it was found that a height of 4 ft. and a distance of 2 ft. 9 in. from the cushion at each end of the table gave the best results. Both fittings were on the same phase. Tests were again taken and gave the following ft.-candles: Corner pockets, 15; centre pockets, 15; centre line of table (ends) 20, (centre) 20. These tests showed a very much more uniform and increased spread of light over the whole table surface. Glare and shadow were entirely absent, and stroboscopic effects non-existent however the balls were hit.

The consumption was reduced to 160 W with vastly increased efficiency. The difference in illumination between the centre line of the table and the pockets will be overcome with a longer fluorescent tube, when these are manufactured, as up to within 9 in. of the edge of the table, the light-meter showed 20 ft.-candles.

The county champion was invited to try out the new lighting. He considered it ideal, the balls being much more clearly defined, and in his opinion there was no eyestrain whatever. With white fluorescent tubes I found that stroboscopic effects were noticeable and the lighting effect was not to be compared with " warm-white " tubes.

Workington. A. C. ADDISON.

Concerning Trams

REGARDING Mr. B. J. Prigmore's letter in your June 22nd issue I suggest that the tram is rather a dangerous vehicle. In the first place it has to be fitted with a cow-catcher life-guard, a very crude encumbrance, and instances are on record of people being run over by trams, despite these precautions.

In my personal experience trams have been stopped by fog before other traffic on the road. Skidding on curves has caused derailments resulting in serious accidents, *e.g.*, at Kennington Oval about 1933. A big objection is the hold-up of cars following one that has developed a fault. With the trolley-bus, succeeding cars can easily by-pass the defective vehicle. Again there is the cacophony when either new or old trams pass over points and other trackwork.

The trolley-bus can be run about 25 per cent. more cheaply and, unlike the tram, can pull into the kerb, thus eliminating many dangerous occurrences between platform and

kerb. As the towns and roadways have already been constructed, special tram avenues are obviously impracticable in most cases owing to the limitation of space, but the rails and conduit, if any, form a serious menace to cyclists. The cycle is one of the major forms of transport, especially in provincial towns. In one instance in South London, when a cyclist got both wheels jammed in a slot conduit. no fewer than forty trams were held up for over two hours.

I am a member of an electrical research establishment and in no way connected with tramways.

Watford. A. R. GRIERSON.

Engineers and the Public

RECENT statements by politicians that our industry is in a chaotic condition give an idea of the public's ignorance of engineering. Many councillors going round a 200,000-kW station wonder what the men do to pass the time away. Tell them of 1,400 lb. per sq. in. pressure and of temperatures so high that the steam pipes are red hot, as in the new plant at Battersea, and they think it has all come automatically, by the inevitable progress of science. Tell them that in the years of war although everything, taxes, cost of coal, salaries and wages, have risen enormously electricity on the whole has rather come down in price, and they see no merit in it, believing that it is only necessary for a controlling committee to give instructions and the whole thing is done. Show them an electric lamp and tell them that there is fifty years of intensive research by makers at a cost of many hundreds of thousands of pounds, and they cannot believe that so trivial an object took that effort.

In a newspaper article we were told that in 1945 we could have motor-car engines of teacup size and working on high octane spirit, high-frequency current for roasting meat quickly and cheaply, and greatly improved electric lamps, if "other interests" did not interfere. The writer did not state that all these are the result of years of research by scientists, inventors and manufacturers who have spent millions of pounds in getting results which are not yet perfected but are being made available for use.

The electric lamps have been developed from the Moore tube of fifty years ago, the high speed petrol engines have been in a continuous state of development ever since motor cars came, the high-frequency oven will not so far do the work stated. The notion that people spend time and money in working out patents only in order to suppress them, is an obvious absurdity. It is this continued misrepresentation that prevents us from having patent laws that should encourage invention.

People believe that it is better to make it impossible for a man to hold an invention for long, so that it may become the property of the nation without payment. They do not see that the effect of this treatment is to suppress British inventors and to make us dependent on other nations for ideas, also that manufacturers cannot afford to spend large sums of money on developing ideas where patent rights have been destroyed by prior publication; many inventions have to lie unused through this.

We must try to educate the public and get them to understand that the people are the chief beneficiaries of our work. Some presumably intelligent people have been astonished when I have told them that they were debtors to the electrical industry for cheap electricity and excellent apparatus, as they believed that engineers worked only for money!

Tynemouth. C. TURNBULL, M.I.E.E.

Purchase Rights in Northmet Area

IN the notes on this subject appearing in your issue of July 6th, 1945, it is stated :—

> "It is understood that the conferences have been convened by the Joint Electricity Authority at the request of the Electricity Commissioners and the Ministry of Fuel and Power in order that a post-war reconstruction scheme might be evolved and better distribution of electricity obtained."

In order to avoid any misunderstanding, it should be made clear that the conferences to which reference is made in the note have been called with the knowledge, but not at the "request," of the Electricity Commissioners or the Ministry of Fuel and Power. The Minister, in November, 1944, indicated, on the general question of the exercise or non-exercise of purchase rights in the London and Home Counties Electricity District, that he was fully aware of the great importance of the subject, and that full regard was being given to it in the Government's consideration of the reorganisation of the electricity supply industry.

London, W.C.2. LESLIE GORDON,
Clerk and Solicitor,
London and Home Counties J.E.A.

Watford Agricultural Show

Comprehensive Display of Electrical Equipment

A JOINT display by the Watford Electricity Department and the Northmet Power Co. of electrical appliances for use in the farm and in the home attracted much attention at an agricultural show held last Saturday by the Watford & District Agricultural Society at Cassiobury Park. Despite present-day difficulties a remarkably comprehensive display of apparatus was assembled and throughout the day demonstrations were given of electrical equipment for the dairy, barn machinery, pumping, egg testing and grading, tomato grading, home laundry and fruit bottling. Besides milking machinery, sterilisers, coolers, cold room, bottle washers and water heaters, etc., the dairy exhibit included an electric milk pram.

The now well-known " Essex " mill was a prominent feature of the barn machinery section, which also included mixers, root cutters, sheep shearers and a model of a grain drying and storage plant. There was an electrically operated cultivator and other horticultural apparatus included portable spraying plant, a nursery circulating pump, soil-heating cable, plant irradiator, greenhouse heaters and a forced-draught fan for horticultural boilers. Poultry farmers were also interested in the latest types of incubators, brooders, poultry pluckers and poultry house lighting fittings. Pumping plant, bench grinders, portable electric drills, welding plant and battery chargers completed the farm section.

In addition to a centre-piece formed by a " Poplar " kitchen unit, the domestic appliance section included four different types of cookers, water heaters, washboilers, a washing machine, refrigerators, vacuum cleaners, fires, kettles, lighting fittings, irons, soldering irons, and a potato peeler. In the centre of the stand an inquiry bureau drew attention to the various functions which a unit of electricity will perform.

Electrical methods of measuring moisture in grain, wood, etc., were demonstrated on the stand of Marconi Instruments, Ltd., and electric fences were to be seen on the stands of the Harvest Saver & Implement Co., Ltd., and the Cooper-Stewart Engineering Co., Ltd., the latter also showing clipping and shearing machines and a battery charger. " Kulectra " 12-V lighting plants fitted with liquid-cooled lampholders were exhibited by K. F. Rushton.

Display of farm and domestic electrical appliances arranged by the Watford Electricity Department and the Northmet Power Co. at the Watford Agricultural Show

The Sun's Eclipse

SPECIAL seven-day observations of the sun's partial eclipse by the moon on July 9th were organised by the Department of Scientific and Industrial Research. British radio services, both military as well as civil, including " Radar," were utilised and the National Physical Laboratory sent special apparatus to the north of Scotland for " sounding " the upper atmosphere to observe how the reflection of pulse signals from ionised strata might be affected by diminution of radiation from the sun. The lower (Heaviside) layer is caused to be reflective by ultra-violet light from the sun, since both radio and optical eclipses occur at the same time and place. Some investigators suppose the higher (Appleton) layer to be of the same origin whereas others are inclined to the view that it is due to showers of material particles ejected from the sun. If the latter surmise be correct, then the radio eclipse should have occurred earlier in time by perhaps an hour or two than the optical obscuration. The fact that this month's eclipse, duration 2·5 hours, 90 per cent. obscured in Scotland at 3.50 p.m. (D.B.S.T.), took place at about noon (G.M.T.) on a summer's day should have enabled the two ionised layers to be separately observed more distinctly than at times of previous eclipses.

Views on the News

Reflections on Current Topics

A QUESTION put to me recently was whether a severe electric shock could affect the arteries permanently, as is sometimes supposed. The particular reference was to the sudden deaths recently, within a short time of one another, of two electrical engineers, about fifty years of age. The coincidental feature was that both of them some time ago received shocks at 1,730 V to earth, but were able to resume work shortly afterwards. The post-mortem examination in each case gave the cause of death as a coronary-occlusion blood clot lodged in the artery from the heart, the arteries being prematurely hardened. A high medical authority to whom I submitted the case tells me that he cannot imagine that one heavy dose of current could have the result indicated. Coronary thrombosis, he says, which is not uncommon and not necessarily fatal, occurs at a time of life when physical powers are undiminished and the arteries have deteriorated through disease. This should dispose of any fears of a "delayed action" effect in similar circumstances.

* * *

In view of the great advances that have been made during the war in the use of electricity on farms I was not surprised at the interest shown in the joint exhibit of the Watford Electricity Department and the Northmet Power Co. at the Watford & District Agricultural Society's show. A good deal of enterprise has been shown in the organisation of this show and the success of the function more than exceeded expectations. Much of the credit may be attributed to an electrical man, for the hon. secretary is none other than Mr. D. G. W. Ackworth, manager of the G.E.C. Cooker Department.

* * *

Advocacy of a "T.V.A." for Wales continues. I have just received a pamphlet by R. T. Pierce, originally submitted to the Welsh Reconstruction Council in 1941, in which the subject of electricity supply in Wales is discussed and a body on the lines of the Tennessee Valley Authority is proposed. But so far as I can see the only resemblance which the suggested Welsh Electricity Board would bear to the T.V.A. would be its overall control of electricity production. It is admitted that electricity is sold cheaply by the T.V.A. because that side of the Authority's activities is secondary to its great flood control and irrigation undertakings which bear the civil engineering costs. There could be no comparable basis in Wales, unless a Severn Barrage Scheme, which the pamphlet does not mention, could possibly be considered in that light. The development of wind and water power and the generation of electricity at the pithead by gas turbines which the author advocates would not make a Welsh Electricity Board into a T.V.A. The idea of a Board may have its merits, but why drag in the T.V.A.?

* * *

There has been much discussion of the question who should pay for mains and services to temporary houses which are likely to become redundant in due course—the electricity supply undertaking or the housing authority. The Ministry of Health has rather hedged on the question as was indicated in the annual report of the I.M.E.A. I note that at Swansea the Corporation Electricity Committee has suggested that the Housing Committee shall make a contribution of £8 per house to supply 2,817 houses on the town's new housing and trading estates which, presumably, are permanent, not temporary. The total capital expenditure is put at £92,000 so that the proposed contribution represents about a quarter of the cost.

* * *

German bombs laid waste a good deal of Farringdon Street, E.C., and the head offices of Babcock & Wilcox, Ltd., have suffered severely. They have been hit twice and only one wing now remains in use. Emergency offices have been taken at Elstree, Epsom and other places round London, but this has been found very inconvenient. Now, I learn, the company has just purchased for £65,000 a modern building comprising about 21,000 sq. ft. at Buxton House, Little Trinity Square, Queen Victoria Street, and this will be used until it is possible to construct in Marylebone Road, opposite the Marylebone Town Hall, a new seven-storey building in which the whole of the London offices will be centralised.

* * *

Printers have an established sign language for use in the correction of proofs and it is as well for authors to be acquainted with it. They may secure this knowledge by purchasing British Standard No. 1219 (2s. post free) from the B.S.I., 28, Victoria Street, S.W.1. This has been prepared with the assistance of a number of printers' and journalists' organisations and may therefore be considered authentic. From an editor's point of view the most useful section is probably that giving recommendations for the preparation of "copy" for the printer; observance of these would save much labour and greatly reduce the consumption of aspirin in editorial offices.—REFLECTOR

COMMERCE and INDUSTRY

Reviving Civilian Production. Payment During Illness.

Man-Power for Industry

THERE is abundant evidence that the rate of release of men and women from the Services and workers from the munitions industries will be slower than is required to meet the demand for labour for essential "civilian" production. Therefore as a means of accelerating transfers from war factories to peacetime industry the Ministry of Labour and National Service has introduced a system by which their former employers can "nominate" men and women for early return—if they are willing to return. Should their present employers wish to retain them they will have to give "overwhelmingly strong reasons." The scheme applies to six groups of industries, one o which includes electricity supply and another "housing fitments." As regards the latter class special reference has been made to the production of gas and electric cookers.

Employers who wish to secure the return of former employees should notify the Ministry of Labour of their present employment and inquiries will then be made by the appropriate local office of the Ministry with a view to arranging their release. Workers who wish to return to their former employers may facilitate matters by writing to them, asking the employers to nominate them for release.

Sick Pay for Supply Workers

Five weeks at two-thirds pay followed by seven weeks at half pay will be payable to employees in the electricity supply industry under a sick pay scheme approved by the National Joint Industrial Council for the Electricity Supply Industry to come into operation on August 1st. To qualify for benefit an employee must have completed one year's continuous service with an electricity undertaking. One half of the statutory benefit paid under the National Health Insurance Scheme will be deducted from payments, which also will be reduced if the employee is receiving compensation for any industrial disease or accident under the Workmen's Compensation Act or Employers' Liability Acts.

Private Trade with France

The French Government is now prepared to grant licences for import on private account of spare parts and replacements for all types of machinery and equipment, and other manufactured products in quantities less than 5 tons in weight and less than £5,000 in value, excluding industrial plant and machine tools. Importers will apply in France to the appropriate authorities for import licences which will only be granted in respect of goods required to meet essential needs, and when these are issued will be able to obtain the foreign exchange necessary for the purchases. Normal United Kingdom export licensing procedure will apply to goods subject to licences on export under the Export of Goods (Control) Order, and applications should be made to the Export Licensing Department, 4, Fenchurch Avenue, London, E.C.3, either directly or through the usual channels for the goods concerned. Applications for shipping facilities, in duplicate, giving the French import licence number, should be addressed to the Commercial Counsellor to the French Embassy, 3, Albert Hall Mansions, London, S.W.7, and must be accompanied by two copies of the relevant invoices. All other correspondence concerning shipment should be addressed to "Service du Transit," French Purchasing Mission, 20, Queen Anne Street, London, W.1. Goods should be consigned to "IMPEX" (for the importers' account) at port of unloading in France. The French Government is also prepared to issue licences to export from France on private account, the position being in general similar to that with regard to imports on private account from other overseas countries.

Control Orders

Mica.—The Control of Mica (No. 4) Order, 1945 (S.R. & O. 1945 No. 813), amends the Control of Mica (No. 3) Order, 1944, so that built-up mica and mica-splittings other than book-form splittings are exempt from control under Ministry of Supply Orders. Inquiries concerning this Order should be addressed to the Ministry of Supply, Mica Control, Euston House, Eversholt Street, London, N.W.1.

Diamond Tools.—The Minister of Supply has released Mr. R. L. Prain from his appointment as Controller of Diamond Tools and the Control has been terminated. Any inquiries in connection with diamond tools should, in future, be addressed to the Raw Materials Department (R.M.1A.), Shell Mex House, Strand, W.C.2. Mr. Prain will continue to act as Controller of Diamond Dies and as Controller of Quartz Crystals.

Iron and Steel.—The Control of Iron and Steel (No. 42) Order, 1945 (S.R. & O. 1945 No. 814), increases the prices of wire nails, the thinner sizes of heavy plates, certain types of forging ingots and forgings and wire ropes; provides for an increase in the merchants' cutting margin on heavy steel bars and sections; and reduces the price of cemented hard metal finished tool tips.

Bolts and Nuts.—The Control of Bolts and Nuts, etc. (No. 8) Order, 1945 (S.R. & O. 1945 No. 815), revokes all previous Control of Bolts, Nuts, etc., Orders and removes all restrictions on the acquisition and disposal of bolts, nuts, screw studs, washers and rivets. The maximum price provisions of the revoked Orders are remade in consolidated form.

Tropical Packaging

Recommendations for the preservation and packaging of technical equipment for despatch to tropical theatres of war in the Far East have been issued, at the request of the Anglo-American Packaging Committee of the Ministry of Production, as Supplement No. 2 to B.S. 1133/1943, which code dealt fully with mechanical protection. The new supplement, which supersedes the first one published last year, is concerned specifically with problems

of the tropics. The wide range of goods covered includes electrical and telecommunications stores, some 1,560 items being individually listed to furnish a typical guide for the treatment of similar products. The three principal methods of packaging that have been standardised in Britain and the United States are described in detail, with step by step sequence of operations illustrated at appropriate points. A table shows the whole range of preservatives and packing materials normally specified by Government Departments, each identified by a number and title, with short notes on methods of application. The recommendations are not mandatory so that detailed instructions of Government departments should be complied with at all times. The new document, of 198 pages including index, is obtainable for 5s. from the British Standards Institution, 28, Victoria Street, London, S.W.1.

E.D.A. Joins House-Building Committee

The British Electrical Development Association has now become a member of the House-Building Industries' Standing Committee. The membership of this Committee totals twenty-two associations, representing industries allied with house-building. The Committee is engaged on selecting, from plans submitted in a competition, thirty from which houses of the English traditional type will be built.

County of London Plan

A report of the Town Planning Committee of the London County Council on the County of London Plan recommends the development of a series of communities comprising several neighbouring units, and the matching of the residential accommodation to the industrial provision. In cases where it is desirable to segregate industry from residential areas industrial estates should be established; some of them sited in the outer parts of the county to provide work locally. Three principal density zones are advocated averaging 200, 136 and 70 persons per acre, a mixed development of houses and flats being allowed in each zone.

Ship Welding

Recommendations by the Admiralty Ship Welding Committee for the guidance of shipbuilders, designers, inspectors and foremen engaged in the fabrication of ships' structures by welding have been issued by the Stationery Office in the form of a booklet (M.2) containing six pages of text and eighteen sheets of sketches and drawings. The object is to set out those factors which need special consideration for the confinement of locked-up (residual) stresses within safe limits.

"Electricity Canvass" Prosecution

A defendant at Hartismere (Norfolk) Sessions recently was stated to have canvassed villagers saying that he was from the East Anglian Electric Supply Co. A sub-postmistress at Stoke Ash said defendant told her that one free light and one free plug would be put in and any additional lights would cost 5s. each. He said he was there to take orders, and she paid him 10s. for which he gave a receipt. Another resident of Stoke Ash said defendant informed her that if the company could get 35 names it would lay electricity on. She ordered three extra lights and paid him 10s. A witness from Thornham Magna said she ordered five lights and paid 15s. Defendant, who admitted obtaining six other sums, was stated to have served for seven years with the Royal Engineers and to have been wounded and discharged with a disability pension. He said he was short of money and wanted to get his wife to Newcastle. He was bound over for three years and ordered to make restitution of the money and pay £3 1s. costs.

Widow's Claim Fails

In February last year a linesman employed by the Derbyshire & Nottinghamshire Electric Power Co., Thomas Paling, received a fatal shock while working on a part of the company's overhead system. It was stated at the inquest that Paling thought that the lines had been disconnected when actually one of them was still "live."

At Nottingham Assizes recently his widow claimed damages from the company on behalf of herself and two young daughters. Counsel for the plaintiff contended that the company had not complied with electricity regulations and that the system of working was unsafe. On behalf of the company it was maintained that Paling, as an experienced workman, should have satisfied himself that the lines were safe to work upon before beginning the work.

The judge, Mr. Justice Macnaghten, dismissed the action with costs, holding that there were no grounds for the suggestion that the company had failed to take reasonable precautions.

French Railway Voltage

In an article on French railways published in the *Electrical Review* of June 22nd (p. 918) the operating voltage of the electrified Paris-Lyons line was stated to be 1,130; it is actually 1,500.

Electric Turret Clock

The twelfth-century parish church of Rippingale, near Bourne, Lincolnshire, now possesses the first electric turret clock to be erected since the ending of hostilities in Europe. It has three skeleton dials and strikes the hours on the tenor bell of the ring of six. The mechanism, in two parts, is mounted on a main bedplate, one for operating the dials and releasing the striking and the other for striking the hours. The timekeeping portion is driven by a synchronous motor which rotates at 200 RPM. The rotor is made from a special alloy of the "Nifal" type and as the motor is self-starting, a non-reversing attachment is fitted to ensure that it is impossible for the clock to run in the wrong direction. The reduction gearing of the timepiece is of the wheel-and-pinion type, all totally enclosed in an oil bath.

The striking unit is made up of a single snail-cam of heavy design, rotated by a small motor through worm-reduction gearing. The cam depresses the lever which is coupled to the striking hammer and makes one complete rotation for each blow. An attached "locking-plate" mechanism is also stepped at each blow and when the correct hour has been struck the switch controlling the driving motor is tripped, so that the unit stops until released at the next hour. The reduction gearing of the

striking unit is enclosed in a casing and runs in an oil bath. It is also provided with ball bearings at all major points.

The clock is the gift of Mr. Joseph William Smith in memory of his mother, who was a former resident of the parish. It was dedicated and set going by the Rector, the Rev. J. E. Williams. Without time controlled AC a far more massive and complex mechanism would have been necessary.

Exhibition of Inspection Equipment

An exhibition of inspection equipment is being held by the Sheffield Trades Technical Societies from August 20th to 25th in the Cutlers' Hall, Sheffield. The Gauge and Tool Makers' Association is co-operating and several member-firms will be exhibiting.

Incidentally, copies of the 1945 edition of the Association's Members' Handbook are now available on application to the secretary, Mr. G. T. Beach, Standbrook House, Old Bond Street, W.1.

" Passport to Peace "

This is the title of a booklet prepared by the United Steel Companies for the information of its former employees now serving in the Forces and Merchant Navy. Its possession admits any of these employees to any department of the companies' organisation in which they formerly worked to enable them to renew old acquaintance and it gives some useful advice and offers of assistance as a supplement to the Government's " Release and Resettlement " booklet.

Flameproof Apparatus

The usual quarterly schedule of electrical equipment, both mining and industrial, for which certificates of flameproof enclosure were issued by the Ministry of Fuel and Power (Coal Division) during the three months ended June 30th is now available. At the request of the B.E.A.M.A. a few copies can be purchased for 1s. 2½d. post free from the Library, Ministry of Fuel and Power, King's Buildings, Dean Stanley Street, London, S.W.1.

Trade Publications

British Thomson-Houston Co., Ltd., Bridle Path, Watford Junction, Herts.—Infra-red bulletin (No. 2) illustrating and describing " Mazda " radiation lamp ovens of various shapes and sizes for baking painted objects, drying papier maché containers, softening plastics, drying small coils, steel tubes, latex on fabrics and coil-box heating.

Siemens Electric Lamps & Supplies, Ltd., 38, Upper Thames Street, London, E.C.4.—New list (No. 976) giving full particulars of lamp price reductions.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—Illustrated booklet (No. OCB-2) containing maintenance instructions for oil-immersed circuit-breakers.

Delco-Remy & Hyatt, Ltd., Church Street, Dunstable, Beds.—Illustrated brochure containing technical data on miniature motors for actuating aircraft ancillary devices; both totally enclosed and fan-ventilated flameproof types, DC shunt, series, compound and split field of 0·05 to 4 HP at 12 and 24 V of 2·5 to 4·5 in. diameter; also three-phase 200 to 450 cycle 100/250 V of 0·3 to 1·5 HP and 4 in. diameter as well as tachometer generators.

Frank Whitelegg, 90, Robin Hood Lane, Sutton, Surrey.—Priced list (BAW) describing a winding machine of the stationary armature type.

Cheaper Lamps

A reduction in the prices for " Ensign " and " Ekco " lamps is announced by E. K. Cole, Ltd

Australian Manufacturers' Council

The Federal Council of Electrical, Radio and Telephone Manufacturers of Australia has been formed in Sydney. Mr. L. P. R. Bean is the president and Mr. G. S. Noek secretary.

Factory Managers' Year Book

A list of the membership is a feature of the Year Book produced by the Institution of Factory Managers, 63, Gayton Road, Harrow, Middlesex. The publication also includes the Institution's accounts and the secretary's and treasurer's reports for 1944 and the presidential address of Sir Murdoch Macdonald.

Leigh Creek Coalfield

Tenders (Melbourne) states that favourable reports on the development of the Leigh Creek coalfield have been made by two South Australian Government engineers, Messrs. H. T. Angwin and F. H. Harrison. During a visit to the United States many boilers were seen which burned fuel of a much higher moisture content than the Leigh Creek coal.

Fatalities

Motor Mechanic's Death.—John Trant Woods (42), a motor mechanic, was found dead with the wire of an electric drilling machine touching his face. The wires in the plug had become frayed. At the inquest at Frodsham a verdict of " Death by misadventure " was recorded.

Shock from Refrigerator.—At an inquest held at Lambley, Notts, it was stated that Susan Radford (54), who was scrubbing the floor of a shop, was found lying unconscious with her arm in contact with an electric refrigerator. Evidence was given that the machine was not efficiently earthed, due to rubber insulation having perished. The coroner said he thought it important that such machines should be periodically examined.

Annual Holidays

Mitchell Electric, Ltd., is closing its works and offices from July 20th to 30th.

Brook Motors, Ltd., are closing their works from August 10th to 20th.

The Aberdare works of Aberdare Cables, Ltd., will close from July 28th to August 7th.

Trade Announcement

Owing to the completion of Government war contracts Malcolm & Allan (London), Ltd., have closed their offices at Toft Lodge, Broxbourne. Communications should now be addressed to the company's head office at 12, Henrietta Street, Strand, London, W.C.2.

Overhead Line Charts—III

For 6·6-kV Lines

By J. S. Forrest, *M.A., B.Sc., F.Inst.P.*

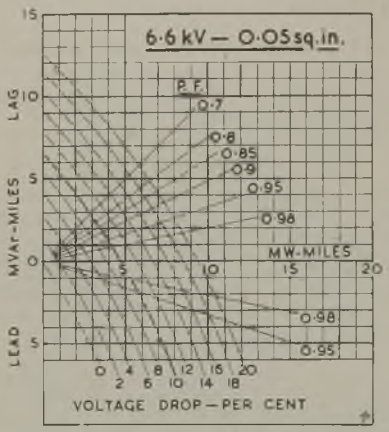


Fig. 7.—(Use also for 3·3-kV)

Example 2

A 6·6-kV feeder is 5 miles long, and the line conductors have a cross-sectional area of 0·20 sq. in. Under light load conditions, the feeder supplies a load of 1,000 kW at a power factor of 0·95 lagging, while the peak load is 2,000 kW at 0·8 lagging. What voltage range is required at the sending end to maintain 6·6 kV at the receiving end?

The transmitted load is 5 MW-miles at 0·95 lagging power factor under light load conditions. The 6·6 kV chart for 0·20 sq. in. conductors (Fig. 9) shows that the line voltage drop will be 4·5 per cent. Similarly, under peak load conditions, the load is 10 MW-miles at 0·8 lagging power factor, and the corresponding voltage drop is seen to be 14 per cent. The range of sending-end voltage required is therefore 6·9 kV to 7·5 kV.

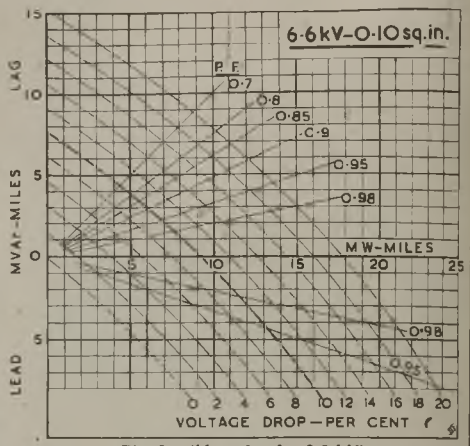


Fig. 8.—(Use also for 3·3-kV)

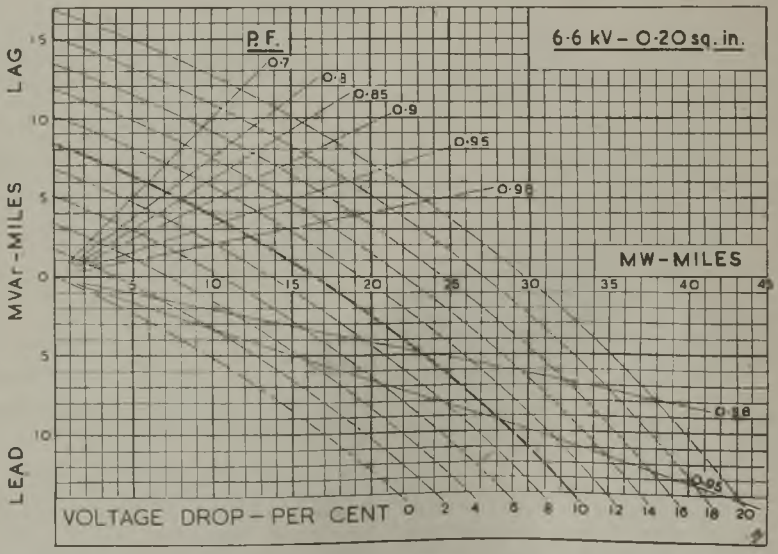


Fig. 9.—(Use also for 3·3-kV)

Transmission-line Protection

High-speed Protection Using Superimposed Carrier Signalling

By D. H. Towns and H. McDonald

FOR the protection of long overhead transmission lines a pilotless system is generally preferable for reasons of economy. It is desirable that it should be rapid in action and of the unit type and high-speed carrier-current protection satisfies these requirements. Carrier protection was used in Great Britain on a section of the 132-kV grid in 1931, and was probably the first example of its kind in the world. It was not of the high-speed class, but with the development of high-speed directional relays, concurrent with the speeding up of a circuit-breaker operation, several forms of high-speed equipment are in service on high-voltage overhead transmission-lines, ensuring rapid and selective clearing of faults over the whole feeder length.

The carrier signal, at a frequency between 50 and 200 kc/s, may be used either to ensure stability following an external fault, or cause tripping with an internal fault ; but, since the latter may sever the line or " short " the phase or phases over which the high-frequency transmission takes place, the second alternative arrangement is seldom adopted.

In the modern system to be described the signal is used to stabilise protection on sound sections of the network under fault conditions, the presence and direction of the fault current having been first detected by high-speed non-directional and directional relays at each end of each network section.

With an external fault (fig. 1a) the direction of power flow is into the sound section at one end and out of it at the other. The directional relay at the end remote from the fault operates to trip whereas that at the end near to the fault does not operate, but allows a stabilising signal to be transmitted and prevents tripping at the remote end. If the fault is internal (fig. 1b) the power flows into the section at both ends and causes both directional relays to operate, thus interrupting the carrier signal and causing tripping.

Although the stabilising and tripping sequences are controlled by the directional relays, they are initiated by two separate non-directional relays. By setting the stage-one relay (which initiates stabilising) lower than the stage-two relay (which initiates tripping) the sensitivity of protection for stabilising is made slightly greater than that for tripping, thus ensuring that any fault current sufficient to cause tripping is also large enough to stabilise. The overall tripping time with internal faults for a fault current exceeding approximately five times the setting is three cycles, at 50 c/s frequency, and the stabilising time is one cycle or less, so that there is an adequate margin of safety for the transmission of the stabilising signal.

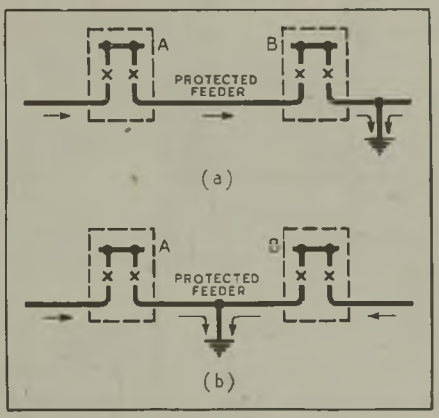


Fig. 1.—Diagram representing operating principle, showing external and internal fault sequences

(a) With external fault; directional relay at A operates without directional relay at B operating, so stabilising signal is transmitted from B to A, tripping thus prevented at A. (b) With internal fault: directional relays at A and B operate, interrupting stabilising signal; tripping thus initiated at A and B.

The components required at each feeder end (fig. 2) comprise (1) three phase-fault relays and one earth-fault relay, each having a directional element, a stage-one non-directional element, a stage-two non-directional element and a flag indicator; one tripping-relay having a time-lag element and two high-speed tripping elements. (2) Three line-current transformers. (3) Three capacitative voltage transformers, two having high-frequency injection and filter equipment. (4) One carrier cabinet, two tuned choke coils, and two line coupling filters (mounted in the capacitative voltage transformers). (5) One rectifier and charger with 250-V and 50-V batteries.

Relays.—The fault-detecting relays are connected in ordinary over-current and earth-fault arrangement (fig. 3a) the directional element of each being of the balanced-beam type. The phase-fault directional element (fig. 4) has polarising and restraining voltage windings and an operating current winding. The fluxes of the two voltage windings assist in the restraining magnet and oppose in the operating magnet, so that when there is no operating current the beam of the element is restrained.

When current flows in the direction for operation the flux of the current winding is added to that of the polarising voltage winding in the operating magnet and subtracted from that of the polarising voltage winding on the restraining magnet (fig. 4a). If the magnitude and direction of the current are such that the resultant of the three fluxes in the operating magnet is greater than that of the three fluxes in the restraining magnet, the element operates. If the current is in the opposite direction, the flux in the restraining magnet is increased and that in the operating magnet is decreased so that the element is restrained still more. Under normal-load conditions with current flowing in the direction for operation, the flux in the restraining magnet is greater than that in the operating magnet and the relay does not operate.

The polarising voltage winding is 90 deg.-connected (fig. 4b), and the restraining voltage winding is 30 deg.-connected; that is, the element for R-B faults, which is energised by the R-phase current, is polarised by the W-B volts and restrained by the B-R volts. Consequently, with an R-B phase fault the polarising voltage is little affected by distortion of the voltage vectors, whereas the restraining voltage collapses. The phase angle of the flux of the polarising winding is adjusted by means of a series condenser and a resistor to lead the polarising voltage by 30 deg. Maximum torque occurs when this flux is in phase with the current-winding flux; that is, when the current lags behind its associated star voltage by 60 deg. The current in the restraining voltage winding is adjusted by means of a series reactor and resistor, so that its flux is in phase with the polarising voltage flux.

The earth-fault directional element operates on the same general principles as the phase-fault directional element. It has, however, only two windings, one energised from the residual circuit of the three line-current transformers and the other from current transformers on the solidly-earthed neutrals of power transformers. The fluxes add in one magnet and subtract in the other, and consequently the relative polarities of the currents in the two windings determine the magnet in which the

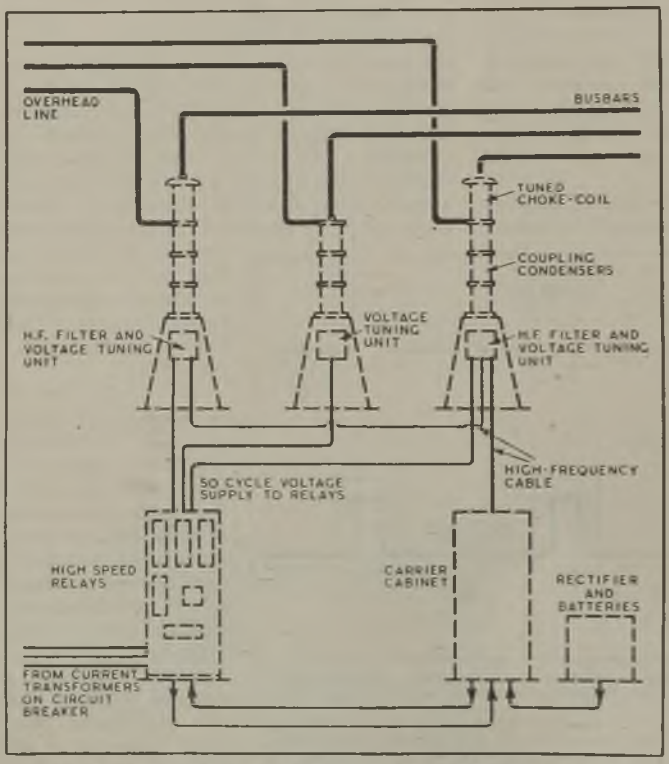


Fig. 2.—General layout of components needed at each feeder end

larger flux is set up; that is, determine operation or restraint of the relay element. A saturable auto-transformer is connected in series with each winding, in order that appreciable differences may still be maintained between the torques exerted by the two magnets if one current is much larger than the other.

When no neutral is available for operating the polarising winding of the earth-fault directional relay, a voltage coil is fitted for operating from the broken-delta winding of the voltage transformers. In other respects the construction of the relay is as described.

The two non-directional elements in each relay have rotating armatures and operate at very high speeds. The stage-one element has one pair of contacts, which initiate the stabilising signal. The stage-two element has one pair of tripping contacts, one pair of stabilising contacts (in parallel with the contacts of the stage-one element) and one pair of contacts for the purpose of operating a flag indicator.

The tripping relay comprises a DC electromagnetic time-lag element energised by contacts in the phase-fault and earth-fault relays, if the carrier receiving and lock-out relay has not operated, together with two high-speed tripping elements. It takes about 0·03 sec. to operate so there is time for the stabilising carrier signal to be received before tripping

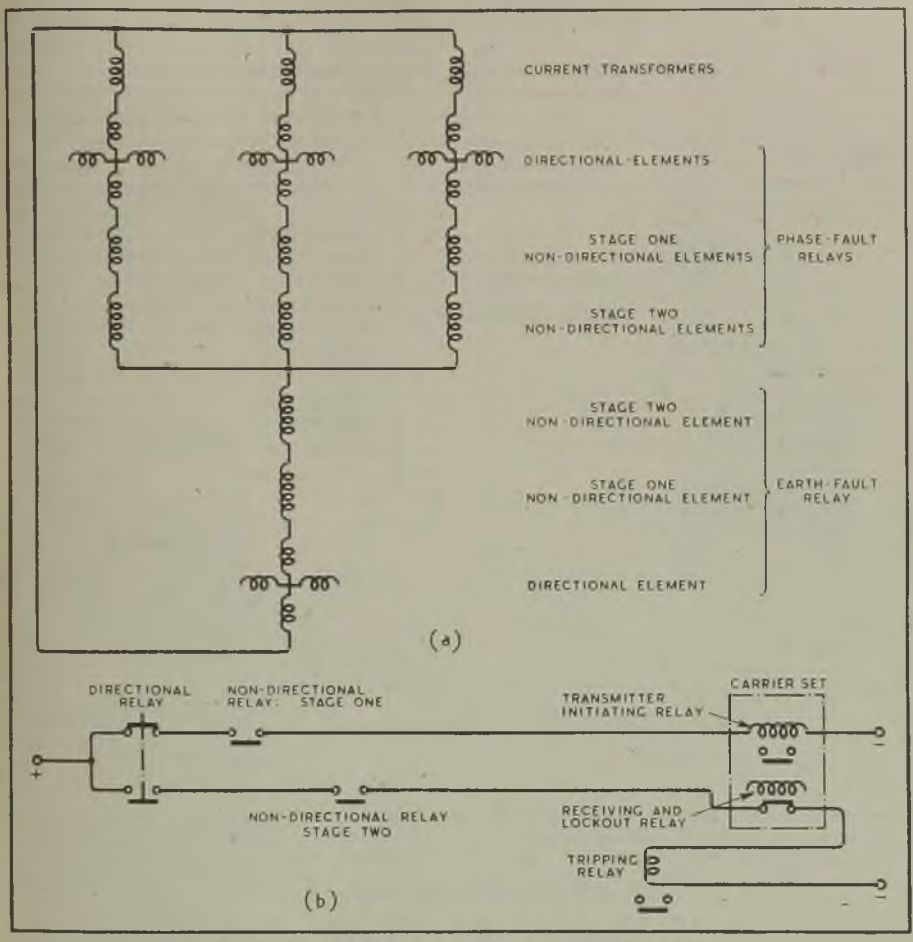


Fig. 3.—Simplified diagram of AC and DC connections

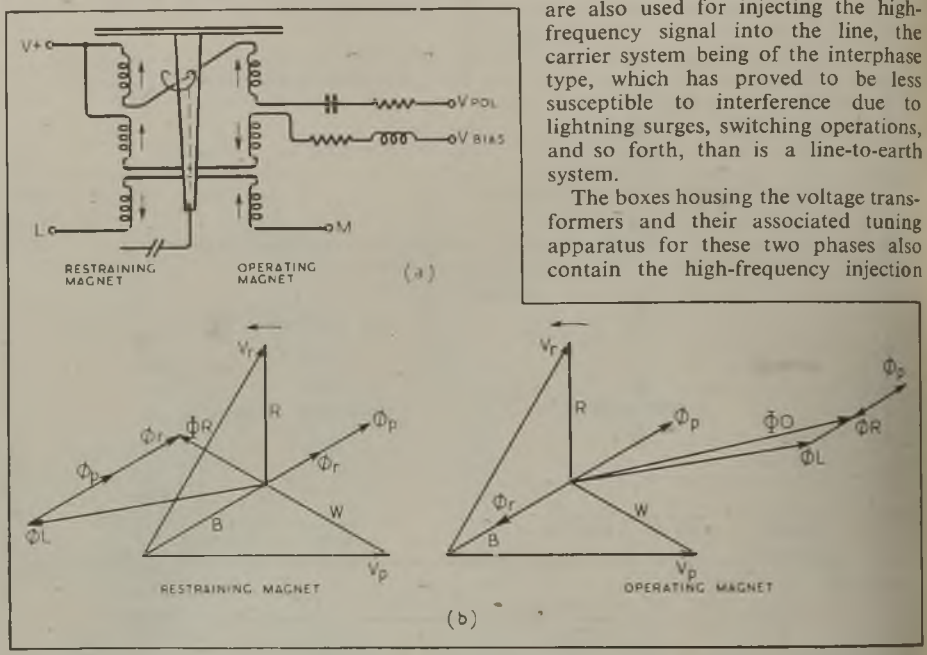
can take place. When the time-lag element does operate it energises the high-speed tripping elements, which open the circuit-breaker, seal themselves in and energise the appropriate flag indicators in the phase-fault relays.

Current Transformers.—The current coils of the fault-detecting relays are energised from current transformers in the circuit-breaker controlling the protected feeder and in the solidly-earthed neutrals of one or more power transformers. The transformer characteristics required depend on the maximum fault current that may occur in the protected feeder and also on the relay settings, since the latter affect the burden imposed on the transformers by the relays. The characteristics should be such that with the desired relay settings the current transformers do not saturate up to the maximum fault current.

Voltage Transformers.—The voltage for the directional relays is normally obtained from three capacitative transformers, each consisting of a condenser stack containing oil-filled plate condensers together with a step-down transformer and 50-cycle tuning components, the latter being accommodated with the voltage transformer in a weather-proof welded steel box underneath the condenser stack ; the whole assembly is mounted on a steel framework. The voltage transformer has two 63·5-V secondary windings, one for operating the phase-fault directional relays and the other for connecting in broken delta to the earth-fault relay when residual-voltage polarising of the latter is used. The condenser stacks of two phases are also used for injecting the high-frequency signal into the line, the carrier system being of the interphase type, which has proved to be less susceptible to interference due to lightning surges, switching operations, and so forth, than is a line-to-earth system.

The boxes housing the voltage transformers and their associated tuning apparatus for these two phases also contain the high-frequency injection transformers and their associated tuning and filter components. In addition each of the three boxes contains a protective spark gap and an earthing switch, which eliminates risk of shock by automatically earthing the bottom end of the main condenser stack when the door giving access to the voltage transformer and high-frequency equipment is removed. If suitable voltage transformers already exist, the voltage for the protection relays may be taken from them and the condenser stacks can then be used solely for injecting the h.f. carrier signal into the line, only two stacks being required.

High-frequency Equipment.—The carrier set comprises a voltage regulator panel,



V_p—polarising voltage ; V_r—restraining voltage ; $\emptyset_p$—flux due to polarising voltage ; $\emptyset r$—flux due to restraining voltage. $\emptyset L$—flux due to current; ΦO—resultant flux in operating magnet; $\emptyset R$—resultant flux in restraining magnet.

Fig. 4.—Principle of phase-fault directional element

transmitter panel, meter panel, receiver panel, telephone panel, filter-and-attenuator panel, high-frequency termination and balance panel and a terminal panel, all mounted in a ventilated metal cabinet (fig. 6). The receiver is permanently connected to the line, so that it is always ready to accept signals and the transmission is initiated by the fault-detecting relays as already described.

The object of the choke coils mounted on two of the condenser stacks (fig. 7), is to confine the high-frequency signals to the protected section and so to prevent loss of signal strength in adjacent sections. They are therefore tuned with a parallel condenser to form a rejector circuit at carrier frequency, but have negligible impedance at the power frequency. Each coil is fitted with a protective spark gap. The carrier sets and their associated high-frequency equipment are tuned to different frequencies in different line sections to avoid interference between adjacent equipments.

Fig. 5. — Typical assembly of relays on self-contained cubicle

The power for the carrier set is obtained from suitable rectifiers connected to the AC mains. In addition, 250-V and 50-V batteries normally float on the output circuits of the rectifier and receive a small trickle charge. They are large enough to maintain the protection for 24 hours.

Indications and Alarms. — Each of the phase-fault and earth-fault relays is provided with a flag indicator, energised through a contact on the stage-two element and a contact on one of the high-speed tripping elements. The high-speed elements of the tripping relay are also provided with contacts to give local and or remote alarms. The carrier set is provided with alarm relays, energised by the anode current of each valve, with indicating lamps.

Test links and terminals are provided for checking all currents and voltages; the equipment can also be completely isolated for checking its operation by means of secondary injection.

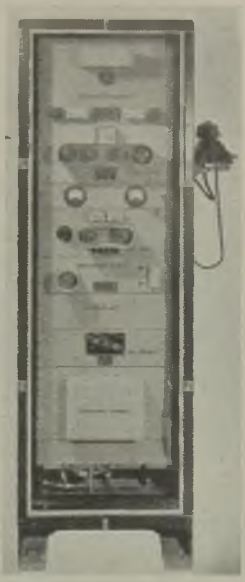


Fig. 6. — Typical cabinet containing carrier transmitter, receiver and telephone equipment

The carrier-set is provided with metering facilities for each individual valve, so that routine checks may easily be made. A test key also enables a signal to be sent from either end so that the strength received at the other end can be measured, but the signal is automatically interrupted if a fault occurs in the protected feeder during its transmission, so that routine testing does not interfere with protection.

Simplex Telephony.—If required, the high-frequency equipment can provide for telephony over the normal protection channels by modulation of the carrier current with voice frequencies, transmission then being at a lower level than for protection, so that the latter can operate at any time, whether or not the telephone is in use. Since approximately the same carrier frequency is used in both directions, the telephony is necessarily simplex (the two ends cannot transmit speech simultaneously). The addition of telephony is of considerable assistance when testing, particularly where communication facilities between substations are poor or non-existent.

Conclusion.—The application of high-frequency carrier-current protection is at present confined to overhead transmission networks. It seems likely that this limitation will continue,

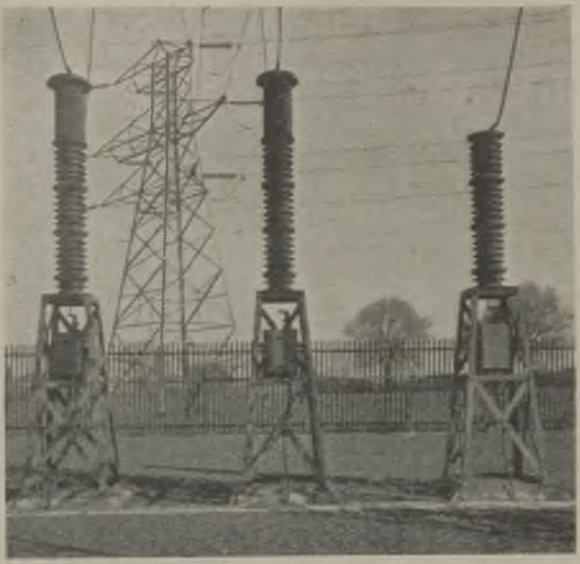


Fig. 7.—Typical group of capacitative voltage transformers, showing coupling condensers and high-frequency tuned choke coils for superimposed carrier protection at a 132-kV grid switching station

since the attenuation of a high-frequency signal is so great in cable networks as to make it unusable. The performance of the apparatus put into service during the last few years on lines wholly overhead indicates that the protection has not only the same high reliability and efficiency as other well-established pilotless protective systems, but also the advantages of a shorter operating time and of not requiring co-ordination with the settings of adjacent protection.

In consequence, it is probable that the use of the system on long overhead lines will extend considerably, more particularly because, in association with high-speed circuit-breakers, it provides a means of guarding against system instability under fault conditions.

The authors thank A. Reyrolle & Co., Ltd., and the General Electric Co., Ltd., for permission to publish the detailed information contained in this article, and the Central Electricity Board for permission to reproduce photographs.

The British Council

AN aspect of the work of the British Council (this month celebrating its tenth anniversary) that is of immediate utility is in furthering knowledge abroad of the contributions of this country to science and engineering. The Science Committee (chairman, Sir Harry Dale) and its engineering panel (chairman, Sir William Larke, and secretary, Professor S. J. Davies), in addition to translating into many foreign languages accounts of researches and technical achievements here, has given advice to overseas countries developing systems of engineering training so that these may be carried out with British equipment, textbooks and periodicals. Great weight is attached to providing facilities for personal contacts with scientists of the allied nations, including exchange visits. Scholarships have been awarded to students from abroad to enable them to study British methods at first hand, in which connection no opportunity has been lost of emphasing the high standards attained by our universities and institutions.

An example of the arrangements for students is the summer course in electrical engineering, which was held at the high-voltage laboratory of Queen Mary College, London, E., during the first half of this month. Four lectures were given by Professor W. J. John, Dr. A. Tropper, Messrs. J. M. Hawkins and C. T. W. Sutton on subjects ranging from elementary travelling-wave theory to the compression cable. Students will also work in the well equipped high-voltage laboratory, which has been described in the *Electrical Review*, and visit electrical engineering works in the London area.

Purchase Rights

IT has already been reported that the London and Home Counties J.E.A. had arranged meetings of local authorities in its area which own purchase rights in connection with company-owned electricity supply undertakings. The Authority's General Purposes Committee reports that such meetings have been held in the areas of the Slough & Datchet and Windsor companies; the Uxbridge & District Electric Supply Co.; part of the area of the Northmet Power Co.; the Brentford and (part) Metropolitan Companies; and the Egham & Staines and (part) Woking Companies. Discussions are being continued in each case and the Committee proposes to report fully to a later meeting of the Joint Electricity Authority.

ELECTRICITY SUPPLY

Appliance Earthing at Douglas.

Bradford. — HIGHER CHARGES. — Revised charges recommended by the Electricity Committee are estimated to produce an additional revenue of £16,000 per annum. It is proposed to increase by 5 per cent. (making 25 per cent. above the charges at July 1st, 1938) those rates which are not subject to a coal-price adjustment, except domestic and industrial lighting and lighting in churches, theatres, cinemas, etc.

Brighton.—GAS-ELECTRICITY CHOICE. — By a decision of the Town Council confirming a recommendation of the Health and Housing Committee, where gas only is available it is to be supplied to factory-made temporary houses, and correspondingly with electricity. If, however, both services are available electricity is to be used.

Chesterfield.—DISTRIBUTION WORK. — The Electricity Committee is to provide a supply to Arnold Laver & Co., Ltd., at West Bars at a cost of £377 and improve the supply to Joseph Clayton & Sons, Ltd. (£1,604) and in the Highfield area (£3,242).

Clitheroe.—OVERHEAD LINES.—The proposed erection of overhead lines at Bolton-by-Bowland by Clitheroe Corporation was considered recently by the North-East Lancashire Joint Planning Committee, which discussed the question of whether the rural beauty of the district would be marred. The Committee confirmed a recommendation of its technical sub-committee that the permission of the Minister of Town and Country Planning must be sought before any overhead service lines were installed anywhere in its area. Mr. G. Hetherington, town clerk of Clitheroe, said that an important consideration was the extension of electricity to farms.

Clyde Valley.—ELECTRICITY IN NEW HOUSING SCHEMES.—In the area served by the Clyde Valley Electrical Power Co., of more than 5,000 houses already passed for erection, over 3,000 will be of the " all-electric " type.

Douglas (Isle of Man). — EARTHING OF APPARATUS.—The Electricity Committee is to resume the work of earthing apparatus on consumers' premises which was commenced in 1938 but abandoned in consequence of the war. The borough electrical engineer estimates the cost at £3,300.

RESULT OF YEAR'S WORKING.—The Committee reports a surplus for the year of £15,851.

Dundee. — REVISED CHARGES. — The Town Council on June 28th agreed to increase electricity charges to certain consumers. The principal change is for lighting in which the charge goes up from 2¾d. to 3¼d. per kWh.

Hereford.—DECISION AGAIN REVERSED. — A recommendation of the Housing Committee that electric cookers, refrigerators and wash boilers should be installed in 100 prefabricated houses was the subject of a debate at the last meeting of the City Council. Mr. A. R. Clayton, who asked why the Committee had reversed its decision by now recommending the installation of electricity instead of gas, was told by Dr. J. V. Shaw that it had been influenced by its two women members who were of the opinion that electricity would be the better form of heating. Mr. C. G. Marchant, chairman of the Gas Committee, spoke in support of the use of gas, while Mrs. Bentley-Taylor was strongly in favour of electricity. Eventually an amendment by the Gas Committee chairman substituting gas for electricity was carried by fifteen votes to four.

Hereford's Altered Decision

Lichfield.—SUPPLY TO ESTATES.—The Electricity Committee is to provide a supply to housing estates at a cost of £19,115.

Marlow (Bucks).—ELECTRICITY CHOSEN.—When draft plans for 26 houses in blocks of six, four and two were presented to the Urban District Council the chairman of the Housing Committee said it was considered more economical to use electricity for all purposes. Councillor L. J. Smith thought that the houses should have gas as well, but Councillor Whitfield contended that when people got used to cooking by electricity they did not want to change; electricity was cleaner than gas. The Committee's recommendation in favour of electricity was approved.

Middlesbrough.—COAL AND ELECTRICITY CHARGES.—In a report to the Town Council, the borough electrical engineer stated that since 1937 coal charges to the electricity undertaking had risen by £25,000, while electricity consumers were not paying a penny more. This one-sided arrangement could not go on for ever.

Northern Ireland.—INQUIRY INTO BOARD'S PROPOSALS.—The inquiry into the application of the Electricity Board for Northern Ireland for confirmation of its No. 8 Development Scheme was continued in Belfast last week. Mr. Thomas Christie, B.Sc., chief engineer to the Board, said there was no reason why the Board should not go ahead with the development at once from an engineering point of view. Statements referring to the alleged inadequacy of supplies of electricity provided by the Portglenone undertaking and supporting the Board's application were entered on behalf of the Portglenone Manufacturing Co. and other local commercial concerns.

Mr. R. P. Beddow, secretary of the British Electric Traction Co., gave evidence on behalf of the Antrim Electricity Supply Co. and the Antrim Electricity Distribution Co. He said that the companies had provided the requisite supplies, including those required for war purposes, and they had been congratulated by the Ministry of Aircraft Production. In his opinion Scheme No. 8 was not a development scheme at all, but a very unfair means of taking powers to acquire his companies' undertakings. He drew attention to the absence of any provision for the compensation of the companies' staffs. In reply to Mr. Wynn Parry, K.C. (for the Board) he said that the British Electric Traction Co. had put £80,000 into the Antrim Electricity Supply Co. for which interest at 7 per cent. had been paid.

Rotherham.—POWER CHARGES.—The Electricity Committee is applying for authority to

adjust the price of electricity to cover the cost of fuel to power consumers not at present subject to a coal clause.

St. Marylebone.—STANDARD KITCHEN UNITS.—Housing Committee has appointed a sub-committee to make arrangements for standardised kitchen units, etc., in order to prevent any delay in the schemes for the erection of flats at the Barrow Hill and Church Street estates.

St. Pancras.—SWITCHGEAR FOR SUBSTATIONS.—The Council's five-year programme included the replacement of certain substation plant, and it is now proposed to obtain prices for such alterations from the makers of the original equipment, the total estimated cost being £43,916. It is also proposed to obtain prices for high- and low-voltage switchgear for three new substations (estimated cost £13,755). Application is being made for consent to defray £30,000 of the total cost out of unallocated profits, the remainder to be met by loan.

Stirling.—CHANGE-OVER.—Application is being made to the Electricity Commissioners for permission to change over the electricity supply system from DC to AC.

Swindon.—PURCHASE OF PLANT.—The Electricity Committee has decided to purchase plant and equipment from the Ministry of Supply for £8,000. The plant was installed by the Ministry at the G.W.R. works.

Wells (Norfolk).—STREET LIGHTING CHANGE.—The Urban District Council has accepted an estimate of the East Anglian Electric Supply Co., Ltd., for street lighting. Before the war gas was used for lighting.

Area Extension Inquiry

Opposition to Derby and Notts Company's Application

AN inquiry was held at Chesterfield on July 10th and 11th into an application by the Derbyshire and Nottinghamshire Power Co. to become the authorised suppliers for an area of some 70 square miles in North Derbyshire. The company's application for a North Derbyshire Electricity (Extension) Special Order to cover this district was opposed by the Chesterfield and Mansfield Borough Councils, Bolsover and Staveley Urban District Councils and Chesterfield R.D.C. They put forward an alternative scheme under which the area in dispute could be covered by an extension of the existing municipal undertakings of Chesterfield and Mansfield. It was also stated that an amalgamation of the Chesterfield and Bolsover undertakings was being negotiated in connection with the municipal scheme. The inquiry was conducted by Mr. H. Nimmo, Electricity Commissioner. Mr. Craig Henderson, K.C., represented the power company and Mr. E. J. C. Neep the municipal authorities.

No Authorised Supply

Mr. Craig Henderson explained that the area concerned was the only part of Nottinghamshire and Derbyshire for which there was no authorised supply. The Derby and Notts Co. supplied all the remainder of the two counties with the exception of the urban areas administered by municipal undertakings. The company's mains were in and could quickly be extended to meet domestic needs and the demands of forthcoming housing development. It was already supplying a substantial part of North Derbyshire under a 1932 Extension Order. Many applications had been received for the company to supply premises within the area which was the subject of the inquiry. Between 1932 and 1935 Fringe Orders had been obtained to supply some 1,092 premises including a housing estate of Chesterfield R.D.C. at Gleadless. In the urban district of Staveley and adjoining parishes there were eight non-statutory companies giving supplies, obtaining electricity in bulk from the Staveley Coal & Iron Co. Complaints had been received about the frequency (30 cycles), the price and the general inadequacy of the service. The power company had now completed the purchase of those non-statutory companies and, if that Order were granted, it would introduce a standard service.

Mr. C. R. King, general manager the power company, said that when the company took over the non-statutory companies it applied its own lower tariffs. The company estimated that it would sell 2½ million kWh in the proposed added area in the first year rising to 3,400,000 in the third year. Capital expenditure over the three years was put at £207,500. It expected to make a small margin of profit the first year.

Ald. H. Varley, chairman of the Chesterfield Electricity Committee, said the Chesterfield undertaking was well equipped for development. The local authorities were all very perturbed about the application and set up a Consultative Committee. A consulting engineer was called in to evolve a counter scheme under which the area in dispute could be supplied by Chesterfield on the westerly side and Mansfield on the easterly side. They intended to apply at once for Special Orders to extend their service areas to cover the district. Chesterfield Corporation and the other local authorities were out for municipal ownership of the electricity distribution system.

Councillor H. Needham (Bolsover U.D.C.), Mrs. D. M. Sutton (Staveley U.D.C.), Mr. Sam Sales (Chesterfield R.D.C.) and Alderman J. A. Beck (Mansfield) all gave evidence in favour of the counter scheme. Mr. R. W. Mountain, consulting engineer to the local authorities' Consultative Committee, gave details of the counter proposals.

Mr. Neep said that the power company had jumped in quickly to "scotch" in that area for all time any question of competition from local authorities.

Mr. Craig Henderson claimed that the Chesterfield and Mansfield schemes merely existed on paper. They were based on the power company's scheme and it was frankly admitted that the scheme depended on using the power company's mains and bulk supply.

Ignition Tester

Examination of Running Engines

FAULTS in the sparking plugs or cables, distributor, magneto, coil, or battery forming part of the ignition system of an internal combustion engine may easily be diagnosed pictorially by means of a cathode-ray oscillograph. The instrument, as made by the English Electric Co., Ltd., is described by Mr. F. R. F. Ramsay (chief ignition engineer, D. Napier & Son, British patent 563,502) as providing a series of peaked figures on a single screen, one for each sparking plug arranged in the firing order of the engine cylinders.

The shapes are suggestive of particular faults. For instance, an excessively large spark gap forms a high-peak figure while a short-circuited gap forms a low-peak figure. A misfire causes the figure to flicker and a weak rocker, which causes the contacts to bounce above a certain speed, makes the row of figures dance on the screen as the engine is speeded up in a way that suggests the cause of the trouble. A valuable feature of the instrument is that direct access to the engine is not necessary.

The electrical pulses which actuate the cathode-ray tube are obtained from the low-voltage side of the magneto, or coil, instead of from the secondary side which supplies the sparks. The primary and secondary windings of any magneto, or coil, constitute a transformer whose primary is open-circuited when the primary contact breaker opens to form the spark on the secondary side so that any alteration in the secondary load (sparking plug) will alter the wave-form of the primary voltage peak shown on a cathode-ray screen, thus enabling the nature of the secondary load and its condition to be inferred. The instrument can be connected to the magneto switch or, in the case of battery ignition, to the low-voltage terminal of the coil; or, since the connection does not affect the ignition, a permanent socket can be provided for it on the instrument panel of a motor vehicle.

The " fixing " of the row of figures in firing order is attained by triggering the cathode-ray with a tiny fraction of the voltage tapped from one of the plugs. The ray then traverses the screen once for every two revolutions of the engine. The trigger connection does not affect the spark at the plug; consequently it can be made permanently or otherwise. An attenuator dial, which consists of a stepped resistance, shunts the primary current in increasing amounts as the dial is operated and enables the viewer to see which plugs are likely to misfire.

A fully " tropicalised " instrument for the Services is of about the same dimensions as a portable typewriter, and is arranged to be energised either from 220-V AC mains, or from a 6 to 24-V accumulator, as desired. It can be used on a vehicle or aircraft while in motion and can be easily adapted as a switchboard instrument for the routine supervision of a group of engines, as in a multi-engined aircraft, or boat, or in an engine test house.

The instrument owes its inception to an approach to the Ignition Department of D. Napier & Son, manufacturers of the " Sabre " engine, by the Department of Tank Design during the war for something which would locate faulty plugs on tank engines without the long delay attending the removal of each plug from its usually inaccessible and completely screened position.

" Tropicalised " cathode-ray ignition tester for the Services

Electricity in Victoria

THE following figures have been issued by the State Electricity Commission of Victoria for the year 1943-44 : Electricity generated, 1,477·7 million kWh. Electricity sales, 1,201·3 million kWh. Number of consumers (excluding bulk sales), 300,465. Average price per kWh sold : domestic, 1·822d. ; industrial, 0·812d. ; commercial, 1·835d. Number of farms served, 7,467. Number of motors connected, 59,483 (365,746 HP).

Although the restrictions on the buying, selling and hiring of heating and cooking appliances have been lifted for some time, essential materials for their manufacture are still either strictly controlled or in very short supply, so that the position so far as the consumer is concerned is little altered. Electrical fittings of some kinds are now gradually coming on to the retail market, but many items are still difficult to secure. Strangely enough, it always seems that the lines mostly needed are those which are last to make their appearance.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The General Electric Co., Ltd., in its report for 1944-45 to be presented at the annual meeting on July 26th, announces a profit on trading and income from investments (including receipts from subsidiaries) of £1,880,697, as compared with £1,812,409 for 1943-44. The net profit, after meeting depreciation, directors' fees and pension fund contribution, is £1,303,919 (£1,240,730). Adding the £865,134 brought forward the total available is £2,168,253. Provision for income tax is again £700,000 and after meeting the preference dividends and the ordinary dividend (10 per cent. plus 7½ per cent. bonus) a balance of £964,270 is carried forward.

The Enfield Rolling Mills, Ltd., show a profit for 1944 of £102,875, including tax refund. This compares with £113,921 for 1943. Depreciation takes £39,152 (£45,055), interest £4,385 (£3,773), debenture interest £7,896 (£8,040), fees, war damage, etc., £8,671 (£13,619), obsolescence £1,872 (£10,260) and taxation £28,500 (£8,000). The dividend is maintained at 5 per cent. and £121,457 (£123,058) is carried forward.

In a statement circulated with the report the chairman, the Earl of Verulam, says that the company's sheet and strip mill has been one of the largest non-Government producers of brass strip for small arms ammunition, the output amounting to 22,000 tons. In addition 35,500,000 brass blanks for 20 mm. cannon shells and 2,000,000 blanks for 2-pdr. anti-tank shells have been produced. They have also manufactured 9,500,000 copper driving bands. Throughout the war they have been engaged on copper alloys and have patented several other alloys for special purposes. Their zinc mill has been required to produce large quantities of battery zinc. The company is now operating three secondary aluminium refineries.

Thomas Bolton & Sons, Ltd.—An increase in the trading profit from £288,398 to £298,568 is reported in the accounts for the year ended March 31st last. After providing for depreciation £60,000 (£70,000), directors' fees £3,750 (same) and debenture interest. £17,435 (same) there remains a net profit of £217,383 (£197,016). Income tax takes £138,152 (£131,072), general reserve £10,000 (£20,000) and contingencies reserve £30,000 (£10,000). A final dividend of 5 per cent. with a cash bonus of 2½ per cent. again makes the total distribution 10 per cent. and £75,603 (£68,872) is carried forward.

Referring to changes in the directorate, which have taken place since last year, a statement by the chairman, Mr. P. V. Hunter, announces the appointment of Mr. T. J. Tait, secretary to the company until his retirement from that position in March. Mr. J. A. Foulds succeeds him as secretary. With regard to the company's activities during the war, the chairman mentions special alloys for aircraft and aero engines. About 50 million machined components, many to extremely fine limits of dimensions, have been supplied, together with nearly 60 million copper and cupro-nickel shell bands for 2-pdr. quick-firing guns up to the largest calibre naval ordnance. Many hundreds of tons of bronze wire and strand have been supplied for seamining operations, and several more hundred tons of tinned copper wire for the buoyant cables developed for disposing of magnetic mines. The length of wire produced for these two purposes alone was approximately a hundred thousand miles.

Revo Electric Co., Ltd.—At the general meeting of the company on Wednesday the chairman stated that the increased profits were due to increased production. Reserves now totalled £285,000. During the war new plant costing £250,000 had been installed and new buildings amounted in area to approximately 30,000 sq. ft., plans being in hand for the erection of a further 36,000 sq. ft. of buildings. Vast quantities of war equipment had been produced and a prominent part had been taken in the development of fluorescent tubular lighting. Cookers were already being manufactured for the Government's emergency housing schemes and to meet current rehabilitation problems. New designs would be made available as quickly as possible, and other new products would include a house service unit, and street lighting and industrial equipment.

Ward & Goldstone, Ltd., report a net profit of £38,939 for the year ended March 31st last, as compared with £28,330. A final dividend of 10 per cent. (same) is to be paid with an additional 5 per cent. bonus, making 25 per cent. (20 per cent.). The carry-forward is increased from £46,194 to £55,542. In a statement accompanying the report the chairman, Mr. A. A. Goldstone, says that no account has been taken of the sum likely to be allowable for tax refund but the total is substantial.

Franco Signs, Ltd.—Mr. J. F. Mallabar, chairman, stated at the annual general meeting that a staff pension scheme had been instituted during the year. The general reserve now stood at £85,000. During the war the company had turned over its production to making parts of Mosquitoes, torpedo tubes, P.I.A.T. gun mountings, mortar and other bombs, floats for Sunderland aircraft, and general stores, including medical glassware. One factory, since rebuilt, was severely damaged by bombs and work at others was badly hampered, yet a labour force which at its peak exceeded 3,000 employees continued to work steadily.

Electrical Finance & Securities, Ltd.—Mr. H. C. Drayton, chairman, stated at the annual general meeting that consumers supplied by their companies at the end of December last numbered 66,661, as compared with 62,903 at the end of 1939. The connected load was 207,391 kW (177,374 kW), and sales of electricity amounted to 113½ million kWh (66½ million kWh). The revenue had increased from £461,000 to £753,000, the average price paid by consumers falling from 1·66d. to 1·59d. per kWh. With regard to proposals that electrical energy should be sold on the " postalisation " principle, Mr. Drayton said that the telephone service had not been dealt with in this way although the principle was the same and the necessary

basic condition was there, namely, State monopoly. Of course, there was the chance that it could not be done without the State having to make up the deficiency or a much higher rate being paid by industry and business.

Electrical Switchgear & Associated Manufacturers, Ltd.—Dividends, etc., received in respect of the year ended March 31st last totalled £35,675 (against £35,584) and the net profit was £17,878 (against £16,820). The ordinary dividend is maintained at 20 per cent. and £16,435 (£15,182) is carried forward.

The Folkestone Electricity Supply Co., Ltd., a subsidiary of the County of London Electric Supply Co., Ltd., reports a revenue for 1944 amounting to £141,245 (£115,402). Charges and fees absorb £89,318 (£75,256), depreciation, etc., £25,000 (£23,500), taxation £20,000 (£29,000), contingencies £3,000 (£2,000) and preference dividend for the two years to September 30th, 1944, £2,500 (same), leaving £9,205 (£7,778) to be carried forward.

The Delhi Electric Supply & Traction Co., Ltd., is again to pay a final dividend of 5 per cent., tax free, making 9 per cent., tax free (same).

The company's Delhi agent has visited London for discussions on the Provincial Government's proposal to purchase the company's undertaking. Upon his return he will take up a number of important points with the Delhi authorities. The directors state that they find it impossible to estimate what the agreed fair market valuation will be. The company has an issued capital of £200,000.

J. Stone & Co., Ltd.—Giving details of the company's war effort at the annual general meeting on July 10th, Mr. Kenneth Preston, the chairman, said that over 300,000 automatic voltage and current regulators were supplied to the M.A.P. alone. They had been supplied for aircraft, tanks, naval vessels and new developments such as beam location. All their light alloy foundries had been working at high pressure and castings had been supplied for the Bristol Hercules, Rolls-Royce Merlin and Napier Sabre aeroplane engines. Altogether 28,300,000 incendiary bombs were produced by the company, while marine propellers numbered more than 20,800. Numbers of battleships, cruisers and carriers had been fitted with aeroplane lifting cranes embodying the company's gears, while some thousands of bomb hoists for aircraft had been produced.

The Ceara Tramway, Light & Power Co., Ltd., is negotiating privately in Brazil for the sale of the undertaking to the Government of the State of Ceara.

The Burma Electric Supply Co., Ltd., states that the profit to July 31st, 1944, was £122 raising the balance carried forward to £1,627.

The Palestine Electric Corporation, Ltd., is maintaining the dividend on the ordinary and "A" ordinary shares at 5 per cent., tax free. The net profit for 1944 was £119,129 (£125,687) after providing for taxation and £30,000 for deferred maintenance. In the previous year £20,000 was allocated to war reserve. The output during 1944 was 173·6 million kWh (against 149·5 million.)

The Welwyn Garden Electricity Supply Co., Ltd., announces a net revenue of £22,460 for the past year. An ordinary dividend of 1·8d. per share is being paid.

Ultra Electric (Holdings), Ltd., state that the net balance for 1944-45 was £12,893 (against £10,587). The dividend remains unchanged at 10 per cent. The holding in the operating company, Ultra Electric, Ltd., (at cost) has risen from £198,998 to £263,998. That company's trading profit was £53,050 (against £64,140 for the preceding eleven months). It is hoped to have "Ultra" products on the market again before the end of this year.

E. K. Cole, Ltd., have declared an interim dividend of 8 per cent. (same).

The Mirrlees Watson Co., Ltd., is again paying a dividend of 8 per cent.

The Tellus Super Vacuum Cleaner Co., Ltd., reports a net profit of £241 for 1944, as compared with £225 in the previous year. This reduces the debit balance to £17,007.

The Telegraph Construction & Maintenance Co., Ltd., is maintaining its interim dividend at 5 per cent.

New Companies

Johnson British Electric, Ltd.—Private company. Registered July 3rd. Capital, £12,000. Objects: To carry on the business of manufacturers of, and dealers in electrical and radio goods, fittings and equipment, etc. Directors: A. E. Johnson, Bron Wylfa, St. Asaph, North Wales; and L. G. Johnson, 43, Essex Road, E.4. Registered office: 446, Salisbury House, E.C.2.

Philectric Installations, Ltd.—Private company. Registered July 6th. Capital, £2,000. Objects: To carry on the business of electrical installation and illuminating engineers, etc. Directors: I. McG. Phillips, Sheephill Farm, Stoke d'Abernon, Cobham, Surrey, and two others. Registered office: 276, Hook Road, Surbiton.

G. Bernard Pountney & Knight, Ltd.—Private company. Registered July 6th. Capital, £2,000. Objects: To carry on the business of electrical, wireless and general engineers, etc. Directors: G. B. Pountney, 45a, Church Hill, Northfield, Birmingham; and A. R. Knight, 18, The Causeway, Yardley, Birmingham. Registered office: 45a, Church Hill, Northfield, Birmingham.

Mec-Electric, Ltd.—Private company. Registered July 9th. Capital, £1,000. Objects: To carry on the business of dealers in radio sets and accessories, batteries, etc. Directors: W. H. Hawkins, The Vineries, Gillingham, Kent; and L. D. Fleet, 102, Alarick Crescent, New Addington, Surrey. Registered office: 95-97, High Street, Chatham.

M. Brosan, Ltd.—Private company. Registered June 28th. Capital, £3,000. Objects: To acquire the business of a television, electrical and wireless manufacturer and wholesale and retail distributor carried on by Mrs. M. Brosan. Directors: Margaret Brosan and R. Brosan (director of British Diamid, Ltd., etc.), both of 187, Willesden Lane, N.W.10. Registered office: 245, Kilburn High Road, N.W.6.

H.N. Electrical Supplies, Ltd.—Private company. Registered June 28th. Capital, £500. Objects: To acquire the business of a manufacturer of and wholesale dealer in electrical supplies carried on by Hyman Nathan, as "H.N. Electrical Supplies," at 46, Golden

House, Pulteney Street, London, W.1. First directors: J. Maizner, 49, Manor Avenue, S.E.4, H. Nathan, 83, Mount Pleasant Road, N.W.10, and A. Fry, 40, Gloucester Place, W.1. Solicitors: Thornton, Lynne & Lawson, 240, High Holborn, W.C.1.

Lat Manufacturing Co., Ltd.—Private company. Registered July 5th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, batteries, accumulators, motors, radiators, torches, motor accessories, etc. Directors: G. V. Lateulere, 39, Falstaff Road, Shirley, Birmingham, and two others. Registered office: 38a, Paradise Street, Birmingham. 1.

Evolution Accessories (Engineering), Ltd.—Private company. Registered July 4th. Capital, £1,000. Objects: To carry on the business of manufacturers, importers and exporters of, and dealers in, lamps, bulbs, valves, electrical goods, accessories and equipment, neon signs, ultra violet ray, radio and television apparatus, etc. Subscribers: Helen Horowitz, 31, Vallance Road, E.1; and G. Perlmutter, 58, Lingwood Road, E.5. Secretary: E. H. Hawtin. Registered office: 203, Regent Street, W.1.

Electrical Products (Colne), Ltd.—Private company. Registered July 2nd. Capital, £1,000. Objects: To carry on the business of electrical, motor, television, radio and mechanical engineers, etc. Directors: E. Pearson and Blanche Pearson, both of 28, Selby Street, Colne. Registered office: 29, Albert Road, Colne.

Lancing Electrical Manufacturing Co., Ltd.—Private company. Registered July 5th. Capital, £1,000. Objects: To carry on the business of electrical, wireless and general engineers, etc. Directors: F. W. Langley, Methuen House, Crabtree Lane, Lancing; L. L. Lloyd, 1, Rosebery Avenue, West Worthing and L. D. Holgate, 2, East Road, S.W.19. Registered office: Commonwealth House, New Oxford Street, W.C.1.

F. E. Jagger, Ltd.—Private company. Registered June 22nd. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical equipment, batteries, lamps, etc. F. E. Jagger, 62, Abbotsford Road, Blackpool, is the first director.

Companies' Returns

Statements of Capital

Phœnix Electrical Co. (London), Ltd.—Capital, £1,500 in 1,494 preference shares of £1 and 120 ordinary shares of 1s. Return dated October 27th (filed December 20th), 1944. All shares taken up. £1,500 paid. Mortgages and charges: Nil.

Scott Insulated Wire Co., Ltd.—Capital, £14,000 in 4,000 preference and 10,000 ordinary shares of £1. Return dated December 31st. 2,075 preference and 10,000 ordinary shares shares taken up. £12,075 paid. Mortgages and charges: Nil.

Universal Electric Time & Telephone Systems, Ltd.—Capital, £12,000 in 6,000 6 per cent. cumulative redeemable preference and 6,000 ordinary shares of £1. Return dated March 5th. 5,850 preference and 6,000 ordinary shares taken up. £11,850 paid. Mortgages and charges: £4,525.

Increase of Capital

A. Webster & Son (Burnley), Ltd.—The nominal capital has been increased by the addition of £1,500 in £1 ordinary shares beyond the registered capital of £500.

Mortgages and Charges

Modern Telephone Co., Ltd.—Particulars filed of £5,000 debentures authorised June 22nd, 1945, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Davey, Paxman and Co., Ltd.—Mortgage on various properties in Colchester, dated June, 12th to secure £380. Holders: Trustees of Colchester Permanent Benefit Building Society.

H. Tinsley & Co., Ltd.—Charge on Afton Lodge, Freshwater, Isle of Wight, dated June 21st, to secure £2,000 and any other moneys due or to become due from the company to the Temperance Permanent Building Society.

Liquidations

Relay Equipment, Ltd.—Meeting of members August 14th at the offices of Newman Ogle, Bevan & Donald, Spencer House, South Place, E.C.2, to hear an account of the voluntary winding-up by the liquidator, Mr. W. H. Bevan.

B. & B. Batteries, Ltd.—First meetings of creditors and contributories July 24th at Columbia House (3rd floor), Aldwych, W.C.2.

Princeley Radio & Television Corpn. (of Gt. Britain), Ltd.—First meetings of creditors and contributories July 24th at Columbia House (Room 56, 5th floor), Aldwych, W.C.2.

Whitehead Switchgear & Inventions, Ltd.—Last day for receiving proofs for dividend July 27th. Liquidator, Mr. L. S. Findlay, 35, Windsor Place, Cardiff.

Bankruptcies

W. G. Head, electrical engineer, lately carrying on business at 30a, High Street, Ashford.—Application for discharge to be heard on August 7th at the Guildhall, Canterbury.

T. R. W. Wyness and **G. W. Bale**, trading as Wyness & Bale, electrical engineers, 13, Commercial Street, Brighouse, Yorks. (Separate application of G. W. Bale.)—Application for discharge to be heard on August 2nd at the County Court, Prescott Street, Halifax.

R. J. M. Holmes (deceased), late of 17, Buston Terrace, Newcastle-upon-Tyne, electrical engineer.—Last day for receiving proofs for dividend July 28th. Trustee, Mr. A. K. Ferguson, Gibb Chambers, Westgate Road, Newcastle-upon-Tyne, Official Receiver.

J. J. Symons, formerly carrying on business as the Zodiac Peerless Electric Lamp Co., at 25, Denmark Street, Charing Cross Road, W.C.—Order for discharge made at the London Bankruptcy Court on July 10th, subject to judgment for £585.

STOCKS AND SHARES

TUESDAY EVENING.

STOCK Exchange markets await with caution the issue of the General Election. At the time of the poll, a good deal of optimism was manifest. Estimates of a Conservative majority were running high. For no special reason, the hopefulness then engendered, gave way to a more subdued sentiment. Prices that had been advanced pretty sharply on the eve of the Election gave way from the best, and the markets assumed a slightly duller cast. Here and there, speculation and speculative investment make their influence felt, but speaking generally, the present disposition is to wait upon the course of events for the next week or so. An active market prevails in Cossor shares. In the radio group as a whole, interest is well sustained.

Home Railways

The Home Railway dividend season opens next week, but the interim dividends for the first six months of the year excite no more than tepid interest. The Southern Railway will presumably pay the usual half yearly 2½ per cent. due on the preferred stock. The price shows no change at 75½, but the 5 per cent. preference is better at 118½. London Passenger issues hold their previous levels. British Electric Traction deferred is 15 points better at 1215, and Tillings hold their previous advance to 58s., declaration of the customary interim dividend of 5 per cent. having no effect.

The Rising Tide

British Insulated Callender's Cables are 1s. higher at 45s. 6d., and Henley's keep steady at 28s. Siemens, after 39s., returned to 38s. 6d., leaving a rise of 4s. in three weeks, while Johnson & Phillips, at 79s. 6d., have put on 4s. 6d. in about the same time. English Electrics are 1s. higher on the week, at 56s., Crabtrees 6d. better at 43s. 6d., Metal Industries "B" similarly harder at 51s. 6d., while International Combustions at 8¼ and Tube Investments at 5⅝ are both 2s. 6d. up. Westinghouse Brake have risen to 79s. Veritys are a little higher at 9s., and Allen Wests at 8s. 6d. Ward & Goldstone remain at 30s. 6d. East African Power new shares at 6s. remain at the issue price of 29s.

The General Electric Company has declared its usual dividend of 10 per cent. and bonus of 7½ per cent., making 17½ per cent. for the year. The price of the shares now treads closely upon the level £5, at which the yield on the money would be 3½ per cent.

Miscellaneous Movements

A. C. Cossor shares are an erratic market and at 41s. 6d., the shares are 1s. lower. Philco eased off to 14s. E.M.I. came back to 34s. 9d., after being 9d. higher. Telephone Rentals hardened to 12s. 9d. Cable & Wireless ordinary receded to 92 and the 5½ per cent. preferred to 114. In spite of this, Globe Telegraph & Trust ordinary are 1s. 6d. to the good at 44s. International "Tel. & Tel." are two dollars lower at 33, on selling from New York, where a spasm of weakness was attributed to fears of a Labour victory at our polls. Ceara Tramways debenture has spurted to 60 on the likelihood of the company being taken over by the Brazilian Government. The price stood at 42½ at the beginning of this month.

Electric Construction

The Electric Construction Company's year ends with March, and the annual report which appeared last July showed record results. The accounts for the year ended last March report rather less profit, although the reduction, £3,600, is negligible and has, of course, no effect upon the dividend which is maintained, as previously announced, at 12½ per cent.

The company's report is particularly interesting from its reference to the decrease in national work and in Government orders. The report points out that an interval must elapse before the works can return to normal peacetime production, but, in his statement, the chairman says that the prospects are good. From this, it is reasonable to expect that the 12½ per cent. dividend, under ordinary conditions, can be continued.

At the present price of £3 a share, the yield comes to £4 3s. 4d. per cent. on the money. The company is in a strong financial position and the general reserve has been raised to £250,000 by the allocation of £20,000 from profits of the past year.

Revo Electric

Revo Electric has done well for the year ended March 31st, last, the profit, after depreciation, being £249,266, an increase of £48,000. When all allowances are made, there is £70,121 left, against £66,845 for the previous year. Reserves are raised to £250,000 and the dividend, as already announced, with the bonus, makes 17½ per cent. for the year. At the currently-quoted 44s., the yield on the money is practically 4 per cent. The company's issued ordinary capital of £367,500 is all in ordinary shares of 10s. each.

New Money

Withdrawal of the ban on new capital issues ranging up to £50,000 is of material assistance in those cases where comparatively small amounts of money are required, rather than such considerable sums as would render necessary an approach to bankers or to shareholders. No official permission need be applied for on behalf of a company wanting to raise anything up to £50,000. The intention has been to assist the smaller business. The bigger concerns, however, experience the benefit of the wider relaxation now allowed to companies, and others, that wish to obtain additional capital for the extension and development of their business under peacetime conditions.

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.

P. J. G. ADAMS. — "Electric water heaters." 18105. November 2nd, 1943. (570316.)

W. Blackman, Cinema-Television, Ltd., and G. A. R. Tomes.—"Photo-electric cells." 6478. May 20th, 1941. (570199.)

Bratt Colbran, Ltd., and R. H. Masterman. —"Electric heating elements." 14725. September 8th, 1943. (570300.)

British Thomson-Houston Co., Ltd.— "Modulation indicating or measuring means." 19498/43. November 23rd, 1942. (570279.)

British Thomson-Houston Co., Ltd., and J. Moir.—"Thermionic valve voltage regulators." 14515. September 6th, 1943. (570299.)

British Thomson-Houston Co., Ltd., and J. H. Walker.—"Inductor alternators." 9754. June 17th, 1943. (570246.)

C. A. V., Ltd., W. A. Bevis, T. Curzon and V. Bedggood.—"Electric switches suitable for gun firing mechanisms." 20364. December 6th, 1943. (570285.)

Cinema-Television, Ltd., and A. Sommer.— "Methods of coating surfaces by evaporation." 16553. December 23rd, 1941. (570200.)

Communications Patents, Ltd., and G. B. Ringham. — "Radio wave trans-receivers." 20036. December 1st, 1943. (570283.)

Consolidated Mining & Smelting Co., of Canada, Ltd. — "Addition agent for caustic alkali electrolytes used in the production of hydrogen and oxygen." 7868/42. June 26th, 1941. (570233.)

F. B. Dehn (Richmond Manufacturing Co.). —"Magnetic separators." 20826. December 13t, 1943. (570195.)

E. I. Du Pont De Nemours & Co.—"Electrically insulated conductors." 21448/43. December 28th, 1942. (570226.)

E. I. Du Pont De Nemours & Co., and A. G. Gray.—"Electrodeposition of lead." 20681. December 10th, 1943. (570287.)

G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd.—"Power transmission toothed gearing." 14055. August 27th, 1943. (570192.)

L. Fuller and E. W. Sudlow.—"Electric secondary batteries." 17382. October 21st, 1943. (570309.)

H. Jefferson.—"Phase shifting circuit arrangements." 1497. February 4th, 1942. (570203.)

O. E. H. Klemperer.—"Cathode ray tubes." 2406. February 13th, 1943. (570213.)

Landis & Gyr, Soc. Anon.—"Coin freed apparatus, *e.g.*, for electricity or gas." 13378/42. January 8th, 1942. (Patent of addition to 550395 and 563041.) (570209.)

Linde Air Products Co.—"Electric welding apparatus." 20803/43. December 18th, 1942. (570288.)

J. Lucas, Ltd., J. A. Laird and H. E. Whitehouse.—"Ignition magnetos." 19797. November 26th, 1943. (570281.)

Marconi's Wireless Telegraph Co., Ltd., G. L. Grisdale and H. C. Norwood.—"Logging scales suitable for use in radio receivers." 20628. December 9th, 1943. (570224.)

T. Price & Son (Stampers), Ltd., and E. E. Price.—"Electrically heated smoothing irons." 14969. September 13th, 1943. (570303.)

L. J. Van Rooyen and W. O. Agar.—"Radio direction finders." 1502. February 4th, 1942. (570204.)

Scophony, Ltd., and G. Wikkenhauser.— "Systems for transmitting intelligence with the aid of a beam of light." 21555. December 23rd, 1943. (570227.)

C. Shaw. — "Electrically heated floors." 11101. July 8th, 1943. (570251.)

Siemens Bros. & Co., Ltd., and R. S. Bone.— "Telephone instrument circuits." 21408. December 21st, 1943. (570291.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—"Metal vapour electric-discharge lamps." 19396. November 19th, 1943. (570324.)

C. G. Smith.—"Secondary batteries." 17778. October 28th, 1943. (570312.)

H. G. Solomon.—"Electric condensers more particularly intended for the production of h.f. impulses and for use in h.f. circuits." 11187. July 9th, 1943. (570188.)

Standard Telephones & Cables, Ltd., and L. J. Heaton-Armstrong.—"Antenna systems." 417. January 12th, 1942. (570201.)

Standard Telephones & Cables, Ltd., and L. H. Webb.—"Electrical connecting elements." 12707. August 6th, 1943. (570255.)

F. L. Steghart.—"Electric measuring instrument." 10962. July 6th, 1943. (570184.)

W. E. Stilwell, Jnr.—"Remote control circuit-breaker with overload protection." 8229/43. June 5th, 1942. (570264.) "Circuit-breakers for controlling electric circuits." 19722/44. June 5th, 1942. (Divided out of 570264.) (570293.)

V. G. Manufacturing Co., Ltd., and W. Blain.—"Connectors for electrical conductors." 15218. September 16th, 1943. (570307.)

Westinghouse Electric International Co.— "Control systems for electric motor driven vehicles." 4517/43. March 19th, 1942. (570215.)

TRADE MARKS

THE following applications have been made for British trade marks. Objections may be entered within a month from July 11th:—

GLADIATOR. No. 629,822, Class 9. Wireless and television instruments and apparatus, loudspeakers, sound amplifiers, battery chargers and parts thereof not included in other classes. —Metropolitan Distribution, Ltd., Trewirgie Vean, Falmouth Road, Redruth, Cornwall.

HESCO. No. 633,990, Class 9. Electric flat irons and vacuum cleaners.—Hornby Electrical Supplies Co., Ltd., 21/25, St. Anne's Court, London, W.1.

ALDACO. No. 634,865, Class 11. Rings for holding electric lamp shades. — Archibald Lawrence Williams, 14, Laburnum Grove, North End, Portsmouth.

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.

Belfast.—August 3rd. Electricity Department. Fire extinguisning equipments for substations; and replating battery. (See this issue.)

Chichester.—August 17th. City Council. About 20 miles of 11 kV and control cables and accessories. (July 13th.)

Littleborough.—July 23rd. Electricity Department. 11-kV ring-main unit and l.v. switchgear. (July 6th.)

Lowestoft.—July 26th. Electricity Department. Supply and delivery of l.v. cable. (See this issue.)

Manchester.—July 30th. Electricity Department. Manufacture, testing and delivery at Stuart Street generating station of 33,000-V cable. (July 13th.)

New Zealand.—September 18th. Public Works Department. One 23,000-BHP turbine and 16,667-BHP generator for Waitaki power scheme.

Southampton.—August 1st. Electricity Department. Cables and domestic appliances. (July 13th.)

Swansea.—August 4th. Borough Council. Electrically equipped pumping station at Morristone Park. Trevelyan Price, waterworks engineer, Guildhall, Swansea. (Deposit, £5 5s.).

Whittingham, Preston.—August 3rd. Mental Hospital. Supply and erection of generating plant and other electrical gear. (July 13th.)

Wilton.—August 25th. Borough Council. Supply and erection of a public lighting installation in the borough. Borough surveyor, Municipal Offices, Fugglestone House, Wilton.

Workington.—Borough Council. Electrical installations in connection with the erection of 150 permanent houses at Salterbeck housing estate. A. B. Cooper, borough engineer, Town Hall, Workington. (Deposit, £2 2s.).

Orders Placed

Darlington.—Corporation. Accepted. E.h.v. switchgear in connection with alterations and additions to electricity supply in the Eastbourne area (£1,730).—A. Reyrolle & Co.

Hull.—Electricity Committee. Accepted. 5-ton mobile crane (£1,384).—Herbert Morris. Cable for five years.—Crompton Parkinson.

Liverpool.—Electricity Committe. Accepted. Equipment of static substations.—J. G. Statter & Co. (£1,449); A. Reyrolle & Co. (£2,035).

Busbar panel transformers, distributors.—J. G. Statter & Co. (£456); English Electric Co. (£505).

London.—ST. PANCRAS.—Contracts and Libraries Committee. Recommended. Four rows of panels for meter racks (£84).—Bertram Thomas (Engineers).

Part of work of laying e.h.v. mains from Prince Albert Road to the power station (£3,500).—Standard Telephones & Cables.

Cables: extension of contracts for one year from August 1st.—Metropolitan Electric Cable & Construction Co.; Standard Telephones & Cables.

Newcastle-on-Tyne.—City Council. Accepted. Fittings for relighting the High Level and Redheugh bridges (£981).—G.E.C.

Stockport.—Electricity Committee. Accepted. Underground disconnecting boxes (£267).—W. Lucy & Co. 6·6-kV switchboard and oil circuit-breaker for Winifred substation (£648).—Ferguson, Pailin. Switchgear spares (£503).—G.E.C.

Swinton and Pendlebury. — Electricity Committee. Accepted. 1,500-kVA transformers (£1,220 each).—Metropolitan-Vickers. 500 and 300-kVA transformers (£468 and £325 each).—English Electric Co.

Torquay.—Electricity Committee. Accepted. 11-kV switchgear for strengthening distribution system (£5,680).—B.T.H. Co.

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.

Alnwick.—Conversion of Bondgate Hall into Council Offices; U.D.C. surveyor.

Ancoats.—Works additions, Bradford Street; Moston Brick and Building Co., Ltd., builders, Kenyon Lane, Moston, Manchester, 10.

Billingham-on-Tees.—Printing works, Station Road, for the Billingham Press, Ltd.; A. W. Holt, architect, Bishopton Road, Stockton-on-Tees.

Bishop Auckland.—Houses (52); U.D.C. surveyor.

Caernarvonshire.—Erection of new library, at Education Offices, Caernarvon; Architect's Department, County Offices, Caernarvon.

Chesterfield. — Works additions, Clayton Street; Hyde & Son, Ltd.

Houses (25), Old Hall site; borough engineer.

Darlington.—Factory, Valley Street North, for Boyd & Son; Lawson & Boddy, builders, Maude Street.

Dumfries.—Houses (36), Lincluden; burgh surveyor.

Durham.—Houses on cleared sites at Elvet, Church Street and Hallgarth Street; city engineer.

East Sussex.—Workshops for woodwork, plumbing, etc., at County School, East Grinstead (£2,700); county architect, County Hall, Lewes.

Gateshead.—Additions to works for Clarke, Chapman & Co., Ltd.

Glasgow.—School at Penilee; city architect.

Guildford.—Houses (70); borough engineer, Municipal Offices, High Street.

Hastings.—Three school kitchens; borough engineer.

Ipswich.—Dwellings (32), St. George's Street; E. McLaughlan, borough surveyor.

Lancaster.—Houses (72), Hare Runs estate; borough engineer, Dalton Square.

Lichfield.—Houses and bungalows (52), for R.D.C.; J. G. Rimand, architect, Rural Council House, Lichfield.

Liverpool.—Offices and works, Breckside Park; Unit Construction Co., Bentham Drive, Childwall, Liverpool, 16.

London.—Rebuilding St. Mary's Hospital, Praed Street; A. W. Hall, architect, 9, Southampton Row, London, W.C.1.

Longbenton.—Rebuilding ten war-damaged houses; U.D.C. surveyor.

Manchester.—Experimental houses; William Arnold, Ltd., Upper Brook Street, Chorlton-on-Medlock, Manchester, 13.

Northampton.—Conversion of Council Chamber into offices (£2,000), for R.D.C.; R. J. Miller, surveyor, 1, Spencer Parade.

Oxford.—Dining hall and kitchen unit (£3,380), Temple Cowley School; borough engineer, Municipal Buildings.

Paisley.—Proposed new maternity hospital to cost £500,000; T. Tait, architect.

Houses, Ferguslie (40) and Gallowhill (160); burgh surveyor.

Pocklington (Yorks).—Houses (85) for the R.D.C.; W. A. Kellett, architect, 8, Lendal, York.

Reddish.—Foundry, Conway Street; Storey Foundry Co., Ltd., Sheffield Street, Heaton Norris, Stockport.

Rotherham.—Houses for R.D.C.: Lawton, Knight & Co., architects, Regent House, Moorgate, Rotherham.

Rugby.—Houses (76), Overslade estate; borough surveyor, The Lawn.

Sheffield.—Laundry; South Yorkshire District Laundries Association, Shiregreen, Sheffield, 5.

South Shields. — Extensions to Harton Laundry; T. A. Page, Son & Bradbury, King Street, South Shields.

Stockport.—Houses, Holly Street and Canterbury Road: Hugh Owen & Sons, Ltd., builders, 35, Dialstone Lane.

Sunderland. — Extensions to factory for National Galvanizers, Ltd.; Huntley & Sons, Marion Street, Sunderland.

Swinton.—Extensions to calico printing works, Oak Street: Sackville & Swallow, Ltd., calico printers, 105, Princess Street, Manchester, 1.

Tenterden.—Houses (27) for R.D.C.; G. D. Forder, surveyor, Council Offices, East Hill, Tenterden, Kent.

Walsall.—X-ray block at Manor Hospital (£1,500); borough engineer.

Wolverhampton.—Scheme for civic centre; W. Mervyn Law, borough engineer.

Worthing.—Central packing station, West Worthing railway station; Farmers & Growers Industries, Ltd.

News from South Africa

By our Cape Town Correspondent

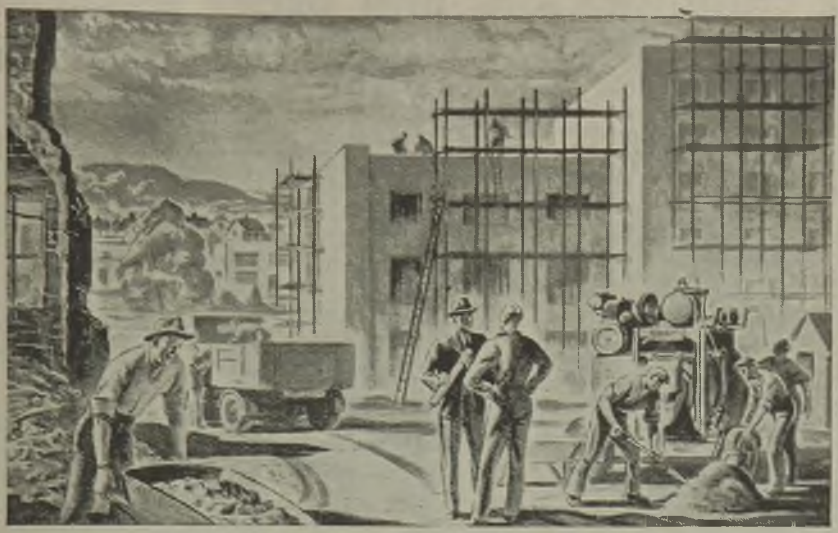
AT the nineteenth convention of the Association of Municipal Electricity Undertakings of South Africa and Rhodesia, the city electrical engineer of Salisbury, Mr. J. S. Clinton, was elected president. He said that the gesture was particularly appreciated as he would shortly be leaving Salisbury and then would no longer be in charge of a municipal electricity undertaking. In his address Mr. Clinton suggested that the membership of the Association should be widened to admit representatives of Chambers of Commerce and of such industries as those manufacturing and distributing electrical goods, and organisations like the Cable Makers' Association. If membership were extended to the staffs of undertakings the Association would be that much more powerful. He envisaged the possibility of a National Joint Electricity Board emerging from such an identity of interests.

Sale of Electrical Appliances

There has been a proposal to the Cape Town City Council from traders that the Council should not resume the hire-purchase sale of electrical appliances when these return freely to the market. This suggestion has been rejected. In the twelve years that the hire-purchase scheme was in operation before its abandonment in 1942 due to war conditions, sales of appliances amounted to £1,500,000 and the electricity consumption developed from 65,000,000 to 300,000,000 kWh. The Council has seven showrooms in different parts of the city area and these are likely to be put into use again in the near future. Similar developments will certainly also take place in towns like Johannesburg and Durban.

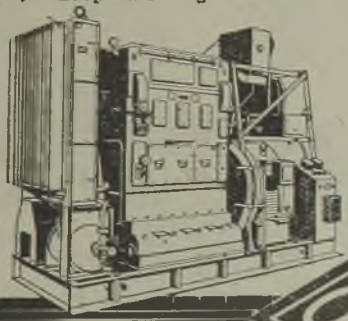
Generation

There is a growing feeling in certain parts of South Africa that all the main electricity generating stations should pass into the control of the Electricity Supply Commission, which undoubtedly has a great record of achievement. On the other hand, many of the municipalities are eager to retain their power stations. At Port Elizabeth, for example, there has been some agitation from industrial interests for the local power station to be taken over by the Commission, which it is felt could better assure the increasing supply that will be needed for the industrial developments of the future. However, extensions now planned by the Port Elizabeth Electricity Department, which will add 40,000 kW to the total generating station capacity, should enable the Department to meet the additional demand.



BUILDING

One of the greatest tasks which lies ahead of the nation in the coming days of Peace will be the building of factories and houses. Factories to employ those now employed in winning the war; factories to produce the goods which we must soon export in vast quantities; houses for countless people who have lost their homes; houses for those who have never yet set up a home; BUILDING—truly a word of deep meaning. Modern building on a large scale calls for POWER in many and various ways, but wherever there is a need for power there is a PETTER ENGINE to fit the job. May we place our long experience and knowledge at your disposal?



★ *Available in a wide range from 11/540 B.H.P.*

75

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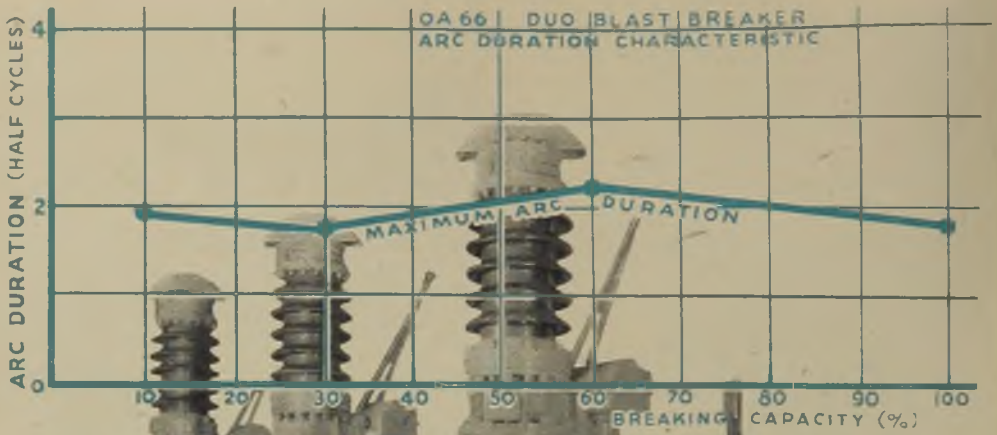

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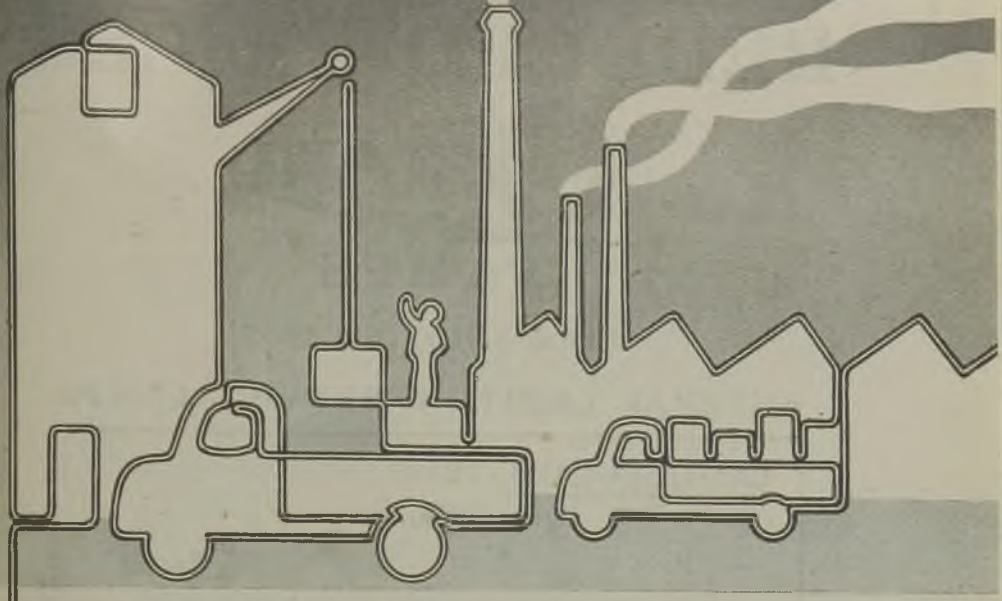

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CROMPTON *paper* CABLES

CROMPTON PARKINSON LIMITED, ELECTRA HOUSE, VICTORIA EMBANKMENT, LONDON, W.C.2
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REDUCED PRICES

Osram LAMPS

From JULY 16th 1945

GENERAL LIGHTING SERVICE LAMPS

COILED-COIL PEARL

Standard Voltages (200-260)

	s.	d.
40 watt	1	6
*60 watt	1	6
*75 watt	1	8
*100 watt	1	10

**Available shortly*

SINGLE COIL PEARL & CLEAR

Standard Voltages (100-130 & 200-260)

	s.	d.
15 and 25 watt	1	3
40 and 60 watt	1	3
75 watt	1	7
100 watt	1	9
150 watt	2	9
CLEAR		
200 watt	4	6
300 watt	8	0
500 watt	10	6

Prices do not include Purchase Tax.

Write for Price List OS 9759 which gives full particulars of all price reductions.

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.

OFFICIAL NOTICES, TENDERS, ETC.

CITY OF CHICHESTER

Contract No. 35 for Cables and Cable Laying

THE Council of the City of Chichester invite tenders from experienced contractors for the manufacture, supply and laying of approximately 20 miles of 11-kV and control cables and accessories. Specifications, plan and form of tender may be obtained on application in writing to the Consulting Engineers, Messrs. Mackness & Shipley, Parliament Mansions, Abbey Orchard Street, London, S.W.1. All applications must be accompanied by a deposit of two guineas, returnable on receipt of a bona-fide tender.

Tenders, in plain sealed envelopes, endorsed "Tender for Electrical Contract No. 35," must reach the undersigned at the Municipal Offices, North Street, Chichester, not later than noon on Friday, August 17th, 1945.

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

ERIC BANKS, Town Clerk.
2302

CITY AND COUNTY BOROUGH OF BELFAST

Electricity Department

TENDERS are invited for supply, delivery and erection of (a) Carbon Dioxide Fire Extinguishing Equipments for Electrical Substations (Specification No. G.49) and (b) Replating Regulating Cells of Storage Battery (Specification No. G.51).

Forms of tender may be obtained from the City Electrical Engineer and General Manager, East Bridge Street, Belfast.

Each tender, in sealed envelope marked "Tender for — Electricity Department," and endorsed with the name and address of the person tendering, must be lodged with the undersigned not later than 4 p.m. on Friday, 3rd August, 1945.

An official receipt must be obtained for every tender delivered by hand. Tenders sent by post should be registered.

JOHN DUNLOP,
Town Clerk.
City Hall, Belfast. 2373

BOROUGH OF LOWESTOFT

Electricity Department

THE Council of the Borough of Lowestoft invites tenders for the supply and delivery of L.T. 4 and 5-core P.I.L.S.S.T.A. Cable.

Applications for specifications should be addressed to Borough Electrical Engineer and General Manager, Electricity Works, Norwich Road, Lowestoft. Tenders, enclosed in plain sealed envelopes, endorsed "Tender for Cable," should be addressed to the undersigned, by whom they are to be received not later than first post on Thursday, 26th July, 1945.

The Council may, at their option, accept the whole or part of any tender, but in either case do not bind themselves to accept the lowest or any tender.

(Signed) F. B. NUNNEY, M.A.,
Town Clerk.
Town Hall, Lowestoft. 2357

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 *and* 40 *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 STOCKTON-ON-TEES

Electricity Department

Assistant Mains Engineer

APPLICATIONS are invited for the above appointment from qualified electrical engineers with sound technical training and experience in the Mains Department of an Electricity Supply Undertaking.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the selected candidate will be required to pass a medical examination.

The salary and conditions of employment will be in accordance with the N.J.B. Schedule, Class F, Grade 8a, at present commencing at £371 per annum.

Applications, stating age, marital state, training and qualifications, details of past experience, present appointment, etc., together with copy of testimonials, should be forwarded to Mr. N. Hunter, M.I.E.E., General Manager and Engineer, Corporation Electricity Offices, Bishopton Lane, Stockton-on-Tees, not later than the 30th July, 1945.

Permission has been obtained to advertise this vacancy which has been approved by Division A.9 (D) of the Appointments Department.

N. HUNTER, M.I.E.E.,
General Manager and Engineer.
Corporation Electricity Offices,
Bishopton Lane, Stockton-on-Tees.
4th July, 1945. 2312

BOROUGH OF DARWEN

Electricity Department

Appointment of Mains Assistant

APPLICANTS for above position must have had sound technical training and be experienced in work on the layout, connection and maintenance of E.H.T. and L.T. distribution systems, including substations. Experience in change-over work will be an added recommendation.

Salary will be in accordance with N.J.B. Schedule, Class C, Grade 8 (commencing £329 per annum), with possible increase due to reclassification in the near future.

The successful candidate will be required to pass a medical examination and contribute to the Council's Superannuation Scheme.

Applications, giving full details of age, training and experience, together with copies of three testimonials, are to be endorsed "Mains Assistant," and must reach the undersigned by Monday, July 30th, 1945.

The Ministry of Labour and National Service, A9D., have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

ALEX WATSON, A.M.C.T., A.M.I.E.E.,
Borough Electrical Engineer.
Electricity Works,
Robin Bank Rd., Darwen. 2354

METROPOLITAN BOROUGH OF ISLINGTON

Appointment of Engineer and General Manager, Electricity Undertaking

THE Council invite applications for the position of Engineer and General Manager of their Electricity Undertaking from corporate members of the Institution of Electrical Engineers experienced in the management and administration of an Electricity Undertaking. Corporate membership also of the Institution of Civil Engineers or the Institution of Mechanical Engineers would be an advantage. The salary for the position will be in accordance with the agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers, dated 9th July, 1941, and in accordance with Clause 10 of the agreement the salary for the first year will be 85% of the full salary, and for the second year 92½% thereof, the full salary being payable in the third and subsequent years. The approximate salary for the financial year ending 31st March, 1946, is £1,683 2s. In addition a temporary cost-of-living bonus is payable in accordance with the recommendations of the Whitley Council, and at the present time the bonus amounts to £33 16s. per annum. A motor car will be provided and no car allowance will be payable.

The appointment will be determinable by three months' notice on either side and will be subject to the provisions of the Local Government Superannuation Act, 1937, and to the successful candidate passing satisfactorily an examination by the Council's Medical Adviser.

Applications on the forms provided and enclosed in an envelope endorsed "Engineer and General Manager" must reach the undersigned not later than 11th August, 1945.

Canvassing directly or indirectly will be a disqualification.

W. ERIC ADAMS,
Town Clerk.

Town Hall,
Upper St., Islington, N.1.
13th July, 1945. 2380

THE MADRAS ELECTRIC SUPPLY CORPORATION LIMITED

31, Kingston Road, Leatherhead, Surrey

APPLICATIONS are invited from candidates for the following appointments:—

JUNIOR SHIFT ENGINEER, for steam turbine A.C. Generating Station, preferably one trained in a manufacturers' works and with maintenance experience. Salary, Rupees 800 (at present £60) per month for first year, Rs. 850 per month for second year, Rs. 900 per month for third year.

MAINS ENGINEER, with experience in A.C. and D.C. distribution and in maintenance of H.T. and L.T. Cables. Salary, Rupees 800 (at present £60) per month for first year, Rs. 850 per month for second year, Rs. 900 per month for third year.

The appointments would be on a three-years agreement, free passages to and from Madras would be provided, and the officers would, in addition to salary, receive free quarters or a house allowance in lieu of free quarters, and a cost of living increment, at present Rs. 100 per month. A Staff Provident Fund exists, to which both staff and the company contribute.

Applications, stating age of applicant, whether married or single, and giving particulars of experience, to be sent to the company at the address stated above.

6th July, 1945. 2355

MANAGER

A MANAGER required by progressive Electrical Wholesalers (East Anglia) who have considerable scope for development. Successful applicant should be go-ahead, enthusiastic, capable of developing business given initiative, and to ultimately become Director (finance not required).

This is an exceptional post, suitable for an energetic man (under 45) of exceptional business building ability, who is prepared to take control of a small, well-financed business with good connections, and build up a life interest.

Previous experience as Manager not important, but knowledge of electrical wholesale trade and buying essential: trade connections an advantage.

This post involves plenty of prospects and plenty of hard work.

Replies, which will be treated in strictest confidence, should state experience, age, suggested commencing salary. —Box 7923, c/o The Electrical Review.

CITY OF WINCHESTER

Electricity Department

Control Engineer

APPLICATIONS are invited for the above appointment (working a shift rota) at a salary in accordance with Grade 8a, Class D, of the National Joint Board Schedule (at present £329 per annum).

Candidates should have a technical knowledge of alternating current transmission and distribution, and some experience with an Electricity Undertaking in the operation of a high voltage ring main transmission system supplying transformer substations, together with the operation and maintenance of modern cable protective systems and high voltage switchgear.

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

Applications, giving particulars of age, training and experience, and accompanied by copies of any recent testimonials, should be addressed to the City Electrical Engineer, Electricity Department, Gordon Road, Winchester, and be received by him not later than the 30th July, 1945.

The Ministry of Labour and National Service, A9(D), have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

F. W. KEMPTON,
Town Clerk.

Guildhall,
Winchester. 2389

COUNTY BOROUGH OF PRESTON

Electricity Undertaking

Assistant Power Station Chemist

APPLICATIONS are invited for the position of Assistant Power Station Chemist from suitably qualified persons (male or female). Candidates must have had experience with coal testing, gas analysis and boiler feed water treatment. Preference will be given to applicants who have had previous experience in a large Power Station.

The salary and conditions of service will be in accordance with the National Joint Board Schedule, the salary being as per Class J, Grade 9a (at present £349-£365 per annum).

The selected candidate will be required to pass a medical examination and contribute to the Council's Superannuation Scheme under the provisions of the Local Government Superannuation Act, 1937.

Applications, stating age, and giving full particulars of technical qualifications and experience, accompanied by not more than three testimonials, are to be endorsed "Assistant Chemist" and received by the undersigned not later than Saturday, 4th August, 1945.

The Ministry of Labour and National Service, A9(D), have given permission under the Control of Engagement Order, 1945, for the advertisement of this vacancy.

G. A. ROBERTSON,
M.Sc.(Tech.), M.I.E.E., A.M.I.Mech.E.,
Borough Electrical Engineer.

40/41, Lune St., Preston.
July, 1945. 2385

THE LANCASHIRE ELECTRIC POWER COMPANY

Generation Department

Appointment of Technical Assistant and Boiler House Superintendent

APPLICATIONS are invited for the position of TECHNICAL ASSISTANT, to deal with the statistical and technical work of the Generation Department of the above Company.

Also for the position of BOILER HOUSE SUPERINTENDENT at Kearsley Power Station, to take charge of the operation and to supervise the maintenance of the boiler plant.

The salaries will be dependent on experience and capability.

The Ministry of Labour and National Service, A9(D), have given permission under the Control of Engagement Order, 1945, for the advertisement of these vacancies.

Applications should be sent in not later than 31st July, 1945, to The Engineer, Generation Department, Kearsley Power Station, Stoneclough, nr. Manchester. 2384

OLDHAM EDUCATION COMMITTEE

Municipal Technical College
Principal: R. S. Hadlow, B.Sc.(Eng.) Lond., A.M.I.Mech.E.

APPLICATIONS are invited for the post of FULL-TIME LECTURER, duties to commence on 1st September, 1945, or as soon as possible after that date. Candidates should possess either a degree in Mathematics or one in which Mathematics was a subject of the final examination, ability to teach an additional subject being a desirable but not an essential qualification. The post is a permanent one and the duties will include teaching day and evening classes in the Departments of Engineering and Science, including Cadetship and Intensive Engineering Courses, up to the standard of the Higher National Certificate. Salary will be in accordance with the Burnham Scale and previous teaching experience is desirable.

Further particulars may be obtained from the undersigned, together with forms of application, which should be completed and returned immediately.

MAURICE MARRISON.
Director of Education.
Education Offices,
Oldham.
9th July, 1945. 2358

COUNTY BOROUGH OF ROTHERHAM

Generating Station Superintendent

APPLICATIONS are invited from qualified engineers for the position of Generating Station Superintendent. The salary will be in accordance with Grade 3, Class J, of the National Joint Board Schedule, at present £724 to £759.

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

Applications, stating age and giving particulars of education, training and experience, accompanied by copies of not more than three testimonials, should be endorsed "Station Superintendent," and addressed to the Borough Electrical Engineer, Electricity Works, Rotherham, so as to arrive by 8th August, 1945.

The Ministry of Labour and National Service, A.9(D), have given permission under the Control of Engagement Order, 1945, for the advertising of this vacancy. 2376

SURREY EDUCATION COMMITTEE

Kingston Technical College

REQUIRED to commence duties on 1st September, a Graduate Lecturer in Electrical Engineering for Electrical Engineering Subjects to Higher National Certificate standard. Corporate membership of the Institution of Electrical Engineers essential.

The salary will be the Burnham Graduate Scale (£315-15-£555) with placing according to industrial and teaching experience.

Forms of application, which should be returned as soon as possible, may be obtained from the undersigned on receipt of a stamped addressed envelope.

J. W. ARCHER, B.Sc.,
Principal.
2341

WATSON & SONS (ELECTRO-MEDICAL) LIMITED

APPLICATIONS are invited for senior appointments on our sales staff after the present M.O.L. restrictions have been removed. For those possessing initiative, a good personality and knowledge of X-ray equipment there are exceptional opportunities.

Write in confidence in the first instance, giving details of experience and age. Interviews will be arranged later in London.

WATSON & SONS (ELECTRO-MEDICAL) LIMITED.
Temporary Head Office: 76, Castle Street, Reading.
2263

ASSISTANT Designer with previous experience required for Electrical Motor Manufacturers. State age. Permanent progressive position. Applicants should be over 51 or Class A ex-service men only. Apply—Hoggs Motors Limited, Witton, Birmingham, 6. 2379

ELECTRICAL ENGINEER AND MANAGER

REQUIRED for eventual service in Far East, having good experience electrical contracting, cable laying, etc., capable organising and managing large contracting business. Reply, in first instance with full particulars of experience, to—Box 2391, c/o The Electrical Review.

ASSISTANT General Manager required by firm specialising in electrical repairs and maintenance. Applicants should have held executive position and have practical experience in works administration, factory costs, etc., and be familiar with the design and construction of electrical machines. Age not over 45. The successful applicant would be required to pass a medical examination and to become a member of the Staff and Widows' Pension Scheme.—Box G1847, W. H. Smith & Son Ltd., Manchester, 3. 2364

BOYS or Girls required to learn Elect. Inst. making. Apply—W. C. Davey & Co., 180, Tottenham Court Road, W.1. 2318

CLERICAL Assistant, Class A, Ex-Serviceman, for Stores Office. Must have thorough knowledge of all electrical material. Apply—London Electrical Company, 92, Blackfriars Road, S.E.1. 2294

CONTRACTS Manager required by company in the East Midlands carrying out electrical contracting work. Recent technical and commercial experience with electrical contracting industry essential. Commencing salary £400 per annum, plus war bonus. Superannuation scheme. Applications, stating age, present position and details of training and experience, to be sent to—Box 2360, c/o The Electrical Review.

DRAUGHTSMAN required for Electrical Machines. North Kent district. State experience and salary required. Applicants should be over 51 years of age, Class A ex-service men, or otherwise exempt from M.O.L. control.—Box 2383, c/o The Electrical Review.

ELECTRICAL Engineering Firm near Glasgow require a Foreman with first-class experience to take complete charge of Plating and Polishing Shop. Salary £550 p.a., according to qualifications and experience. Applications, which must be in writing, should state date of birth and full details of qualifications and experience (including a list, in chronological order, of posts held). Address—"0571," Wm. Porteous & Co., Glasgow. 2382

ELECTRICAL Engineering Firm near Glasgow require a Foreman with first-class experience of Pressure Die Castings, to take complete charge. Salary £550 p.a., according to qualifications and experience. Applications, which must be in writing, should state date of birth and full details of qualifications and experience (including a list, in chronological order, of posts held). Address—"0572," Wm. Porteous & Co., Glasgow. 2381

ELECTRICAL Engineer required for the estimating and contracts department of a British firm in India, age 23/28, single, with sound technical education and works training. Write, stating age, fullest particulars and copies of testimonials, to—Box ZZ.477, Deacons, 36, Leadenhall Street, London, E.C.3. 2372

ENGINEER/Tester required (Croydon area). Must be fully experienced (practical) in D.C. generators driven by petrol and diesel engines (high speed) and able to carry out any necessary adjustments, etc. Highest priority work and ample post-war prospects. Good rate of pay. Applications from those over 51 or from Class A ex-service men only. Full details of previous experience to—Box 7327, c/o The Electrical Review.

LONDON firm of electrical contractors require Manager. Must have thorough knowledge of trade. Own car an advantage. Good prospects to live man. Write, stating age, experience and salary required, to—Box 2365, c/o The Electrical Review.

MANAGER for Rectifier Department, experienced in design of transformers, metal, valve or mercury arc rectifiers. Applicant must be free from Control of Engagement Order, 1945. Good salary offered for the right man. Write, stating age, experience and salary required, to—Box 2386, c/o The Electrical Review.

MANAGER required, with general experience in the manufacture of lead storage batteries. State experience and salary required.—Box 2376, c/o The Electrical Review.

MANUFACTURERS of Telephones and Small Electrical Apparatus require Draughtsman, Class A ex-service men only. Junior, under 18, not objected to, but some experience essential.—Box 2377, c/o The Electrical Review.

PLANNING Engineer to take charge of planning department and jig and tool drawing office. Must be first-class jig and tool designer having good all-round experience with mass production, particularly on small mechanisms utilising press work, auto parts and bakelite mouldings. Only Class "A" ex-service man accepted until present restrictions removed. Good salary offered for right man. Write, giving age, salary expected, experience, etc., to—Box 2345, c/o The Electrical Review.

REPRESENTATIVE required by wholesalers. Electrical knowledge essential. Applications from those over 51 or from Class A ex-service men only. State experience, salary required, and send copy of testimonials.—Box 2375, c/o The Electrical Review.

SALES Engineer required by old-established concern of Electrical Condenser Manufacturers, to take charge of industrial sales, particularly condensers for power factor correction. Applications from those over 51 or Class A ex-service men only. Full details of commercial and technical qualifications and experience, age, salary required, etc., to—Box 2378, c/o The Electrical Review.

SALES Manager, male or female, for electrical and radio showroom 16 miles north of Charing Cross.—Box 7321, c/o The Electrical Review.

WELL-known Electrical Engineering Company have vacancies for suitable lads, under 18 years of age, with matriculation or general school certificate, for apprenticeship in the above industry. Good rates of pay and living accommodation provided.—Box 2245, c/o The Electrical Review.

WIREMAN wanted, London, over 51 or otherwise free to take position. Best conditions. Reply—Box 2344, c/o The Electrical Review.

X-ray and Medical Engineer required for Scotland. State age, experience and salary required. Good prospects for right man.—Box 263, McCallum & Co., 42, North Bridge, Edinburgh. 2392

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.

CENTRAL Sussex Electricity Ltd.—Senior Clerical Assistant; Dundee Corporation—Junior Assistant Mains Engineer.

SITUATIONS WANTED

ACCOUNTANT (36), 20 years' varied and extensive practical experience with eminent London chartered accountants (final figures, taxation, secretarial duties, costings, etc.), desires responsible Secretary-Accountant position with commercial firm.—Box 7269, c/o The Electrical Review.

ADVERTISER (21), Higher Nat. Cert., City & Guilds Final, 5 yrs.' engineering apprentice, desires a post in electronics, radio or sound reproduction. Exempt military service.—Box 7337, c/o The Electrical Review.

A.M.I.E.E. (30), now disengaged, desires position technical/administrative/research. Wide experience industrial applications. Box 7336, c/o The Electrical Review.

B.Sc.Eng. (E. and M.), A.M.I.C.E., age 39, Switchgear and Distribution Engineer, experienced in the design of power and telecommunication equipment, desires executive post.—Box 7317, c/o The Electrical Review.

B.Sc.Eng. (Hons.) (23), exempt, inventive, wide experience transformer and switchgear testing and commissioning and experimental work, seeks post with better prospects, London area.—Box 7288, c/o The Electrical Review.

CAPABLE Engineer (32), experienced, works installations, application of electric motors, sales, works procedure, office administration, will consider responsible progressive position with medium-size concern. Own car. London or South. Alternatively partnership with small investment.—Box 7303, c/o The Electrical Review.

ELECTRICIAN requires job as permanent Maintenance Hand, good references.—Box 7332, c/o The Electrical Review.

ELECTRICAL and Mechanical Engineer, M.Sc., expert, electrical instruments, motors, generators, also A.C. commutator machines, 16 years' experience, seeks suitable position.—Box 7335, c/o The Electrical Review.

ELECTRICAL Engineer, exempt, 20 years' exp. research-design-manufacture of el. apparatus, domestic and heating, temperature control, inventive abilities, organizer, seeks position.—Box 7300, c/o The Electrical Review.

ELECTRICAL Engineer, German refugee, University training, 30 years' experience consulting power-stations, high tension and factory installations, seeks position.—Box 7302, c/o The Electrical Review.

ELECTRICAL Engineer (24), student I.E.E. up to B.Sc. standard, experience in design, manufacture and testing of electric motors, also knowledge of French and German, seeks change of post providing scope for initiative and organising ability.—Box 7274, c/o The Electrical Review.

ELECTRICAL Test Engineer (27), on release from M.N., desires progressive post with transformer manufacturers or similar concern. Six years' experience in assembling, erecting and testing all types of power and H.T. units. Write—Box 7324, c/o The Electrical Review.

ENGINEER, aged 25, Grad. I.E.E., Grad. I.Mech.E., seeks appointment with electricity supply undertaking, 8 years' experience, manufacture of A.C. and D.C. machines, official tests of generator sets, motors and switchgear.—Box 7330, c/o The Electrical Review.

ENGINEER, Mechanical and Electrical, desires position as Works Manager with reputable firm engaged on instruments, radio, clocks, communications or F.H.P. motors. Advertiser experienced in modern methods and machine tools, also planning, estimating, time study, rate fixing, tool design and work layout, small or large quantities; 15 years administrative includes works and production manager. Age over 40. Any firm desiring to go straight ahead with its peace-time programme on common sense lines and prepared to pay a minimum salary of £1,000 please communicate with—Box 7277, c/o The Electrical Review.

EX-Merchant Navy Electrical Engineer, at present foreman electrician M.A.P. factory, seeks service agencies for North Wales and/or Merseyside areas. Wide experience on "trouble shooting" and maintenance of domestic, industrial and marine equipment, British and American. Age 40, married, car owner, will travel for interviews.—Box 7298, c/o The Electrical Review.

EXPORT Representative (38), A.M.P.O.A., widely travelled Continent and Overseas, fluent French, German, Italian, Spanish, keen, energetic, own car, seeks progressive post with firm expanding export trade. Replies—Box 7334, c/o The Electrical Review.

EX-service man (Class A), prof. el. engineer, with wide experience in high and low voltage machinery and and installations of all kinds, seeks appointment or partnership with el. contractor or consulting engineer firm.—Box M.37, Scripps's, South Molton st., W.1. 7339

GRADUATE I.E.E., aged 29, captain in Royal Engineers, free in October, seeks technical or administrative post with prospects.—Box 7329, c/o The Electrical Review.

MAINTENANCE Electrician, disengaged, seeks berth, competent all branches.—Box 7316, c/o The Electrical Review.

MAN (36), 16 years' design and production engineering experience, desires change to outdoor work, in connection with electrical installation or agricultural implements.—Box 7304, c/o The Electrical Review.

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

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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.,
22-26, BRITANNIA WALK,
CITY ROAD, LONDON, N.1.

Telephone: 5512-3 Clerkenwell. 13

CITY OF WINCHESTER

Electricity Department

THE following surplus material is available for disposal:—

Two 75-kVA. oil-cooled, three-phase, 50-cycle transformers, ratio 11,000/6,750 volts (at no load), with H.V. off-load tappings 2½% and 5% plus and minus. Each transformer is mounted on rollers and manufactured by the English Electric Co. Ltd.;

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One "Murday" switchboard pattern moving coil ammeter, range 0-300 amperes, complete with external shunt. Makers:—Evershed & Vignoles Ltd.

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Electricity Department

THE Borough Council invite offers for the purchase of the machines described hereunder:—

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Two	25,000 lbs.	,,	175 lbs. ,,
Three	20,000 lbs.	,,	175 lbs. ,,
One	12,000 lbs.	,,	200 lbs. ,,
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26

A quantity of nearly new Storage Cells by Young, 350-amp.-hour capacity at 10-hour rate, heavy duty, only a few weeks old, fully charged. Further quantity of new Cells, 100-amp.-hr. cap. Full details from—G.P.U. Ltd., Wembley. 2368

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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). 6781

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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

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T.R.S. Cables and Flexibles, Welding Cables, supplied to M.O.S. requirements.—Edwardes Bros., 20, Blackfriars Road, London, S.E.1. 7348

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6½-kW Turbo-Generating Set, 110 volt D.C., £40.—Stewart Thomson & Sons, Fort Road, Seaforth, Liverpool, 21. 55

7½ h.p. Blackstone Crude Oil Horizontal Engine, complete with water-cooling tank, filter and silencer, and fuel tank and fuel storage tank, 5 ft. long × 3 ft. 6 ins. diameter, direct coupled to a "Bull" Dynamo, 23 amps., 100/160 volts, 320 r.p.m., fitted with a series/shunt switch. The complete unit is in a first-class condition. Best offers to—Messrs. T. S. Bell & Co., 35, Tangier Street, Whitehaven, Cumberland. 49

80-kW, 220-v., 350-revs., S.I., two ped. brgs., on bedplate.—Greenhalgh Bros., Burton's Field Mill, Atherton, nr. Manchester. 2293

100-h.p., 400/3/50, S.R., 730-revs., Louvre Vent., B.T.H. (ball bearings), with Ellison O.I. gear.—Greenhalgh Bros., Burton's Field Mill, Atherton, M/cr. 2294

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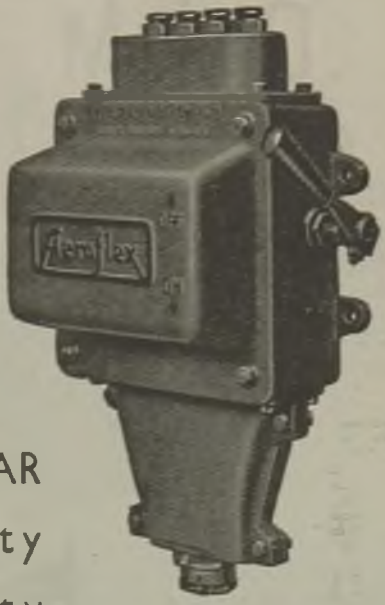

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