ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXVII. No. 3552 DECEMBER 21, 1945 9d. WEEKLY

"CASES" OF PROTECTION

A.S.C.M. Steel Conduit is manufactured only by

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Where would you find anything so symbolical of the best ideas of an Electrical Installation as the British Oak ?

Its robust outer covering provides complete protection and insulation of its inner "cables" of energy, and the same principle continues in added "branches."

It is time-defiant—a virtue also of A.S.C.M. Steel Conduit.

SPECIFY AND USE
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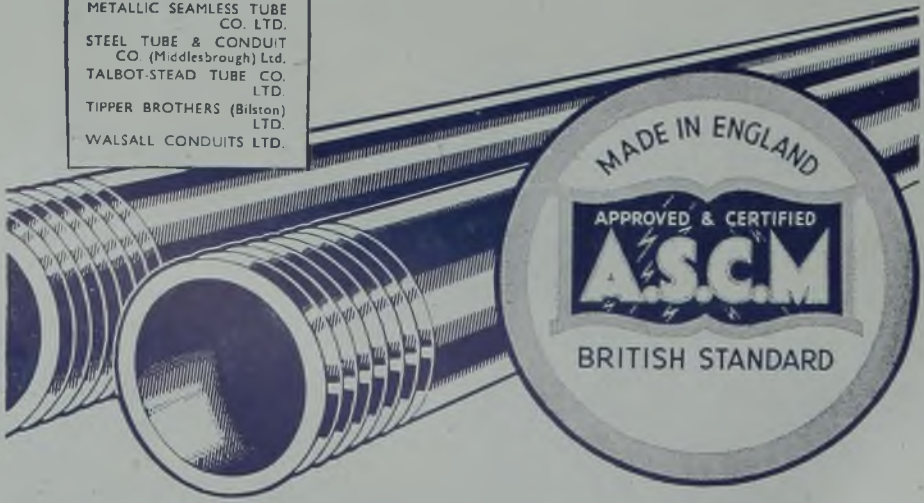

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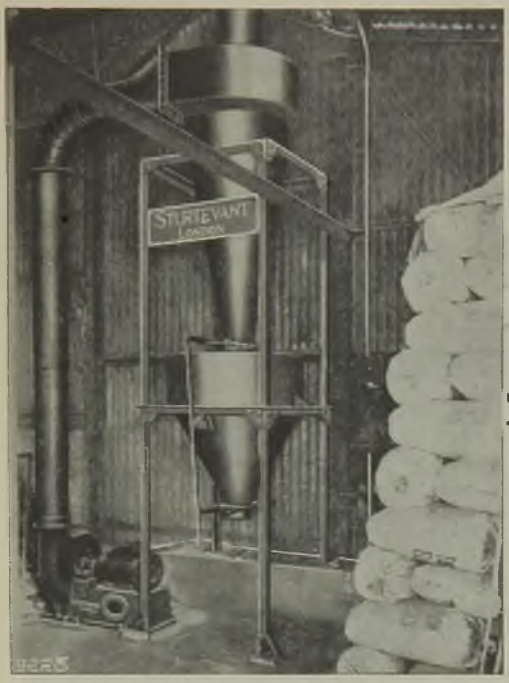

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The Sturtevant T.L. Cyclone Dust Collector solves many Industrial Dust Problems

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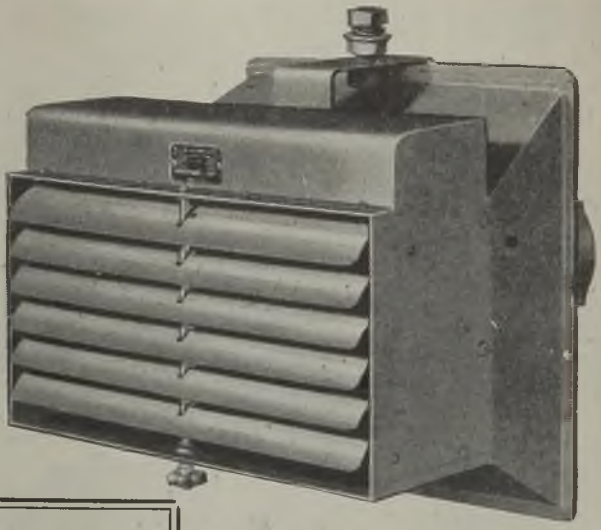
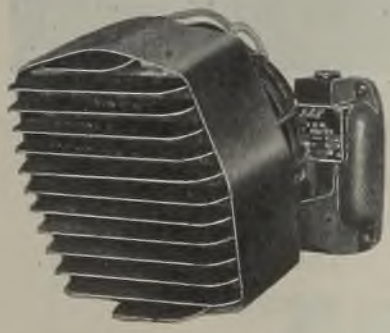
G.E.C.

ELECTRIC UNIT HEATERS

A wartime development which has come to stay





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just as simple to install, easily adjustable for direction of warm air flow. Runs almost noiselessly. Size approx. 9″ x 11¾″. Finished metallic bronze cellulose.

5 to 20 kW IN THIS TYPE

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Lowest capital cost.

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Each unit can be worked independently with or without thermostatic control.

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

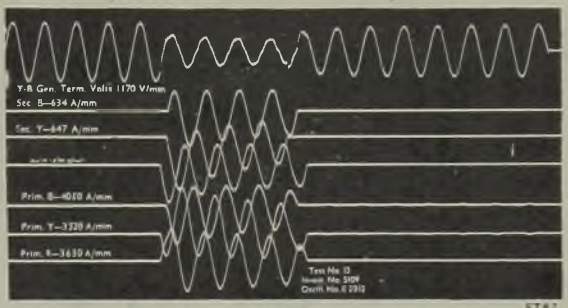
Generator TRANSFORMERS

The 80,000 kVA transformer. Photograph taken after the test. This is one of 5—80,000 kVA and 2—87,000kVA, 11/66kV generator transformers supplied to the London Power Company (Battersea).

Ferranti Large High Voltage Generator Transformers are designed on facts confirmed by full-scale practical tests.

In 1935 a Ferranti Generator Transformer of 80,000 kVA 66 kV was tested to destruction by a series of 14 full-scale short circuit tests.

A typical oscillogram showing 1,420,000 maximum instantaneous kVA (720,000 kVA symmetrical r.m.s. value.)



LARGE POWER TRANSFORMERS supplied by Ferranti ——

Over 9,000,000 kVA for voltages 33 kV and above
Over 6,000,000 kVA for voltages 66 kV and above

FERRANTI LTD.

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Power Factor Improvement

. . . . for many industrial loads, is to connect B.I. Callender's Capacitors direct to the source of low power factor. The initial cost of capacitor control gear is eliminated, starter maintenance is reduced, and improved starting performance obtained. Control is automatic at no extra cost and leading power factors at light loads are avoided. Each capacitor corrects individual motor power factor to a consistently high figure (above ·95) at all loads and reduces the load on all cables back to the source of supply.

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BRITISH INSULATED CALLENDER'S CABLES LIMITED

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BALDWINS

ELECTRICAL STEEL SHEETS
FOR TRANSFORMER AND DYNAMO WORK

ELECTRICAL STAMPINGS
OF ALL DESCRIPTIONS

SPECIAL ALLOY SHEET FOR MAGNETIC TEMPERATURE
COMPENSATION - HIGH FREQUENCY WORK - RELAYS

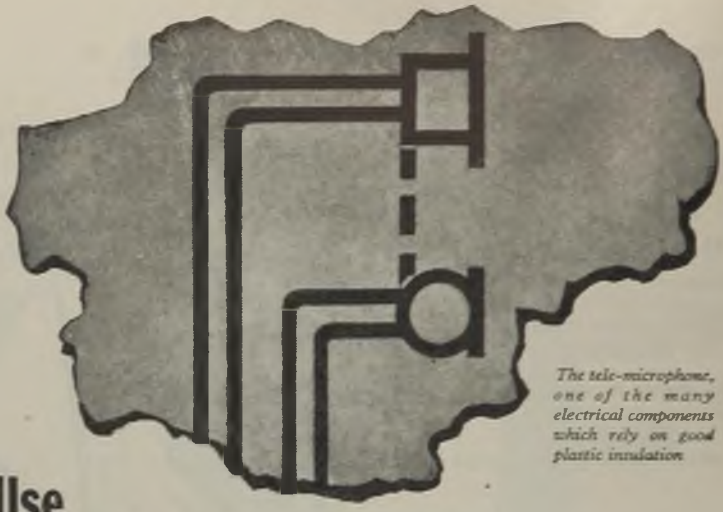
RICHARD THOMAS & BALDWINS LIMITED
WILDEN IRONWORKS, STOURPORT-ON-SEVERN, WORCS

Avoid any discord

People rarely blame themselves for buying a bad lamp. They usually blame the shop who sold it. That is a good thing to remember, and an important reason for selling Kye Lamps.

They are reliable lamps, and satisfy those who buy them. Your customers will remember where they got Kye lamps when they were hard to get. That is why you should keep to Kye now.

KYE **FOR GOODWILL AND SALES**



The tele-microphone, one of the many electrical components which rely on good plastic insulation

Use Radio Pre-Heated Plastics and be certain of Uniform Insulation

TO be a good insulator throughout, a component made of a plastic compound must have cured simultaneously in every part of the moulding. The thin sections must not be overcooked, and the centre of the thick sections must not be spongy.

The only way to be certain that this is the case with plastic components that you use, is to be sure that the plastic powder or preform was pre-heated by a Redifon radio heater before moulding. Redifon heaters plasticize simultaneously *throughout*, which ensures a perfect cure.

Redifon radio heaters have been specially designed to do this particular work. They can deal with between 2 oz. and 3 lbs. of plastic material per minute, using radio frequency outputs of 250 watts to 5 kilowatts. Saving in production time is often over 50 per cent.

Redifon radio heating sets have all the necessary safety devices for use by unskilled operators. They are fully enclosed and simple to operate. Manufacturers who wish for further particulars of the use of radio heating should get in touch with Rediffusion engineers now.

REDIFFUSION Ltd.

Designers and Manufacturers of Radio Communication and Industrial Electronic Equipment

SUBSIDIARY OF BROADCAST RELAY SERVICE LTD.

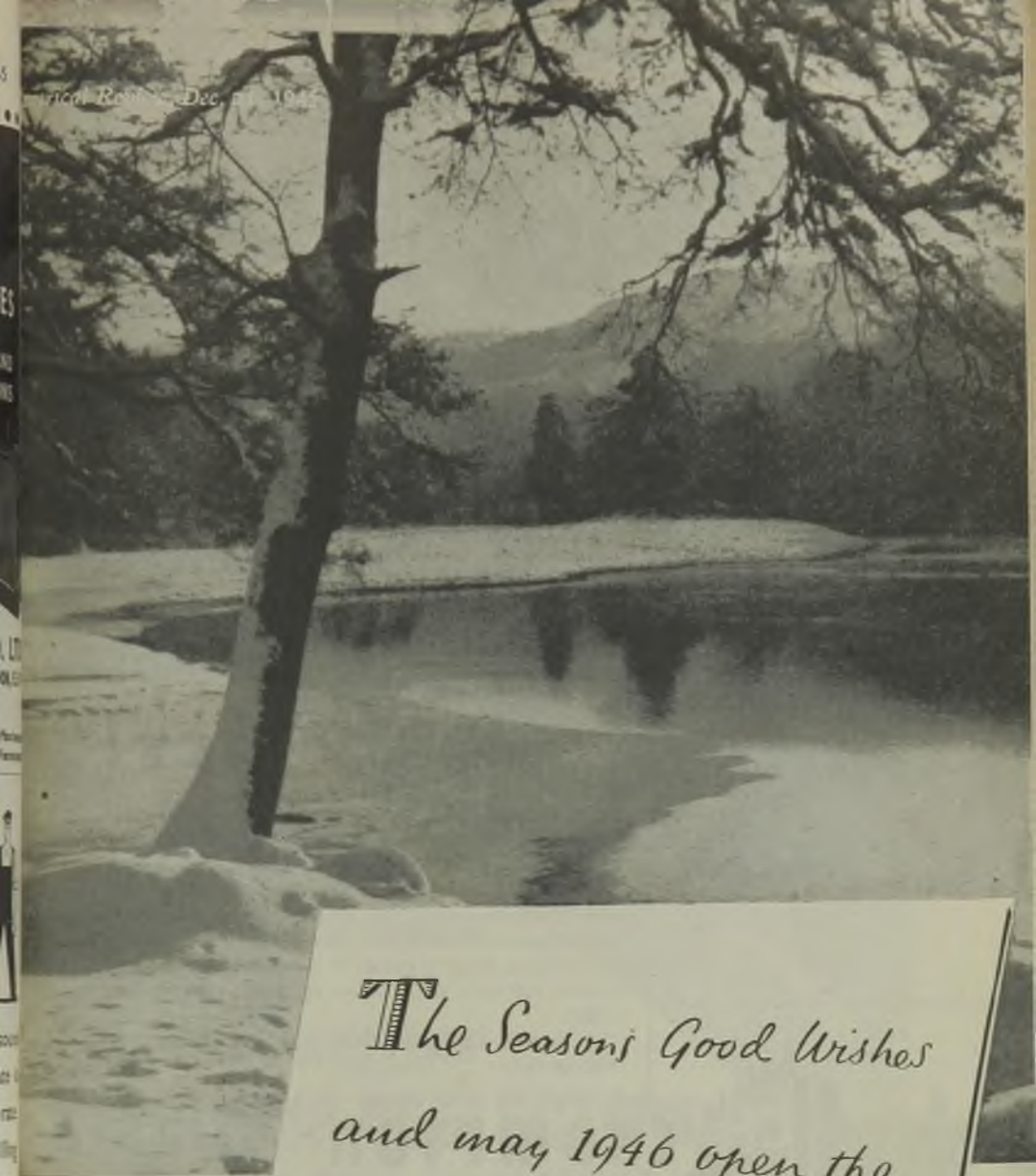
CARLTON HOUSE, REGENT STREET, LONDON, S.W.1

CRABTREE 'LINCOLN' SHOCKPROOF CEILING SWITCHES

CRABTREE 'Lincoln' ceiling switches, with base-fixing centres at 1½in., are offered for one or two-way control, and are available in three patterns: surface, semi-recessed, and semi-recessed complete with iron box.

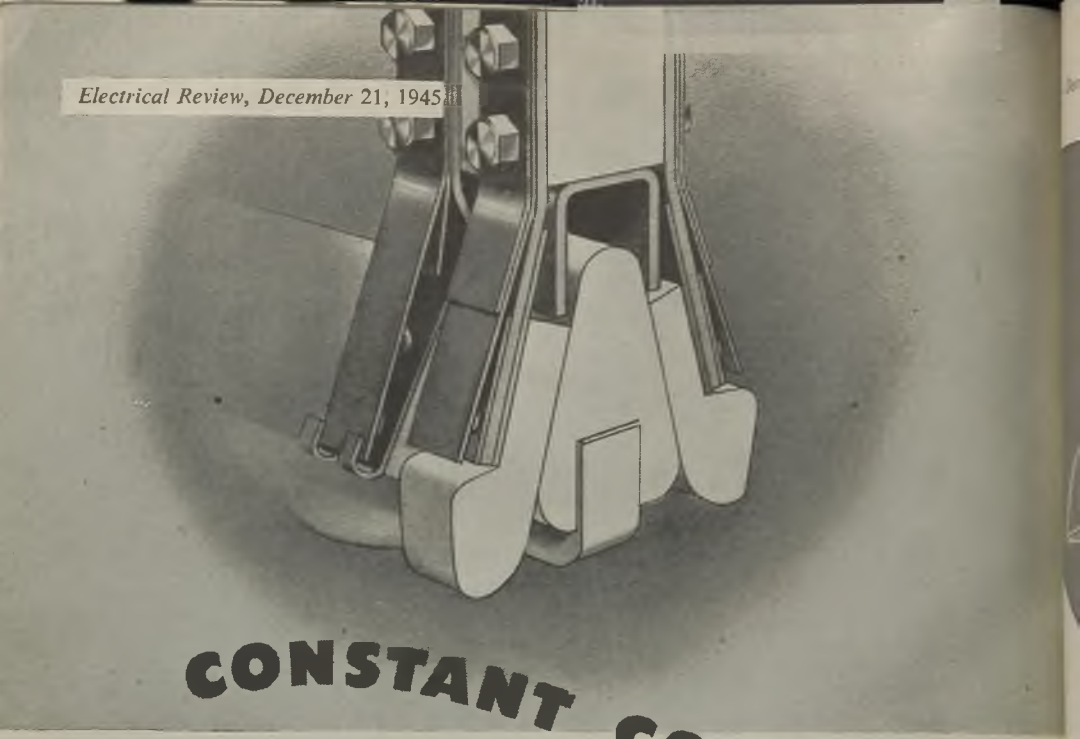
The reciprocal single pull mechanism has an unusually smooth and decisive action, and is enclosed by a moulded 'Jacelite' material cover which affords protection and prevents the ingress of dust and other abrasive agents.

Crabtree ceiling switches can be operated from any angle by an adjustable shockproof cord, and are designed for domestic and commercial service. In bedrooms, for example, control from the bed is best provided by a ceiling switch; while in bathrooms and other humid locations, the ceiling switch is by far the safest form of control yet devised. In offices and shops, where various departments are separated by partitions which do not extend to ceiling height, the ceiling switch provides individual light control simply and inexpensively, and enables the installation to be readily adapted to meet re-arrangements and extensions. A unique feature of ceiling switch practice is that all wiring is at ceiling level. The cost of wall drops to switches is therefore eliminated. Such economy, coupled with the extremely moderate cost of the 'Lincoln' accessory, permits its extensive employment on installations of a most competitive character.



The Seasons Good Wishes and may 1946 open the way to prosperity . . .

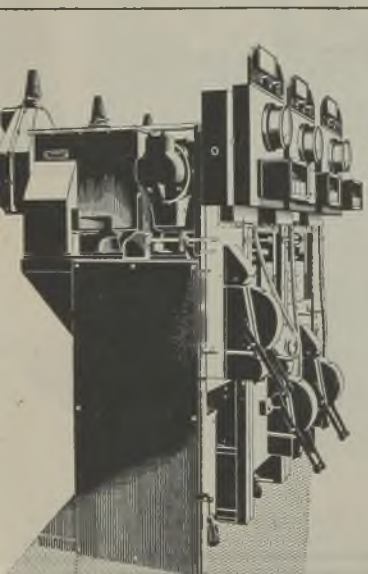
MIDLAND ELECTRIC MANUFACTURING COMPANY, LIMITED



CONSTANT CONTACT!

Constant access to a Short-Circuit Testing Station on the premises puts Crompton Switchgear designers in a favourable position. As members of the Association of Short-Circuit Testing Authorities, Crompton Parkinson provide official proving tests which are invaluable. But the testing station has another vitally important function. It provides a constant stream of experimental and part-by-part test data which forms the basic material for design.

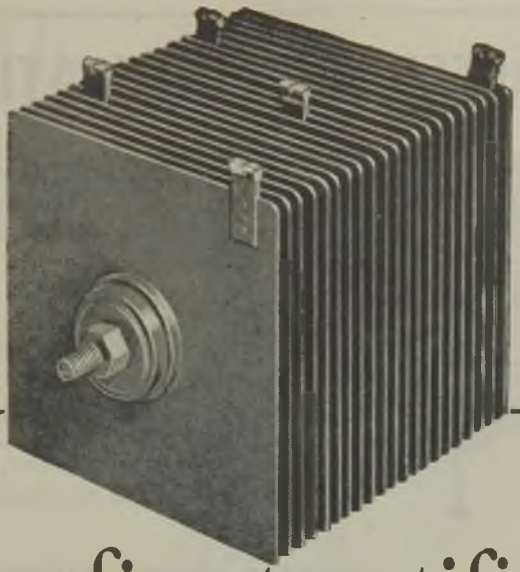
That is why Crompton Switchgear will do its job without fail.



CROMPTON SWITCHGEAR DESIGN BEGINS IN THE TEST STATION

CROMPTON PARKINSON LIMITED

ELECTRA HOUSE



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The mass of accumulated experience enables us to continue pioneering new and advanced designs, and the "Westalite" selenium compound unit is the direct result of years of steady progress towards ever better rectifiers.

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ELECTRICAL REVIEW

December 21, 1945

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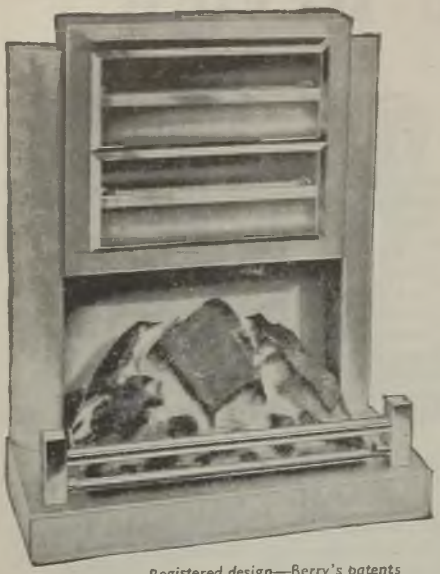

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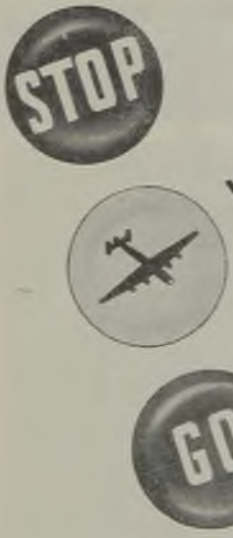
BERRY'S ELECTRIC LTD



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In 1939 our production of the well-known Sangamo Weston Meters was abruptly terminated. Today we are pleased to announce that these meters, quarterly, prepayment, fixed charge or polyphase types are once again available. In the meantime, our whole manufacturing resources have been devoted to the production of Weston Aircraft Instruments . . . The lessons learned during this intensive period have been added to our already extensive "know-how."

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVII. No. 3552. DECEMBER 21, 1945 9d. WEEKLY

Austerity Generation

Limitations Upon Technical Advance

IN considering the programme for new generating plant announced recently by the Central Electricity Board, one naturally asks how far it will embody the most advanced practice that has been shown to be technically possible. Formerly decisions could be made with a reasonable degree of confidence mainly by balancing the estimated value of operational savings against the increased charges incurred in securing them.

With the prevailing uncertainty as to the trend of coal prices and manufacturing costs, straightforward economic comparisons of this kind can no longer be drawn. Moreover, even if these factors were stable they would not now be the dominating ones. A new overriding requirement is that enough generating plant of high efficiency and reliability shall be manufactured and installed as quickly as possible to serve immediate needs. It seems probable that even the 4·5 million kW projected will leave little margin over the expected growth in electrical demand during the next few critical years.

Retarding Factors

There have to be taken into account inevitable manufacturing difficulties, such as those due to scarcity of labour, disproportion between the different types of craftsmen available and competing claims of export and essential home services for products as well as delays from protracted statutory inquiries regarding power station sites. Thus, the fear expressed recently by Mr. W. Dixon at Newcastle-on-Tyne (see our issue of October 19th), that the completion of the extension programme is likely to be in the main at least a year late, seems likely to be only too well grounded.

For the sake of rapid construction in what amounts to a national emergency, some measure of uniformity is, therefore, forced upon the industry. Steam conditions present the aspect that lends itself most readily to standardisation. A 900 lb. per sq. in. pressure has been generally adopted for new 50,000-kW turbo-alternators, though for smaller outputs 650 lb. or so is being retained. Few further 1,250-lb. installations, which might have been expected in greater number as the next stage, are being made.

Steam Temperatures

On the other hand steam temperatures, which have a much more important bearing on thermal efficiency, are being run up to close on the upper limit of proved reliability over long periods with alloy steels, 950 deg. F. at the turbine, although in some cases, including re-heat sets, less expensive carbon steel is being employed at temperatures somewhat above 800 deg.

Hydrogen cooling is being applied to 3,000-RPM alternators for outputs above 50,000 kW, where its advantages are more clearly established. As a means of improving exciter reliability, the three-to-one speed reduction of direct-driven machines suggested by Mr. Dixon appears to offer advantages over separate motor-driven units. Automatic boiler control is a feature of most of the new stations, with its merit of economising labour. From the examples cited it is clear that manu-

facturers—within the limits imposed by the foregoing considerations—are taking full advantage of recent engineering developments. The present position has to be accepted as part of the price paid by Great Britain for rehabilitation as a result of its lone stand at the critical phase of the war, when the responsible Ministry found itself unable to allocate labour and material to the construction of plant to the extent asked for by the Central Electricity Board. At the same time enough is being done to demonstrate that plant of both standard and more advanced types can be manufactured to meet any manner of needs.

Labour Control

THE relaxation in labour control which has been announced does not appear to affect a large proportion of workers in the various branches of the electrical industry as in these the majority of establishments are scheduled under the Essential Work Orders. These Orders cover 8¾ million people (including 2¼ million women) out of a total industrial force of about 16 million (including 6 million women). It is proposed, however, to release industries from the scope of the Orders as quickly as possible, three months' notice being given in each case.

American Aid

THERE appears to be general agreement that the terms on which the United States offers to lend Great Britain the sum of $4,400 million are hard but the best obtainable in the circumstances. The position as regards repayment is not clear but one thing at least is certain: that is, our export trade must be raised very considerably above the pre-war level—an increase of 75 per cent. seems to be the accepted idea. To this the electrical industry must contribute in a great measure and present indications are that given the necessary labour it will succeed in doing so.

Appliance Production

BOARD of Trade statistics show that there has been a substantial rise in the volume of domestic electrical appliances for the home market since the end of the European war; the figures are reproduced in this issue. The advance appears to have been greatest in the case of the smaller appliances, notably irons and vacuum cleaners. There has also been a substantial increase in the production of fires and radiators which, in the third quarter of this year was running at something under 40 per cent. of the pre-war rate. The figures of cooker supplies do not show the increase which might have been expected, nor do those relating to water-heating equipment. This is probably due to the fact that the statistics exclude goods made against Government contracts.

Coal and Charges

MR. SHINWELL'S very definite pronouncement last week that the era of cheap coal had ended and that no reduction in the price could be hoped for will set many electricity supply undertakings thinking. For the past few years they have seen coal prices going from height to height but have still refrained from recovering the full cost by increasing their charges, hoping that one day coal would become cheaper. Now they will know that their hope was a vain one and will have to study very seriously the charges to consumers who are not on coal-clause agreements.

Technical Colleges

THE importance of Technical colleges in the training of electrical engineers was emphasised in the I.E.E. Reports on Further Education. Of the 6,000 recruits in all grades, from professional engineers to foremen and craftsmen, expected to be needed by the electrical industry annually after the return of settled conditions, no fewer than 5,600 would be drawn from these establishments. The co-operation of regional and local colleges is essential to enable each kind to contribute according to its capacity. It is now some eight years since the Regional Advisory Committee for the Manchester District took in hand the integration of centres of technical education over a wide area and its recently issued *Students' Guide* presents a view of a working model of what the country as a whole requires.

Greetings

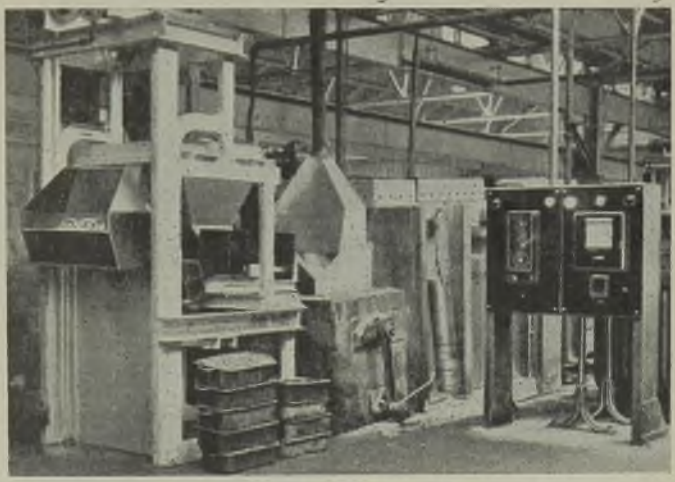
ALTHOUGH the first Christmas since the war will be almost as austere as the last six it will be celebrated in a less strained and anxious atmosphere. It is therefore with greater confidence than for a long time past that we wish our readers a Merry Christmas.

Temperature Treatment

Specialised Processes in Bolt Manufacture

IN the *Electrical Review* of November 30th we published an illustrated article dealing with electrical applications in the production of bolts and studs, excluding the heat-treatment processes, at the Glasgow works of A. P. Newall & Co., Ltd. Our object now is to outline the many specialised heat-treatment processes which we saw in the works, including some very fine examples of induction heating.

Some of the equipments employed have been constructed to the company's special requirements. The heat-treatment processes common to the manufacture of all four main classes of the company's products, "Hitensile," "Newalloy," "Newallastic" and "Hi-Tem" bolts and studs, are hardening and tempering, and except for differences in the operating temperatures—800 to 850 deg. C. for hardening and 500 to 650 deg. C. for tempering—the furnaces installed in the works devoted to these two processes are similar in all respects.

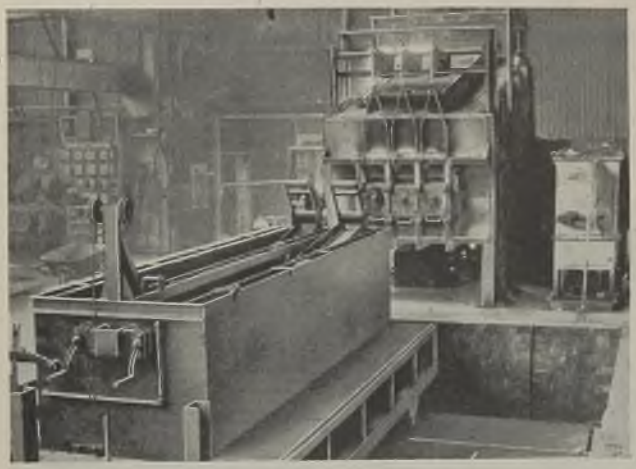


The hardening and tempering furnaces are of the conveyor type, each with a magnetically vibrating loading platform

In some cases the work is brought out from the quenching medium by a worm conveyor (left). The 60-kW carburising furnace (right) has an output of 10 cwt. in 24 hours

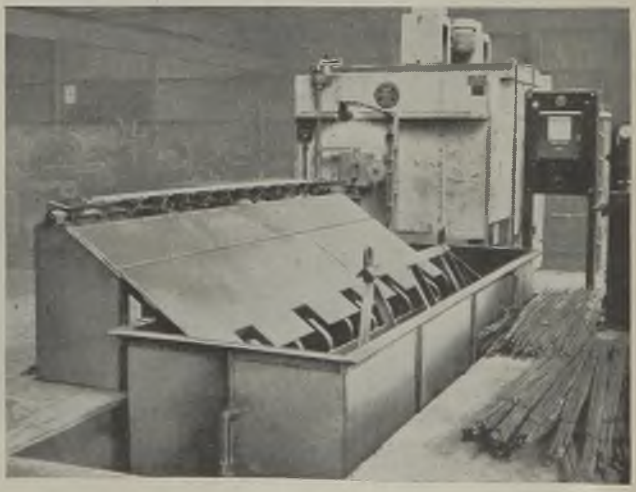
The hardening and tempering furnaces are of the Birlec conveyor type in which the work, while travelling through the heating chambers on conveyor belts, is subjected to radiant heat from electrical resistance elements. The work in all cases is the finished bolts and studs, apart from heat treatment, and in some cases the loading equipment consists essentially of a magnetically vibrated platform which is hopper fed. The vibrator distributes the bolts evenly over the conveyor surface at the front of the furnace, and the belt carries the work slowly through the heating chambers to the discharge end where the bolts fall into a quench tank which, for some furnaces, contains oil and for others water. The furnace conveyor is driven by a constant-speed 710-RPM 2-HP motor, with transmission *via* a variable-speed gear box which provides for conveyor speeds representing from 20 to 80 minutes for the complete travel of the work through the furnace. In some instances the work is brought to the surface from the quenching

medium by a worm conveyor in a perforated-drum housing, and in all cases it is delivered into suitable pans at the shop floor level.



Associated with the higher-grade products, this 3-chamber muffle-type furnace, complete with travelling quenching tank, hardens, tempers and normalises bars

The work is heat treated in an inert atmosphere to prevent scaling during the treatment. There is a gas seal to each furnace, in which town gas is specially treated to remove moisture and sulphur. The gas is mixed with air and burned, and the products of combustion, are pressure fed into the heating chamber to expel all free oxygen. There are two gas plants, each of which will serve two or more furnaces.



In the rotary tempering furnace is a rotor which ensures even distribution of heat and straightness of the product; discharging gear in front

There are two zones in each furnace. The first is a pre-heating zone in which, in the case of the hardening furnaces, the work is raised to 780 deg. C., while in the final zone the temperature is raised to the final treatment temperature. The heating chamber is about 24 in. wide, 12 in. high above the belt, and about 12 ft. long. There are nickel-chrome elements both above and below the carrying portion of the belt, *i.e.*, at the roof and the hearth, and these are contained in refractory built-in blocks by means of hook pins.

The element banks in each zone are balanced in a 3-phase delta system, with two legs above and one leg below the work, *i.e.*, the belt. Thermocouples in the heating chamber operate a mercury switch which, in turn, energises a small relay coil on the contactor. The contactor panel accommodates tripping switches which are adjustable to afford about 10 per cent. overload on the elements. When this figure is exceeded the main contactor is tripped.

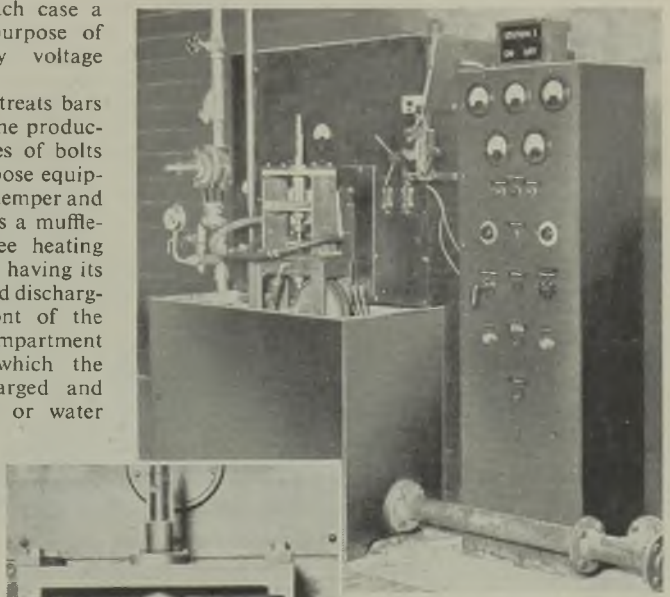
The furnaces are all thermostatically controlled, and the thermostats operate in conjunction with Cambridge graphical-type regulators. As a safeguard against thermostat failure each furnace is also equipped with a gold-wire heat fuse of suitable rating. This is accommodated on the heating-chamber interior wall and is electrically in circuit with the contactor tripping gear. For cleanliness the controllers are housed in an accessible separate room.

At 440 V the rating of each furnace is 100 to 110 kW, and 6 cwt. of work is normally heat treated per hour. The elements are operated at below the supply voltage, however, in order to employ the highest amperage possible, compatible with the external switch and distribution gear costs, etc., and there is in each case a transformer for the purpose of effecting the necessary voltage reduction to 122 V.

A furnace which heat treats bars mainly associated with the production of the higher grades of bolts and studs is a three-purpose equipment which will harden, temper and normalise the bars. It is a muffle-type furnace with three heating chambers, each chamber having its own separate charging and discharging doors. At the front of the furnace is a three-compartment quenching tank into which the heated bars are discharged and which provides for oil or water quenching or air cooling as desired. The tank rests on a traversely travelling platform, so that any tank compartment can be brought into line with any heating chamber for convenient discharging. The platform is motor driven and automatically stopped at the required line-up position by means of a special pre-selector device.

The furnace has two heating zones, the front one being set at a slightly higher temperature to compensate for the losses consequent on the opening of the doors. The operating temperatures and the electrical loadings of the separate heating chambers are up to 1,000 deg. C. and 150 kW. Roof elements only for downward radiation to the bars are provided, and the housing arrangements of the elements are similar to those of the hardening and tempering furnaces already described. The control arrangements are also similar. This furnace is likewise equipped for treatment of the work in an inert atmosphere. It is capable of dealing with 10 cwt. of work an hour, embracing all three treatments, at a total working load of 150 kW.

Another recently installed furnace in the development of which the company played



Above: No. 1 station of the induction heating plant provides for the surface hardening of pins and the like. Left: The work is passed through the central inductor at a speed of about 100 in. per min.

a considerable part is the Newall-Birlec rotary tempering furnace which deals with bars used mainly for the production of "Hi-Tem" and "Newallastic" studs. It has a rotor which revolves slowly inside the heating chamber and which accommodates six tubes, each of about 8 in. diameter. The bars are charged into these tubes and the rotating action permits the bars to roll round inside the tubes during treatment, thus ensuring thoroughly uniform distribution of heat throughout the work and straightness of the finished product.

The furnace is a single-zone type and the heating elements are arranged on the two side walls of the heating chamber. The fixing and construction arrangements of the

elements are similar to those already described. Even distribution of heat throughout the chamber is assisted by two atmosphere agitation fans suspended through the roof. The temperature difference between any two points in the chamber is not more than 3 deg. C. The total electrical loading is 150 kW, the maximum operating temperature is 700 deg. C., and the output is about 10 cwt. per hour.

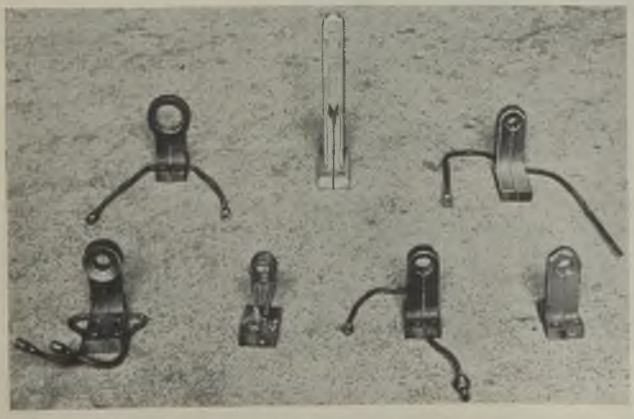
We saw also two carburising furnaces used for heat treating special pins. In one case the hearth measurements of the heating chamber are 2 ft. by 4 ft. and in the other 3 ft. by 5 ft. The carburising boxes are constructed of "Cronite," a chrome-nickel-iron alloy, and in position the charge is completely surrounded by elements, *i.e.*, on the roof, hearth, walls and door. Door switches are so arranged that when the door is opened all the elements are immediately switched off.

The furnaces are loaded at 40 to 60 kW, respectively, and their capacities are 6 and 10 cwt. per 24 hours.

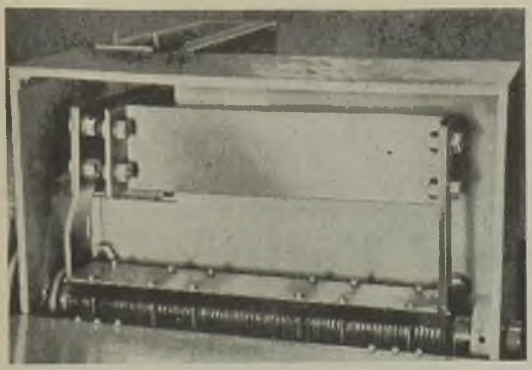
Another recent development is high-frequency induction heating whereby the work actually constitutes the core in the magnetic field within an inductor coil which is supplied with low-voltage high-frequency current, so that by the currents induced in the work heat is rapidly generated at the work surface. The degree of penetration depends on the input and time of the application, and to some extent on the frequency employed. The plant installed for this process includes an Electric Construction Co. 100-kW motor-generator set with a 10,000-cycle output to four stations. No. 1 station provides for the surface hardening of pins and the like; No. 2 for the selective hardening of socket and tappet screw heads, the points of brake adjustment screws, etc.; No. 3 for bar hardening and tempering; and No. 4, which is not yet actually installed, for the rapid heating of blanks for subsequent hot forging. The induction heating equipments used at the stations are Electric Furnace Co. and Birlec products.

At No. 3 station (induction heating) the bar passes slowly through a multi-turn coil

Nos. 1 and 2 stations are supplied through a transformer with a 25 to 1 ratio, thus enabling a single-turn inductor to be used. The work is passed through the inductor at a speed of about 100 in. per min., which results in a depth of penetration of 40 to 50 thous. on a $\frac{7}{8}$-in. diameter pin. Immediately after passing through the inductor coil the work is quenched by a high-pressure water spray to a resultant hardness of 60 to 65 C. Rockwell. The advantage of this method of surface hardening is that 85 per cent. of the penetration is retained at the full



A feature is the simple construction of the inductors to suit the shape of the work pieces



The number of turns on the inductor coil (No. 3 station) is sufficient to reduce the voltage enough to afford ample current

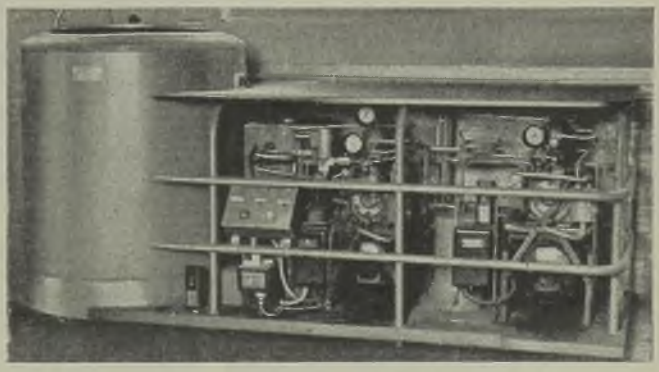
hardness figure. Thus, for spring pins and similar applications, an even rate of wear can be expected throughout the depth of the hardened zone. Another feature is the simple construction of the inductor coils to suit the shapes of the work pieces.

The inductor of No. 3 station is a multi-turn coil through which the bar passes slowly, allowing the surface heat to penetrate to the centre of the bar. Immediately on leaving the inductor coil the bar is quenched by a water spray. The machine may be so arranged that the bar progresses to a further coil by which it can be tempered, so that hardening and temperature can be effected in one operation sequence without deformation of the bar which is thus suitable for centreless grinding. No transformer is necessary in this case as the number of turns on the inductor is sufficient to reduce the low voltage enough to afford ample current.

In No. 4 station the blanks will be fed into the coils automatically, and the timing and ejection also automatically effected. The treatment time is so short that little or no scale is formed, and a very clean line of demarcation results between the portion heated and the original stock.

Incorporated in the high-frequency system is an " Eccodyne " voltage regulator—an electronic device with valve control which evens out fluctuations in the generator voltage. The valves operate a small motor-generator set which imposes a voltage on the field system of the high-frequency generator, thus maintaining constant-voltage conditions.

The title of this article, temperature treatment, as against heat treatment, was prompted by one of the latest developments in the hardening of high-speed tool steel, namely, the application of sub-zero temperatures (— 120 deg. F) in the " heat "-treatment cycle of this steel. It is a " Deepfreeze " equipment, the essential purpose of which is to change the austenite retained after hardening into martensite, to increase the cutting life of the steel. It has two compressors, one of which compresses propane gas and the other ethane gas, in a cascade system. The refrigerating chamber is 24 in. in internal diameter and 30 in. deep. It is essential that this machine shall operate continuously, because if it should stop for more than 30 min. the gases would expand in the system to a pressure above that of the safety blow-off valves. The ethane is circulated in an evaporating coil in the jacket between the refrigerating chamber and the chamber heat insulation. The temperature of the chamber is governed by an expansion rod which actuates a switch which controls the ethane compressor motor.



One of the latest developments is the application of sub-zero temperatures in the " heat "-treatment cycle of high-speed tool steel

Also in the system is a " frost back " device which controls the pressure at which the ethane is returned to the compressor. On

the high-pressure side of the compressor is a pressure control which, when the pressure rises to a predetermined point, starts up and runs the ethane compressor until the pressure falls again. A comprehensive range of tool heat-treatment furnaces installed in the works includes preheating, salt-bath, tempering and carburising equipments.

We are indebted to Mr. A. P. Newall, managing director, for permission to visit the works and to publish this article, and to Mr. A. P. Newall, jnr., director, Mr. C. Reid, works manager, and Mr. A. Wilson, assistant works manager, for their help in compiling the above notes and taking the accompanying photographs.

Transformer Failures

Principal Causes and Suggested Remedies

OPENING the discussion on Dr. E. Billig's paper on "Mechanical Stresses in Transformer Windings," presented to the Transmission Section of the Institution of Electrical Engineers (summarised in last week's issue, p. 864), MR. C. W. MARSHALL (C.E.B.) said that during the war faults on the grid system grew to many times the normal and some thousands of short circuits were caused by enemy action and by our own balloons and defensive measures. Grid supplies were, however, never seriously interrupted due to failures of transformers and none of the few failures of the type described in the paper occurred in grid transformers. Failure of end rings and imperfect clamping had been the main cause of the faults. Unsatisfactory sizes of conductors and shrinkage of the insulation had also caused trouble. Some of the secondary system protective equipment was too slow and primitive.

MR. D. P. SAYERS (Birmingham Electricity Department) said that, while the majority of transformer faults were electrical, faults did occur due to mechanical forces. Faults in tap changing gear, nearly all comparatively trivial, frequently led to more serious troubles and supply interruptions. Mr. J. B. HANSELL (Metropolitan-Vickers) suggested that failures of large transformers on short circuit were very rare and he knew of only one case. In view of the prevalence of secondary effects it was difficult to know where to improve transformers because it was not always possible to find out where the original trouble had been. He briefly described a method for measuring the short-circuit forces on an experimental transformer.

MR. L. SMITH (British Electric Transformer Co.) remarked that in large transformers the designer had to meet so many requirements that it was obvious that in a well-balanced and reputable design, the hazards or trends in regard to forces were counterbalanced by quite adequate supporting area and strength of supports as part of the exercise of the designer's art. MR. R. H. ABELL (C.E.B.) suggested that it might be worth while for users to give greater freedom to designers in regard to impedance and clamping. He also urged greater attention to l.v. windings.

The chairman, MR. E. T. NORRIS (Ferranti), said that there were other characteristics of a transformer to be considered and it would be very unfortunate if consulting engineers and purchasers of large transformers were to take any of the conclusions in the paper as they stood and insert them in specifications as prohibitions or stipulations. High-pressure clamping was a very debatable point indeed, and it was essential not to come to a conclusion as to the cause of failures without the most careful consideration.

The author, replying, agreed that faults on large transformers were rare. That was because the reactance of the supply system was fairly large as compared with the reactance of the transformer. Manufacturers should give users some instructions regarding adjustable clamps.

Gairloch Distribution Scheme

ON Tuesday the North of Scotland Hydro-Electric Board published its distribution scheme for the Gairloch and Aultbea district in north-west Ross-shire. This, the Board's Third Distribution Scheme, has now been submitted to the Secretary of State for confirmation. The scheme is planned to serve an area of 180 sq. miles round Loch Ewe and Loch Maree. With 52 miles of h.v. and 36 miles of l.v. distribution lines, it will make electricity available to over 95 per cent. of the total population of about 1,600 in the distribution area. The electricity will be generated at a power station on the River Kerry. The generating station and reservoir form part of the Board's Second Constructional Scheme which included the Tummel-Garry project, and it therefore received the approval of Parliament along with the Tummel-Garry project last month.

Power Plant Construction

Some Principles of Organisation

By *I. D. Campbell,*
B.Sc., M.I.E.E., A.M.I.Mech.E.

A SCHEME for the construction and extension of a power station can be divided into two principal stages: first, the outlining of the project and preparation of estimates; secondly, the detailed design and execution. After the plant and conditions have been decided, the preliminary scheme is developed by a series of successive approximations to the point where specific requirements can be stated and detailed design can begin. Typical plant dimensions are obtained from existing records or from possible suppliers. Alternative layouts are tried in the drawing office. Some specific limiting factors commonly become evident at this stage and require detailed examination, leading perhaps to the abandonment of some of the alternatives. Time, effort and discouragement at the drawing-board stage are less serious than on the site and must not weigh against the attainment of the best result. Decisions cannot be held up indefinitely, however.

When the form of the project has been decided, estimates can be drawn up for obtaining financial sanction. A detailed description, accompanied by estimates, should be circulated to all staff concerned. After general scrutiny by them it will be passed to the appropriate national or other body for authorisation.

Estimates must be made accurately and in detail and be sufficiently comprehensive to avoid subsequent explanations and supplementary estimates, which delay the job. It is a mistake to cover omissions by deliberate over-estimating. A "spot" estimate multiplied by two "for luck" may still be inadequate, because insufficient thought has been given to detail. Nevertheless, if 90 per cent. accuracy can be obtained by four weeks' work while four months are required for 99 per cent., the extra time could not be justified under present conditions.

Enough money (allocated separately for plant and buildings) must be allowed—for alterations to existing buildings and plant. Skimping in this direction may lead to valuable assets being spoiled. The two sections are commonly handled by separate executives and each must know what money is available.

The starting of detailed design of buildings and foundations, which comes next, requires at least approximate dimensions of plant. The method of selection of plant has, therefore, a determining influence on progress. Selection may be by competitive tendering, by choice based on existing installations or personal preference, or, at present, by official direction.

Free selection enables the quickest start to be made. Competitive tenders, which are often necessary to conform with standing orders or are sometimes desirable on technical grounds generally cause loss of time, as even preliminary dimensions cannot be obtained until the specifications have been completed and tenders selected.

The time spent on the initial draft of a specification will be about half or less than half that required for its completion. The draft has to be read, circulated to all parties concerned, amended, retyped and ultimately duplicated or printed. A specification for a major item of plant is unlikely to take less than six weeks to produce and may well take twice as long. An existing specification can seldom be used "en bloc," and any appreciable modification will entail complete redrafting. The specifications and bills of quantities of the civil engineer can be disposed of comparatively quickly without waiting for detailed discussions with other parties, subject to the general approval of the plant engineers and the correct provision of pipe ducts, cable entries, points of access and other features not always obvious from the plant drawings.

With I.E.E. Model Conditions and so many Standard Specifications there might appear to be little left to specify. This is not so; in fact these standards specifically impose upon purchasers the duty of precisely defining their requirements. It is to be hoped that this condition will improve as standardisation progresses. For example, the B.S. for steam turbines could take much more responsibility off the shoulders of the purchaser than it does.

The following points should be observed by the purchaser. His specifications should take a standard form and should cover every item of plant; this saves a great deal of

correspondence. Most undertakers have standard conditions applicable to all contracts, but there are always additional items applicable to one set of contracts (*e.g.*, site conditions, painting and lagging) that can and should be made uniform.

Matters liable to be overlooked are responsibility in each case for earthing electrical plant, site tests, clear labelling of all plant and controls and procedure for handing over. The need for the provision of a contingency sum in the contract should be borne in mind.

Terminal points should be specified with the responsibility for connecting up. All borderline cases, including chequer plates, supporting steelwork, foundation bolts and limits of drawing-office responsibility, should be defined. Care should be taken that specified procedure conforms to the usual practice of the trade, unless there is definite reason for departure according to a predetermined and rational plan. A standard condition should require all work to conform to relevant British Standards in force at date of contract.

Other matters that must be settled are site storage conditions, handling facilities, responsibility for giving or asking for access to site and overtime conditions. Spares, drawings and instruction books, on an adequate and stated scale, must be properly handed over and identified and the drawings to be approved and the inspection required (if any) should be defined. Although a matter verging upon design, it is important in specification drafting to remember that any feature that is not substantially necessary to the functioning of the plant will sooner or later fall into disuse or decrepitude. Such items, however attractive and ingenious, are better left out.

Importance of Correct Sequence

To maintain uniform progress, specifications must be tackled in the right order. Major items of plant and main pipework come first. To extend or construct a new station takes two or three years and many important items can and should be left for a year or two after the commencement of the scheme. Being too early is as wasteful of time as being too late, and unwanted contractors and material clutter up the site. Auxiliary cabling and wiring cannot usefully be considered as a whole until all other design work has been finished, which usually means the time when erection of the first plant items is about to commence. Conductors and small pipework will then be designed into the job, using runs and terminations reserved and envisaged from the start. Such work must be done to drawings and not left to the improvisations of numerous erectors.

While due account must always be taken in specifications of the preferences and suggestions of operating staff, the latter have a specialised outlook and generally have little conception of the nature of constructional work and the problems of design. Entrusted with a simple exercise in layout, an operating engineer at his first attempt usually ignores the principles of easy access and convenient operation. Conversely he is apt to expect perfection when this is plainly unattainable. His suggestions, more than his requirements, require careful scrutiny; absence of comments should not afterwards be brought up against him. Consultation with staff is best confined to specific cases, complete responsibility resting with the executive engineer who must be competent to judge on operational matters.

Drawing-Office Work

The apportionment of drawing-office work between purchaser and contractor is largely dictated by circumstances, but a reasonably clear understanding is advisable, by specification or correspondence, about borderline cases. The plant contractor will provide information to determine foundation details, but they will generally be designed by the purchaser. The positioning of auxiliaries and control panels may be fixed by purchaser or by mutual arrangement with the contractor at a conference arranged for this purpose.

Layout proposals committed to paper tend to become permanent. All lines on a drawing look alike, and six months after they are drawn there is nothing to indicate which were considered carefully and which were not. Therefore a preliminary proposal should not be committed to paper unless either it has had all the consideration of a final proposal, as far as knowledge at the time permitted and is technically sound, or the whole drawing or scheme is clearly marked *provisional* or *preliminary*.

For development of layouts a drawing-office staff normally experienced in building and civil works, with the guidance of a plant engineer, can cope with most of the ordinary problems of simple plant layout. Where the layout is complex or where there are extensive

alterations to existing plant, the demands on the engineer's attention become excessive and one or two experienced plant draughtsmen are necessary in order to prevent ill-conceived alterations impairing existing plant. The existence of separate executives for plant and buildings necessitates a firm routine for interchanging and checking information.

Plant contractors should be required to submit progress charts showing their programme of manufacture, delivery and erection. The purchaser should compile similar charts for special items showing dates of alterations to existing plant as well as all stages of purchaser's design and construction. Although on account of the slow progress of such work the programme is usually well fixed in everyone's mind and reference to progress charts is infrequent, they are valuable for the control of the job. Of more immediate value are detailed programmes for all operations involving existing plant. Alterations affecting running plant must be planned well in advance and committed to paper, copies being sent to all concerned. The operation can then be carried through without the distracting necessity of planning at the same time.

When an extension or construction programme is carried out with an existing operational or general duty staff the engineering of the separate contracts can well be divided among them. It should be a rule that one person only forms the point of contact with each contractor. Sub-contractors must always be approached through or with the knowledge and approval of the main contractor.

Scrutiny for Errors

All drawings submitted for approval must be scrutinised carefully for general technical errors, as the makers cannot be assumed to be infallible experts, some having recurrent and characteristic faults. Specialists in the undertaking should be consulted as necessary, and the drawing office must as a matter of routine look over all drawings and check as required for conformity with the general layout. Commonly several days or even weeks may elapse before approval, with or without comments, can be given. In general, purchaser's approval does not absolve the contractor from responsibility for the correctness of his drawing or design.

For the execution of the work at least two clerks of works are required, one for civil and building work and one for all mechanical and electrical plant, pipework and wiring. Their duties will be as follows:—

(1) Continuous supervision and inspection of all contractors' work in respect of quality, accuracy, conformity to drawings and samples, and progress; therefore they must be present, or be represented, at site during all hours when the contractor is at work; they must be prepared to exercise initiative in helping contractors to overcome local difficulties.

(2) Checking time and signing time sheets.

(3) Disciplinary control of contractors, liaison between contractors and purchaser's staff and assistance to contractors in provision of services usually required.

(4) Organisation and supervision of storage and handling arrangements.

(5) Observation of safety and Factory Act requirements and checking notification of accidents.

(6) Taking over of spares, tools, keys, drawings and instruction books, ensuring that these are complete and correct, and passing them, properly recorded and receipted to the parties concerned.

(7) Providing against later shortage of stocks of special materials and lubricants required by the new plant; the use of unsuitable lubricants often begins with an oversight in this way.

(8) Organisation of tests in collaboration with the contractor.

(9) Organisation of handing-over procedure and ensuring that all operators are properly instructed; this is a critical period during which there is danger of responsibilities falling between two parties; all arrangements made must be confirmed in writing.

During the guarantee period there will be unfinished, experimental or unsatisfactory items to be attended to, requiring whole or part-time attention from a contractor. Towards the end of the guarantee period the clerks of works must clear up all outstanding points before the contractors finally leave.

The foregoing outline of the general organisation of a constructional or extension scheme is written principally from the point of view of the plant engineer. Technical problems, being innumerable, have been avoided. Too much stress cannot be laid upon the necessity for technical competence and technical alertness of all staff directly concerned. A broad view of the scheme and an exhaustive knowledge and understanding of detail are equally essential to the successful completion of the work.

Unbalanced Loads

Practical Methods of Calculation for Medium-voltage Overhead Lines

By A. G. Milne, A.M.I.E.E.

THE extensive building programme and the brake on normal development during the war will cause a rapid increase in medium-voltage overhead distribution systems, introducing a variety of problems which will require increasingly precise engineering technique. Only the cheapest designs, consistent with efficiency, will be admissible.

The major factor is voltage regulation, for unless this is efficiently tackled, the usefulness of a system is seriously limited. Capital expenditure is influenced by the degree of regulation, and as the tendency towards standardisation fixes spacing and size of conductors, improvement can be effected by greater utilisation of available copper.

The approximate formula for voltage-drop calculations, IR cos ϕ + I X sin ϕ, is limited in application to straightforward cases of balanced load on a line, the separate conductors of which have equal impedances. For unbalanced impedances and unbalanced loads problems are best solved by the method of symmetrical components, used mainly for the calculation of unbalanced fault conditions and circuit unbalance. However, as this method is rather involved, it offers no practical solution.

Simplifying Procedure

Fortunately, in practice extreme accuracy is unnecessary, so that simplifying assumptions can be made. Unbalanced currents, current asymmetry, unsymmetrical spacing of conductors and phase sequence all affect the amount of regulation. With unsymmetrically spaced conductors in an untransposed line there is a transference of power between conductors in the magnetic field, which causes a variation in the values of resistance in each conductor; also inductances differ, while the degree of current balance, current symmetry, and phase sequence affect the mutual inductances.

The resistance and reactance of a conductor cannot be dissociated from the current flowing in it and from the currents flowing in adjacent conductors. A true appreciation is obtained only when the product of the current and impedance is considered in its vectorial relationship. This requires the application of a rigorous solution, the fundamental vector equations of which are developed to provide a voltage drop in vector form for each phase and neutral conductor. The general fundamental equations are shown below:

Methods of Treatment

The symbolic representation of instantaneous vector voltage drop in three phases and neutral, $\triangle E_1$, etc., is shown thus:—

$\triangle E_1 = I_1R + j\omega (L_1I_1 + M_{2.1} I_2 + M_{3.1} I_3 + M_{4.1} I_4)$ vector volts per cm.

$\triangle E_2 = I_2R + j\omega (L_2I_2 + M_{2.1} I_1 + M_{3.2} I_3 + M_{4.2} I_4)$ vector volts per cm.

$\triangle E_3 = I_3R + j\omega (L_3I_3 + M_{3.1} I_1 + M_{3.2} I_2 + M_{4.3} I_4)$ vector volts per cm.

$\triangle E_2 = I_4R + j\omega (L_4I_4 + M_{4.1} I_1 + M_{4.2} I_2 + M_{4.3} I_3)$ vector volts per cm.

where R = AC resistance in ohms per cm of conductor, L = self-inductance in henrys per cm. for each phase to an imaginary neutral, and M = co-efficient of mutual inductance between conductors in henrys per cm.

By substitution of the instantaneous values of current in each conductor in each expression and division by the current associated with each expression, values of R and X are obtained. These values, when expressed as a percentage of the approximate values, obtainable from any handbook tables, show differences in some cases which appear appreciable, but when worked out in terms of voltage drop they prove to be of no practical consequence. It follows, therefore, that a simplification can be introduced, as for all practical purposes R and X for each conductor can be assumed to be equal for any arrangement of conductor, spacing and current balance likely to be encountered.

The calculation of voltage drops can then be reduced basically to a single vector multiplication of a current and an impedance for each phase and neutral, and the change in line and phase voltages can be determined by vector additions and subtractions; that is, calculation by the symbolic method, using rectangular co-ordinates, which enable all vectors to be drawn. To be of practical use, however, further simplification is needed, and this is obtained by reducing the symbolic method to simple algebra by the use of

variations of the approximate formula IR cos ϕ + IX sin ϕ.

The magnitude and direction of the neutral current vector in time phase is derived from the vectorial relationship of the phase currents, and it is thus possible to obtain the total value of voltage drop or rise for each phase and the neutral by the use of simple algebraic expressions, without a sacrifice of accuracy of practical significance.

For the purposes of this article, all references are to a standard form of 400-230 V overhead line, with 7/0·136 in., 0·10 sq. in. hard-drawn copper conductors in vertical formation with 12-in. spacing, though the general formulæ given below, will apply equally to lines involving any size, spacing, and geometric arrangement of conductors commonly encountered in such systems.

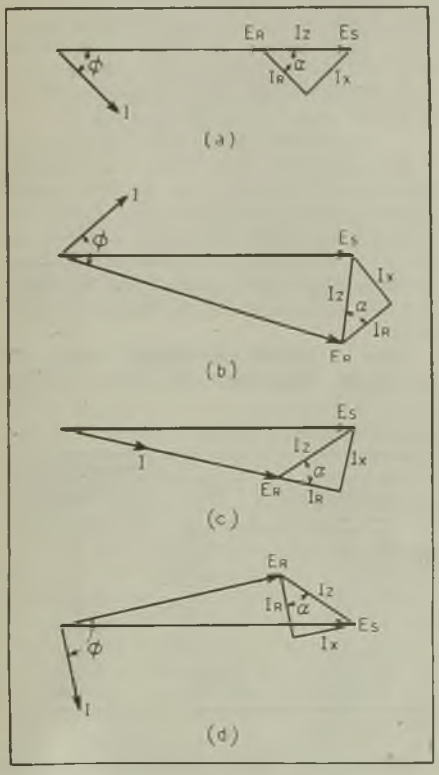


Fig. 1.—Voltage regulation: (a) Maximum, when cos ϕ = cos α = R/Z; (b) zero, when $\phi - \alpha = -\frac{\pi}{2}$ or cos ϕ = sin $\alpha = \frac{X}{Z}$; (c) at unity power factor = IR; (d) at zero power factor = IX. Formula IR cos ϕ + IX sin ϕ is applicable for cases intermediate between (c) and (d)

The approximate formula IR cos ϕ + IX sin ϕ is sufficiently accurate for use on single-phase two-wire and three-wire and three-phase four-wire circuits, assuming

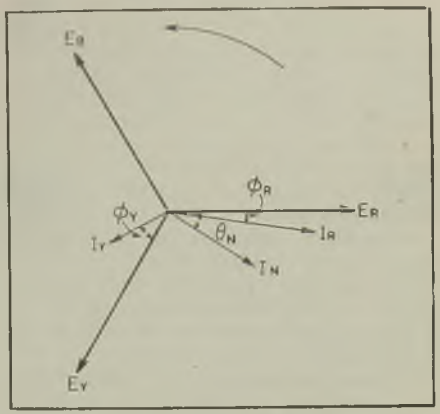


Fig. 2.—Condition of unbalanced asymmetric loading in R and Y phases

E_R reference axis; ϕ_R and ϕ_Y = angle of current lag; θ_N = neutral current angle to reference axis

balanced conditions in the last two cases. The values of R and X are obtainable from handbook tables or X may be calculated from the formula $X = \frac{2\pi f}{1000}(0{\cdot}1021 + 0{\cdot}741 \log_{10}\frac{d}{r})$ in ohms, where r = radius of conductor in inches, and d = distance between conductors in inches. With unequal spacing, d is taken as the mean spacing and is equal to $\sqrt[3]{d_1 \times d_2 \times d_3}$.

Regulation is defined as the percentage rise in load-end voltage, E_R, when full load is thrown off, the sending-end voltage, E_S, remaining constant. Approximately, $E_S - E_R$ = IR cos ϕ + IX sin ϕ. Expressed in a more convenient form, IR cos ϕ + IX sin ϕ = $IZ\left(\frac{R}{Z}\cos\phi + \frac{X}{Z}\sin\phi\right)$, now $\frac{R}{Z} = \cos\alpha$, $\frac{X}{Z} = \sin\alpha = IZ\cos(\phi - \alpha)$, where ϕ is power-factor angle and α is line impedance angle.

From this it can be seen that the regulation is a maximum when the p.f. angle = line impedance angle, *i.e.*, $\phi = \alpha$ or p.f. = $\frac{R}{Z}$, and the regulation is zero when $\phi - \alpha = -\frac{\pi}{2}$, or cos ϕ = sin $\alpha = \frac{X}{Z}$ and also that the formula is applicable only between the limits when

the p.f. is unity and zero lagging. For leading power factor the formula becomes $IR \cos \phi - IX \sin \phi$.

The vector diagrams in Fig. 1 show the voltage relationships at different power factors for one phase, and also how the accuracy of the formula can vary with line impedance angle and power factor. It should be noted that in single-phase two-wire cases, the errors are accentuated due to the displacement of the neutral voltage at the load end (not shown in diagram). Therefore, within the limits stated, this formula is sufficiently accurate for all practical purposes.

A common condition of unbalance in practice is the loading of one phase of a three-phase line. The approximate formulæ for this case, with a load connected between R phase and neutral and phase sequence R Y B may be written as follows:—

R phase, voltage drop to neutral, very nearly $= I_R \cos \phi\ (R_R + R_N) + I_R \sin \phi\ (X_R + X_N)$ .....(1)

Y phase, voltage rise to neutral, very nearly $= I_R\ R_N \cos (60 + \phi) + I_R X_N \sin (60 + \phi)$.....(2)

B phase, voltage rise to neutral, very nearly $= I_R\ R_N \cos (60 - \phi) - I_R X_N \sin (60 - \phi)$ .....(3)

Equations 1, 2 and 3 may be written: R to N drop $= 2 \times I\ (R \cos \phi + X \sin \phi)$; Y to N rise $= IR \cos (60 + \phi) + IX \sin (60 + \phi)$; B to N rise $= IR \cos (60 - \phi) - IX \sin (60 - \phi)$; where all quantities are scalar and ϕ = power factor angle.

For the condition of unbalance where two phases only are loaded the magnitude and angle must first be established with respect to a reference axis, of the current in the neutral. This is accomplished simply in the following manner, assuming R and Y phases are loaded (see Fig. 2). The currents in the loaded phases are added vectorially to give the neutral current: $I_N = I_R + I_Y$; $I_N = I^1_N - jI^{11}_N = (I^1_R - j\,I^{11}_R) + (I^1_Y - jI^{11}_Y)$ and θ = angle of neutral current with respect to the reference axis $\tan \theta = \frac{jI^{11}_N}{I^1_N}$.

Having established values for I_N and θ, the approximate voltage conditions for the three phases, for the same phase sequence, are then given as follows:—

R phase: voltage drop to neutral; drop in phase $= I_R\ (R_R \cos \phi_R + X_R \sin \phi_R)$; rise in N $= I_N\ [(R_N \cos \theta + X_N \sin \theta)]$.
Y phase: voltage drop to neutral; drop in phase $= I_Y\ (R_Y \cos \phi_Y + X_Y \sin \phi_Y)$; rise in N $= I_N\ [R_N \cos (60 + \theta) + X_N \sin (60 + \theta)]$.

B phase: voltage rise to neutral; $I_N\ [R_N \cos (60 - \theta) - X_N \sin (60 - \theta)]$.

These equations may be written:—
Voltage to neutral, very nearly:
R to N drop $= I_R\ (R \cos \phi_R + X \sin \phi_R) + I_N\ (R \cos \theta + X \sin \theta)$ .....(4)
Y to N drop $= I_Y\ (R \cos \phi_Y + X \sin \phi_Y) + I_N\ [R \cos (60 + \theta) + X \sin (60 + \theta)]$ ..(5)
B to N rise $= I_N\ [R \cos (60 - \theta) - X \sin (60 - \theta)]$ .....(6)

All quantities are scalar: ϕ = power factor angle for each phase, and θ = neutral current angle to reference axis. Conditions of unbalance and asymmetric loading can therefore be solved by the above approximate formulæ, in a simple manner and without a sacrifice of accuracy of any practical significance.

Table I shows volt drops values and percentage differences for three different loadings to which three methods were applied in turn, *i.e.* (1) a rigorous solution, making no simplifying assumptions, (2) the symbolic, using rectangular co-ordinates, making the simplifying assumption of equal values of R and X for all phases and neutral, and (3) approximate algebraic formulæ.

TABLE I
TABLE OF PHASE TO NEUTRAL REGULATION

Degree of unbalance	Phase	Approximate method	Symbolic method	Rigorous method	Percentage error of approximate method
R phase loaded, 50 A at unity p.f.	R	24·69VD	23 VD	27 VD	− 0·9
	Y	17·68VR	18 VR	19·4VR	− 0·7
	B	5·36VD	5 VD	5 VD	+ 0·2
R and Y phases loaded, both 50 A at unity p.f.	R	30 VD	30 VD	29·6VD	+ 0·2
	Y	7 VD	5 VD	5 VD	+ 0·9
	B	12·34VR	13 VR	10 VR	+ 1·2
R phase loaded, 50 A at 0·5 lag; Y phase loaded 25 A at 0·8 lag.	R	34 VD	34·2VD	38 VD	− 1·8
	Y	11·9 VD	10 VD	13·5VD	− 0·65
	B	19·75VR	20 VR	20 VR	− 0·10

D indicates drop and R rise in voltage.

CORRESPONDENCE

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

Calling-up of Skilled Men

A COPY of the *Electrical Review* for October 19th has just come into my hands, and I should like to express my indignation and that also of my comrades, at the last paragraph of your editorial.

Judging from this and other sources, it would appear that it is the policy of industry at home to allow the same men who have endured the six years of fighting, not to mention the irksomeness of military life in the recent war, to continue to execute the country's overseas commitments in the peace.

As an electrical engineer who had his training interrupted 6¼ years ago by war service and who now feels that he is at a considerable disadvantage to those who have stayed at home in civilian life, I can only say how strongly I feel that the time has now come for my replacement by one of these latter more fortunate persons.

M.E.F. STAFF SERGEANT, R.E.M.E.

[It was realised when this editorial note was written that there was a risk of causing indignation among Service men. We thought, however, and still think, that these men are better served by keeping industry running at an accelerating pace than by disrupting it by calling up comparatively few "key" men.—Editors, *Electrical Review*.]

Supplies to Farms

WITH reference to the letter from Mr. Douglass in your issue of November 23rd regarding supplies to isolated consumers, it has been generally appreciated in the past that transformer losses present a serious problem. They have become more serious owing to the increased cost of coal.

On the other hand, the number of isolated consumers, and hence the losses incurred in supplying them, usually form a very small percentage of the total and it is not altogether reasonable to consider economics in relation to individual consumers. One must take the fat with the lean. Undertakings that are predominantly rural with only very small power loads do not show losses that are really serious. Improved transformer efficiencies with lower iron losses would, of course, help.

While agreeing with the statements of Mr. Douglass, I would suggest that the way to get over the difficulty is to increase the consumption of the farms. This is actually happening in many instances. On a sample of farms the revenue has almost doubled since before the war, the tariff remaining the same.

London, W.C.2. H. W. GRIMMITT.

Single-Pole Fusing

WITH reference to Mr. Alex. Milne's statement that too many unqualified people carry out installation work, this is only to be expected when one finds so many books available at large stores giving instructions in simple terms on how to do this and also on how to connect up various pieces of apparatus.

Single-pole fusing, in my view, fails to give the same protection as double-pole against such things as the connection of switches in the neutral and the possibility of the neutral of the whole installation being connected to the line side at the meters or main switch.

Although neutrals may be connected correctly at the meters initially, installations are disconnected occasionally, perhaps when the occupiers leave or when new meters or when new main switches are fixed. In each case there is a possibility of connections being reversed, so that in such cases double-pole fusing offers increased protection.

Dorchester. STANLEY ROGERS.

Tests for Craftsmen

AS it appears inevitable that all skilled craftsmen will eventually be included in the Government's scheme of nationalisation, either directly or indirectly, and in view of the encouragement now given to apprentices to devote all possible leisure time to the advancement of their technical knowledge through the various day and evening schools, I would suggest that the Government introduces legislation to secure that before any skilled craftsman is allowed to be employed as such, he shall submit to a trade test at a Government centre to be provided for the purpose, and if successful shall be supplied with a certificate of proficiency.

Such an arrangement would, in my opinion, guarantee reasonable security to apprentices possessing initiative, and would encourage the better type of young man to enter the various trades. Under existing

arrangements a first-class craftsman enjoys no better conditions from a remunerative point of view than one who has never taken his work seriously enough to attain proficiency. As an employer, I would be prepared to submit to a similar trade test, and I trust my remarks may receive the support of others interested.

Mansfield. W. SCOTT.

Load Shedding

REFERENCE has been made in the technical Press recently to the question of load shedding during the present winter months, and I enclose copy of a letter which has been sent to our largest consumers. During the war this Corporation supplied a very large number of Ripplay relays to the wardens, by means of which they could receive a "purple" warning. As these relays are now of no further use for that purpose, I decided that a use might be found for them if they were temporarily installed in the factories and mills of a number of our largest industrial consumers to give direct warning of a need for a reduction of their load.

The enclosed covering letter I think is self-explanatory, and the number of acknowledgements which have already been received indicates that with the co-operation of these large consumers we may be able to avoid "feeder tripping."

Huddersfield. F. A. ELLIS,
Borough Electrical Engineer & Manager.

[The letter referred to states that owing to a national shortage of generating plant it may be necessary to switch off certain sections of the distribution system in order to comply with instructions from the Central Electricity Board to reduce the load on the generating station. It is pointed out that consumers by reducing their loads on receipt of warnings might prevent a total cut-off of the supply. The first warning would be a reduction in the voltage. Should the position become more serious, a signal would be sent over the distribution system to operate "Ripplay" relays on the premises of certain consumers. The instrument would be loaned free of charge, a deposit of £2 required being returnable. It is pointed out that while inconvenience might be caused by the interruption of supply to a factory, serious consequences might attend the cutting-off of hospitals and domestic premises in cases of serious illness.—Editors, *Electrical Review.*]

Technical Study

The Electrical Engineer's Library

WHEN lecturing on "The Electrical Engineer and his Library" to the Association of Supervising Electrical Engineers, MR. C. W. MARSHALL (C.E.B.) remarked that permission to use text books for answering examination questions (which the Association allowed) was an entirely rational procedure.

The most successful British engineers he had known were not bookish individuals; they succeeded remarkably well without much reading, the benefits of which were intellectual rather than material.

As the objective of technical study should accordingly be attainment to at least the standard of an engineering degree, the lecturer proceeded to recommend a series of books (mentioning authors and publishers) which would enable any reasonable examination question to be answered and provide a framework that could be extended by practical experience.

Natural philosophy (called physics in England) made considerable calls on memory, but the main requirements could be satisfied by summarising one's knowledge in formulæ (the beginning of the alliance with mathematics) which became part of the engineer's working equipment. The subject of chemistry was in process of being merged into that of atomic physics, but nothing would be lost by reading through the conventional course.

Mr. Marshall commended the suggestion that it would be preferable to have electrical engineering studies on AC; the theory was in most respects simple and DC could be regarded as a special case. That point of view would, he thought, be generally accepted if the calculus were taught early in life, as it should be.

Mr. H. G. Wells had recommended the compilation of a "World Encyclopedia," to rationalise the world's scientific text books. Such a work would be of inestimable benefit.

The lecturer considered that British Standard Specifications should form part of the library of every engineer. Their nomenclature, drawing symbols and definitions were accepted throughout the English-speaking parts of the world, merging into those of the International Electrotechnical Commission. Some B.S.S. were excellent examples of the condensation of basic information that was hard to obtain from conventional textbooks.

B.S.S. concerned with circuit-breakers provided, in brief but clear form, all the information likely to be required by the user of switchgear. The E.R.A. researches into arc creation and extinction indicated that the study of classical electromagnetism, which had been the basis of all electrical engineering design in the past, might have to give place to something entirely different.

The lecturer's concluding advice to his audience was to avoid too wide reading until they had become thoroughly established in a material sense.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE annual dinner of the Birmingham Centre of the Illuminating Engineering Society was held on December 7th, when over 140 members and their guests were present. **Mr. F. F. Middleton** (chairman of the Centre) presided. In acknowledging a toast to "The Visitors," Mr. H. Hooper (I.E.E. South Midland Centre) said that members of their respective organisations need not be alarmed by suggestions of nationalisation. Mr. A. Brian Cooper (Birmingham and Five Counties Architects' Association) proposing the toast of "The Society," said he thought it of vital importance that lighting should be considered alike by architects and illuminating engineers. By such joint action many difficulties might be overcome. Mr. H. C. Weston (national president of the Illuminating Engineering Society) who responded, said that the Society had grown in responsibility and reputation, and in the coming days its influence would be greatly extended. The Birmingham Centre was the largest in the country, and he congratulated it on its activities.

Mr. A. P. MacAlister is continuing his service with the Islington Borough Council until January 31st, after which **Mr. F. S. Naylor,** borough electrical engineer of Gravesend, will be taking over the duties of borough electrical engineer and general manager.

After fifty years' service with Drake & Gorham, Ltd., **Mr. H. B. Dodsworth** was recently presented with a silver salver by the chairman on behalf of the directors. Mr. Dodsworth originally joined the company as a wireman and was promoted to supervising engineer in 1912. He has been entrusted with the supervision of many large contracts carried out by the company's Manchester branch, and is still responsible for much important work.

Lieut.-Col. H. Riggall, J.P., director of Ruston & Hornsby, Ltd., and associated companies, has been elected president of the British Engineers' Association.

Organised jointly by the London Graduates' Section of the Institution of Mechanical Engineers and the Students' Section of the Institution of Electrical Engineers, a very enjoyable dance, held at the Porchester Hall on December 8th, attracted about six hundred members and friends. Novel elimination dances were arranged by Mr. G. Lyon, to whom, with Mr. S. Smith, is due the credit for the successful function.

Mr. S. A. Gaskell and **Mr. A. D. Mackenzie,** O.B.E., B.Sc., have joined the board of Bruce Peebles & Co., Ltd.

The Dramatic Section of the Sports Association of the Micanite & Insulators Co., Ltd., recently presented the three-act play "Tilly of Bloomsbury." In four nights the performance was given before an audience of 1,400 people. Collections were made on behalf of the Great Ormond Street Hospital for Sick Children and at the final peformance Major Stanley M. Mohr, O.B.E., M.C., managing director of the company and president of the club congratulated the performers and Mrs. Mohr presented bouquets.

Mr. B. Hallows Garside, who as announced in our November 30th issue is relinquishing his position of general manager of the Chelmsford works of Crompton Parkinson, Ltd., on January 1st, will on that date take up the appointment of managing director of the Britannic Electric Cable & Construction Co., Ltd., and of Hopkinson Motors & Electric Co., Ltd. Mr. Garside has been with Crompton Parkinson for eighteen years and before taking over the managership of the Chelmsford works three years ago was director and general manager of the company's subsidiary, Derby Cables, Ltd. In the 1914-18 war Mr. Garside was a pilot in the R.N.A.S. and in the war just concluded he lectured extensively at Derby on airborne tactics to the Home Guard, in which he was captain and deputy company commander.

Mr. F. D. Smith has been appointed general manager of the Britannic Electric Cable & Construction Co., Ltd. Previously he was works manager of Aero Engines, Ltd., Kingswood, and before that he had extensive experience in South America where he was employed in various capacities by the Telephone Trust, Ltd., the Venezuela Telephone Co., and the International Telephone Co.

F./Lt. C. H. Thompson, who has served with the R.A.F. since July, 1942, will resume his position with the P. & B. Engineering Co., Ltd., on January 1st, as technical representative in the London and Home Counties area.

Mr. A. G. Milne, A.M.I.E.E., A.M.I.Mech.E., who has just been appointed technical superintendent to the Blackburn Corporation Electricity Department, has since 1939 been serving with the Yorkshire Electric Power Co. as senior works assistant, Mains Construction Department, and technical assistant to the superintendent of operation. Mr. Milne, who is thirty-five, received his electrical training at Faraday House Electrical Engineering College, where he obtained an honours diploma, and in C. A. Parsons & Co.'s Steam & Electrical Test Department and Electrical Research Department. After serving for a year as junior charge engineer with the County of London Electric Supply Co., Ltd., he was in 1935 appointed assistant district engineer to the Yorkshire Electric Power Co., leaving this company for two years to take up the

position of assistant works manager, Engineers' Tool Department, Thos. Firth & John Brown, Ltd., Sheffield. Mr. Milne has been closely associated with I.E.E. matters and until his move to Blackburn was assistant hon. secretary of the North Midland Centre. While with C. A. Parsons at Newcastle he was capped for Northumberland for Rugby football.

The staff of the National Boiler & General Insurance Co., Ltd., Manchester, presented **Mr. J. E. Brown,** M.I.E.E., with tokens of their esteem on the occasion of his retirement from the position of head of the Electrical Department. Mr. Brown is succeeded by **Mr. A. R. Milne,** B.Sc. (Eng.), A.M.I.E.E., who joined the company in 1928 as an inspecting engineer.

Mr. Joseph Badaro, of Beyrouth and Damascus, is in England for a few weeks with the object of purchasing refrigerators and domestic electrical appliances for export to the Near East. His address is c/o Convoys, Ltd., 30, Bouverie Street, E.C.4.

Mr. J. Vaughan Harries, hon. assistant secretary of the Western Centre of the Institution of Electrical Engineers, has moved to 28, St. Mary Street, Cardiff (telephone: Cardiff 5885).

Mr. E. S. Little has been appointed secretary of the British Thomson-Houston Co., Ltd. Mr. Little, who is a director of the company, will continue his existing duties as comptroller.

To mark the occasion of his recent retirement from the position of superintendent of the Prince of Wales power station, Rotherham, **Mr. J. R. Hawes** was presented by his colleagues with a photograph of the Electricity Department's staff, War Bonds and a pipe. The presentation was made by Mr. W. H. Duffett, borough electrical engineer. Mr. Hawes, who is being succeeded by **Mr. R. S. Atkinson,** power station superintendent at Lincoln, was with the Electricity Department for over forty years.

Obituary

Mr. J. Taylor.—We learn with regret of the death on December 13th, at the age of eighty-four, of Mr John Taylor, joint managing director and vice-chairman of Mather & Platt, Ltd., until his retirement in 1942. In his early days Mr. Taylor was a partner in a firm of fire engineers and was responsible for a number of fire-extinguishing devices which became widely used. His firm was absorbed by Mather & Platt in 1899 and he became a director of the company. He took a leading part in the development of the Park Works, Newton Heath, and travelled extensively on the company's business. He served the Government in a number of directions during the 1914-18 war and was made a C.B.E. Among other things, he was chairman of the committee set up by the Ministry of Reconstruction to study problems connected with electrical machinery and apparatus production.

Mr. P. Rosling.—We regret to report the death of Mr. Percy Rosling, M.I.E.E., which occurred at Lower Bourne, Farnham, Surrey, on Thursday last week. Mr. Rosling was born at Reigate and was educated at Queenwood College, Hants. He was an apprentice and later an assistant with Henley's from 1887 to 1891 and then was in business in partnership until 1903. In that year he joined the British Thomson-Houston Co. and served with that company at Rugby and Leeds for three years. He then rejoined Henley's and was their manager in Australia from 1906 to 1913 when he returned to England as the company's general manager. He retired in 1932.

Mr. H. A. Cox.—We learn with regret of the sudden death recently, at Preston, of Mr. Harold Ainsley Cox, formerly chief of the Testing Department of the English Electric Co.'s Dick, Kerr Works, Preston. Mr. Cox went from Siemens Bros. & Co., Ltd., in 1901, to take charge of the Testing Department of Dick, Kerr & Co., as the works then were, and continued to hold that position until his retirement in 1931. Mr. Cox took a keen interest in the studies and recreation of students and apprentices and many men now well known in the electrical engineering world passed through his department.

Mr. C. H. Sankey, late chairman and managing director of J. H. Sankey & Sons, Ltd., died on December 12th at Tunbridge Wells, at the age of eighty-one.

Mr. Thomas Meech, director of Burdette & Co., Ltd., electrical engineers, died at Woodmansterne on December 7th.

Mr. F. A. Williams, A.M.I.E.E., late of the Engineering Department, Port of London Authority, died at Bournemouth on December 4th at the age of seventy-four.

Mr. R. J. Morris.—We regret to announce the death of Mr. Robert John Morris, a director and sales manager of Edison Swan Cables, Ltd., and a director of the Edison Swan Electric Co., Ltd., which occurred on December 15th after a short illness.

Future of the D.O.T.

ON Monday last the Prime Minister announced that arrangements were in hand for placing the Department of Overseas Trade solely under the Board of Trade instead of its being under the joint control of the Board and the Foreign Office. The responsible minister would be known as the Secretary for Overseas Trade and he would co-ordinate the work of all the departments concerned. Arrangements would be made for the training of members of the Foreign Service within the Board of Trade and for rapid communication between them and the Board of Trade on commercial matters. The Trade Commissioner Service, which operated in the Empire and Commonwealth, would be administered directly by the Board of Trade.

Views on the News

Reflections on Current Topics

MR. DALTON, Chancellor of the Exchequer, has assured Sir Arnold Gridley that he is giving "sympathetic" consideration to the abolition of purchase tax on kettles and other household appliances. This, I think, is certainly a case for "sympathy." It was somewhat illogical to remove the tax from cookers and water heaters and leave it on cooking utensils. These are things that people must have and therefore the tax is merely a means of raising revenue—not a deterrent to purchasing, which was ostensibly one of the principal aims in instituting it. Perhaps we may hope to see it disappear in April. It may be recalled that the tax on copper domestic hollow-ware has already been halved.

* * *

I have been misunderstood. A month ago, in mentioning a new E.D.A. booklet, I commended the advice which it gave to consumers not to rely entirely on the operation of the thermostats of their water-heating systems and said, "I have found this a frequent cause of complaints of the expensiveness of electric water heating." Now I find that this has been interpreted to mean that thermostats are expensive. They are not and they are very necessary adjuncts to water heaters. My remarks applied to operation only. I have known people to go away for a week-end or even longer leaving their automatic water-heating service running. This has naturally resulted in consumption of electricity during their absence, but they have blamed electricity—not themselves.

* * *

People in London and elsewhere who cook by gas are wondering whether they will be able to rely on sufficient pressure for the cooking of their Christmas dinners. Those with electric cookers should not have to worry. There will be very little industrial load on at that time and I am sure that the Minister of Fuel and Power and the Central Electricity Board will not mind a small peak on this special occasion.

* * *

A peculiar situation which has arisen at Middlesbrough may be paralleled elsewhere although I have not come across another example. The chairman-elect of the Gas and Electricity Committee (Councillor H. Madden) is an official of the Electrical Trades Union and represents the employees on the District Joint Board and Industrial Council (Electricity Supply Industry). Normally, of course, as chairman of the Committee, he would be on the other side of the table. Some discussion of the position took place at a recent Council meeting, when it was recommended that the electrical engineer (Mr. H. Haigh) should represent the undertaking on the employers' side. It was represented that occasions would arise when the engineer and his chairman would be in opposition to one another. A majority of the Council confirmed the election of Councillor Madden as chairman of the Committee and the appointment of Mr. Haigh as representative on the D.J.B. and D.J.I.C.

* * *

Sir Patrick Dollan (Glasgow) told a coal education conference recently that power stations and domestic grates were the "most wanton wasters of coal." He was referring to the fact that the thermal efficiency of power stations is below 25 per cent., but I do not think that "wanton" was an appropriate epithet. Sir Patrick went on to say that "the Government would now insist on power stations installing plant capable of a high standard of efficiency"—and that after all the striving of power plant designers to squeeze out the last BThU.

* * *

Commenting on the large number of people still subject to control under Essential Work Orders, the *Yorkshire Post* said:—"While it is announced that a review of the Orders is to start immediately, it may well be asked why it was not started long ago. Has the continued production of 'Canvas Hose Carbons for Searchlights' . . . really been necessary during all the months that have elapsed since the end of the war?" The carbons mentioned were strangers to me but when I looked up the list circulated by the Ministry of Labour of industries scheduled under Essential Work Orders there they were—"Canvas Hose Carbons for A.A. Searchlights." The typist had apparently run two items together to the confusion of the innocent.

* * *

Another example of innocence—from the *Liverpool Daily Post* this time. This contemporary reports:—"Extensive preparations now taking place at Wallasey for increasing the voltage of the electric supply to ordinary consumers from 200 volts to 230 volts have led to the disclosure that the Central Electricity Commissioners, controllers of the 'grid', are considering the institution of a national voltage standard for all lighting, power and equipment." Well, it was bound to leak out at some time. Why did the Central Electricity Commissioners try to keep it dark?—**REFLECTOR.**

Cooling-Tower Efficiency

A Method of Measurement

By G. Oldroyd, *Graduate I.E.E.*

FERRO-CONCRETE hyperbolic cooling towers have been designed to deal with as much as five million gallons of circulating water per hour with a temperature drop across the tower that varies from about 8 to 20 deg. F. Water is pumped up the centre of the tower and distributed through radial pipes situated about one-third of the way up, from which it is sprayed, at several points along each length of pipe, on to a series of louvres. There it is broken up into a fine shower, dropping into a pond at the tower base, to be recirculated to the condensers.

As the water drips through the rows of wooden louvres, the ascending air currents, caused mainly by convection due to the height of the tower, mingle with the water. During this process the air vaporises a certain amount of water, depending on the degree of saturation of the air entering the tower. The bulk of the heat evolved in vaporisation is supplied by the circulating water itself, which is consequently lowered in temperature. Thus the relative humidity of the air plays an important part in the cooling efficiency of the tower. If the humidity is low, the capacity of the entering air to absorb water is increased so that efficiency is better on warm dry days than on cold damp ones.

Effect of Relative Humidity

As the partly saturated air enters the tower and is brought into intimate contact with the warm circulating water, its temperature is increased. As the atmospheric air is a mixture of air and water vapour, complying with Dalton's Law of partial pressures, its absorbing capacity is increased, and more water is absorbed by evaporation, thus raising the relative humidity within the tower. As the relative humidity increases, the cooler water begins to receive heat by conduction until a state of equilibrium is reached at the wet-bulb temperature, when the total heat content of the water and that of the saturated air will be the same. The theoretical cooling range of the tower, therefore, depends on the difference between the circulating-water inlet temperature and the wet-bulb temperature. The state of equilibrium is never reached in practice as the size of tower required would be too great. The extent to which the exposed water cooling surface is increased and the height of the tower, which governs the length of time the air and water are free to mingle, are further factors affecting efficiency, long narrow towers being more efficient than short squat types. High circulating-water temperatures tend to give better efficiencies owing to the increased evaporative effect.

Increase in humidity, due to evaporation as the air passes through the tower, makes it necessary to supply a certain amount of make-up water to overcome the evaporation loss. The quantity is, however, small, compared with the requirements of non-recirculating systems. Because of evaporation loss, the concentration of solids in the circulating water may reach undesirable proportions. The tower should, therefore, be " blown down " periodically as a boiler is.

Estimating Make-up Requirements

The amount of make-up water required may be estimated as follows: Let q lb. per cu. ft. represent the quantity of water vapour in the partially saturated air entering the tower at a temperature of t_0 deg. F. This quantity may be determined from tables, if the degree of saturation or relative humidity has first been ascertained from the readings of a hygrometer. For example, at 60 deg. F. the weight of saturated vapour is 0·0008278 lb. per cu. ft. If the relative humidity is 50 per cent. this weight becomes $0{\cdot}0008278 \times 0{\cdot}5 = 0{\cdot}0004139$ lb. per cu. ft. The total weight of the air entering the tower, W lb. per cu. ft., may be estimated from a Bulkeley psychrometric chart.

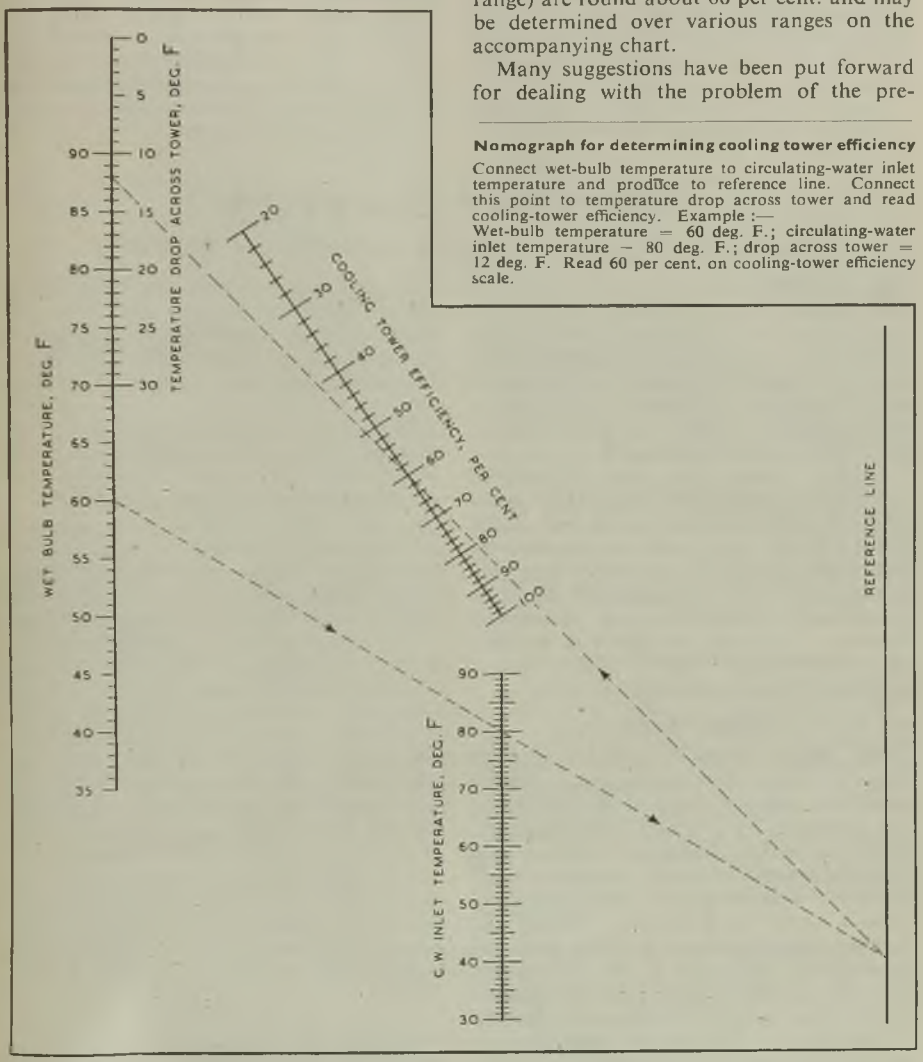
If the exit air from the tower is assumed to be completely saturated and is at t_1 deg. F., its volume will have slightly increased, as will also its moisture content, to a value of, say, q′ lb. of water vapour per cu. ft. In order to evaporate this additional water, $(q' - q) \times h = Y$ BThU are required, where h is the average latent heat of vaporisation between the temperatures t_0 and t_1 from tables.

The air, by the increase in temperature from t_0 to t_1, has received $W \times s \times (t_1 - t_0) = Z$ BThU, where s is the specific heat of air, taken as 0·24. The total amount of

heat taken from the circulating water is therefore Y + Z BThU and the proportion of this due to evaporation effect is $\frac{Y}{Z}$. In this country about 80 per cent. of the cooling is due to evaporation. If the bulk of the water has been cooled through T deg. F. (*i.e.*, circulating water temperature drop across the tower), the weight so cooled $\frac{Y + Z}{T} = E$ lb. Consequently the percentage of water lost by evaporation, that is, the amount of make-up water required, $= \frac{q' - q}{E}$, which is usually in the region of 1 to 2 per cent.

Cooling-tower efficiencies (*i.e.*, the rates of the actual to the theoretical cooling range) are round about 60 per cent. and may be determined over various ranges on the accompanying chart.

Many suggestions have been put forward for dealing with the problem of the precipitation of moisture emitted from the top of the tower on to the surrounding countryside. These have ranged from bleeding hot water from the tower system and replacing it by cold water to the installation of electrostatic precipitation apparatus. The principles



Nomograph for determining cooling tower efficiency

Connect wet-bulb temperature to circulating-water inlet temperature and produce to reference line. Connect this point to temperature drop across tower and read cooling-tower efficiency. Example :— Wet-bulb temperature = 60 deg. F.; circulating-water inlet temperature = 80 deg. F.; drop across tower = 12 deg. F. Read 60 per cent. on cooling-tower efficiency scale.

involved are as follows: The volume of the air and water vapour leaving the tower is changed from v_1 to v_2 as the values of pressure and temperature drop to those of the atmosphere at the tower exit. Owing to the rise in partial air pressure at the tower exit, the temperature may even be reduced to slightly below that of the atmosphere, which probably accounts for the small amount of precipitation apparent even on warm days.

If w_1 — lb. of water per cu. ft. is contained in the exit vapour at its initial temperature and pressure, the density will tend to change to $\left(\frac{w_1 v_2}{v_1}\right)$ lb. per cu. ft. If this figure is greater than the maximum density possible at the atmospheric temperature and pressure, as determined from tables, condensation and consequently precipitation will occur. It would appear, therefore, that in the normal type of tower this difficulty is inherent and that the solution of the problem lies in designs in which the pressure and temperature drop of the exit vapour can be controlled according to atmospheric conditions.

Nuclear Energy

Sir George Thomson's Address to the Junior Engineers

A SUBJECT that has yet to cross the vague borderline which separates physics from engineering was chosen by SIR GEORGE P. THOMSON for his presidential address to the Junior Institution of Engineers. He spoke of what has been commonly called atomic energy, hoping to show that nuclear energy would be a much better term.

Nuclear energy had been released in England more than twenty years ago, but the efficiency of the process was at best of the order of one in a million. Subsequent discoveries permitted successive improvements, the process now being regenerative by geometrical progression of increasing numbers; this might be violent or gradual, the former being difficult to achieve because of the existence of moderating factors.

Easier Method

The easier gradual method involved slowing down the bombarding missiles (neutrons, without electrical charge and so not deflected, by reaction with electrons, from the nuclear target) by collision with some light element (usually carbon) in which the heavy target (uranium) was embedded to form a "pile" of large mass. Energy was produced therein in the form of heat generated by collision while such of the bombarding neutrons as were absorbed by the uranium turned the latter into the new element "plutonium." The process could be controlled to deliver power limited only by the rate at which the heat produced could be removed by cooling water or otherwise.

The purpose of the "piles" constructed in the United States was to make plutonium; either that or the rare isotope of uranium (U.235) in a nearly pure state, was at present necessary to the violent release of atomic energy. Both were more readily split than ordinary uranium and most of the vast sums of money which had been devoted to the war-time project had been spent on their production.

So far no use had been made of the heat generated in the "piles" because the choice of materials was limited. First many substances absorbed neutrons so readily as to stop the "pile" working and, secondly, uranium was an expensive "fuel"; weight for weight it might perhaps cost a thousand times as much as coal, yet it could theoretically release several million times as much energy.

It remained to be seen whether the world's supplies of uranium, with the possible addition of some thorium, would stand the strain of industrial exploitation as well as coal and oil had done. Then there were technical limitations, one of which was critical size which made the process seem unsuitable for use in small units. Another was the necessity for very careful shielding of the great streams of neutrons, which acted on the human body much like hard X-rays. Some 2 ft. thickness of lead and 6 ft. of water would probably be the bare minimum for large powers, which meant such bulk and weight as would be unacceptable for many purposes.

Electricity for Nottinghamshire Farms.—When Mr. C. R. King, general manager of the Derbyshire and Nottinghamshire Power Co. addressed the Nottinghamshire executive of the N.F.U. on December 6th on "Electricity for Farmers," he said there were 54 farms in an area of 100 sq. miles in the south-eastern part of the county still not connected with a supply, but in the next seven years the whole of the area should be covered.

COMMERCE and INDUSTRY

Conversion of Factories. Increased Exports in October.

More Government Factories Allocated

ANOTHER twenty-eight Government factories representing a floor area of over 7,000,000 sq. ft. and eventually giving employment to about 35,000 persons, have recently been allocated by the Board of Trade to various firms for civilian production and export. Among these new allocations are: George Turton Platts & Co., Ltd., Worksop, for electric rail spikes; Charlesworth Bodies, Ltd., Newent, for kitchen units for prefabricated houses; Gramophone Co., Treorchy, for radio equipment, etc.; Fisher & Ludlow, Ltd., Castle Bromwich, for general engineering, etc., including the manufacture of the "Bendix" washing machine; Stern & Bell, Ltd., Birmingham, for engineering; Rist's Wires & Cables, Ltd., Newcastle-under-Lyme, for commercial cables; and Weldall & Assembly, Ltd., Stourbridge, for refrigerators. This brings the total number of Government factories so far allocated to 170 with a floor area of 44,000,000 sq. ft. and providing employment for between 300,000 and 400,000. Nearly all the larger Government factories have now been allocated and the space so dealt with amounts to more than three-fifths of the total expected to become available.

Overseas Trade in October

A summary of Britain's overseas trade just published gives the value of exports of electrical goods and apparatus in the first ten months of this year as £11,274,975 compared with £10,833,114 in the corresponding period of 1944, an increase of £441,861. The return for the first nine months of the year (*Electrical Review*, December 7th) gave the value as £9,786,666 (against £9,982,182) so that the value of exports in October is seen to be £1,488,309 against £850,932 in October, 1944, an increase of £637,377. Figures for electrical machinery exports are included under the general heading of "machinery," the total value of which up to the end of October was £37,021,127 (against £33,245,457). Imports of electrical goods and apparatus in the same period were valued at £18,782,032 (£18,288,652).

Workers in Electrical Industries

Estimates are given in the November *Ministry of Labour Gazette* of the numbers of workpeople in industry in the United Kingdom, based upon unemployment insurance figures, in July last. The grand total for the United Kingdom is 14,000,000. Of these 174,130 are shown to have been engaged in electrical engineering, 38,880 in electrical wiring and contracting and 269,440 in the manufacture of electrical apparatus, cables, lamps, etc. Before the war the approximate numbers engaged in these branches were: Electrical engineering, 119,000; electrical wiring and contracting, 42,000; and electrical apparatus, etc., 180,000.

The same issue of the *Gazette* also analyses the total of 252,963 unemployed insured persons in the United Kingdom at October 15th. Of these the electrical engineering industry accounted for 2,799, electrical wiring and contracting for 381 and electrical apparatus, etc., for 2,771. The respective percentages of the totals for these industries were 1·1, 1·3 and 0·4. For comparative purposes it may be said that the corresponding percentages in July, 1939, were 3·0, 9·7 and 4·6.

Plant for Iceland and the Faroes

Electricity will soon be available to all the 6,000 inhabitants of Vestmanna, a group of islands 30 miles south of Iceland. Hitherto there has been only an inadequate DC service. The new power plant comprises two Mirrlees, Bickerton & Day engines driving 6·6-kV Brush AC generators. Waste heat recovery equipment is fitted to heat the water for the local swimming baths, where all youngsters reaching the age of twelve years have to be able to swim two lengths. British Oil Engines (Export), Ltd., of London, are the main contractors for the power station equipment, and the agents in Iceland responsible for the installation are O. H. Helgason & Co., whose director, Mr. Goodmundson, is at present in Great Britain on a tour of inspection of the manufacturing methods of the power plant companies.

To replace a Continental plant, the failure of which had caused an electrical breakdown in Torshaven, the capital of the Faroe Islands, a Mirrlees engine, developing 300 BHP at 600 RPM, coupled to a 200-kW generator, and complete with switchgear supplied by the Brush Electrical Engineering Co., Ltd., has also been supplied by British Oil Engines (Export), Ltd.

New Cossor Subsidiary

A. C. Cossor, Ltd., announces that heads of agreement as signed by the chairman and a large American electrical company have been approved by the board. This will involve the formation of a new £500,000 subsidiary controlled by Cossors, which will be formed in the immediate future, subject to the approval of the Capital Issues Committee.

Plans are well advanced for the development of one of the company's radar patents applicable to peacetime use. No new financing is expected at present for the carrying out of the current programme.

Aid for Mains Departments

Electricity supply undertakings are being provided by Cable Covers, Ltd., with copies of a "Power Engineer's Equipment Guide." This is a loose-leaf file in which are inserted well-illustrated descriptive sheets dealing with a multiplicity of appliances and materials required by a mains department. These are classified and easily found with the assistance of thumb tabs. The first section deals with the company's own products. The rest of the products listed are by reputable makers for whom Cable Covers, Ltd., are acting as agents in supplying the goods to electricity supply authorities. They comprise a

wide range of equipment of an ancillary character usually ordered in fairly small quantities as engraved plates and labels, trucks and ladders, tools, hangers and racks, road shelters and tarpaulins, protective clothing, linesmen's equipment, fire extinguishers, joint box compound, insulating materials, etc. The sheets will be added to from time to time by the company's representatives. Mains departments should find the guide very serviceable.

The company informs us that it has taken over the sales of the various processes of mechanical cable laying developed by Clough, Smith & Co., Ltd., and Mr. G. D. Worthington, a director of the company, has joined the board of Clough, Smith.

Electricity on the Farm

Post-war Building Studies No. 17—Farm Buildings (Stationery Office, 3s.) includes as one of its sections a reprint of Post-war Building Studies No. 11—Electrical Installations, Part VI, relating to the use of electricity on the farm. The Farm Buildings Committee appointed by the Ministry of Agriculture & Fisheries to prepare the above report sent a mission to the United States and Canada this year. This mission states that Britain lags behind in the mechanisation of the farmstead, partly due to the fact that in America electricity is much more widely and cheaply obtainable. Mr. Tom Williams, Minister of Agriculture, stated in the House of Commons last week that although an extensive programme of new construction on farms could not be contemplated for two or three years, his department would press on with the work of investigation on the lines of the Committee's report so that when development was possible on a large scale, it would take place on sound lines.

Electric Power for N.E. England

A report issued by the Northern Industrial Group dealing with the increased use of by-products from coal, refers to the fact that there is no major power station between Dunston-on-Tyne and Edinburgh. The need for cheap power, gas, water and transport in the North-East is emphasised to help in the attraction of new industries to the area.

Philips Plan to Increase Efficiency

The management and workers of the Philips group of radio and electrical companies have approved a new plan of joint consultation which has won the approval of the trade unions concerned and gives every hourly-paid employee an opportunity to play a part in the concern's development. Instead of having only one Joint Production Committee with very limited terms of reference, there will be a number of Joint Departmental Committees qualified to deal speedily with most of the problems which arise at shop level. Difficult questions will be referred to a central Joint Advisory Council which will also discuss matters of broad policy. Some of the subjects which will be covered by these committees are conditions of employment, welfare and recreation, safety, discipline, training, production, and national reconstruction.

A feature of the plan is the method of ensuring full and equitable worker representation. Under a two-stage election procedure trade unionists first nominate and elect their shop stewards according to trade union rules, by secret ballot. In the second stage, all hourly-paid workers over the age of eighteen, whether unionists or not, decide which of the elected stewards should represent them on the departmental committees. In conjunction with this plan is an internal information service which will keep all employees informed of current events.

Preston Electrical Exhibition

When a man buys a factory he expects it to be equipped with modern devices. Women felt the same about their homes, said Alderman Mrs. Gregory, ex-Mayor of West Ham, and treasurer of the Electrical Association for Women, at the Preston Electrical Exhibition. Houses hitherto, she said, had been "mere boxes of bricks." In the future she expected them to be equipped with cookers, washing machines, etc.

Speaking of the value of electricity to the farmer, Alderman A. Wilson, a member of Preston Electricity Committee, declared that almost 50 per cent. of farms in the district were electrified, but they would not be content until they had 100 per cent. Mr. Frank Ellis, County N.F.U. secretary, said agriculture was a potential customer of £500,000,000 worth of the city's industrial products a year, and electricity should be made more available to farmers. There was a great market for electrification, not only for ordinary farm operations, but in providing domestic amenities equal to those of the town.

Palestinian Industrial Developments

It is reported by *Reuter* from Tel-Aviv that Vulcan Foundries, Ltd., has signed contracts with the Brush Electrical Engineering Co., Ltd., and other engineering firms, by which bulky components, especially castings, are to be made by Vulcan, while motors and high precision parts are to be imported from the United Kingdom for assembly in Palestine.

Iron and Steel Control Relaxed

The Minister of Supply has made the Control of Iron and Steel (No. 45) Order, 1945 (S.R. & O. 1945 No. 1502, Stationery Office, price 1d.) under which the following materials may be acquired without licence:—ferro alloys (other than spiegeleisen and ferro-manganese smelted in a blast furnace); calcium silicide; tungsten metal powder; tungsten metal sintered lumps; tungsten metal scrap; titanium carbide; cemented carbide hard metal; molybdenum metal powder; molybdenum metal scrap; and any chemical compound of molybdenum or tungsten or vanadium.

Containers and Packaging

The Control of Containers and Packaging (No. 4) (General) Order, 1945 (S.R. & O. 1945 No. 1509) revokes and remakes in consolidated form with amendments the Control of Containers and Packaging (Nos. 1/3) Orders, 1944-45. The Order removes all restrictions on the manufacture and use of containers and holders with the following exceptions: (a) If tinplate, blackplate, etc., is issued for manufacture, the sizes

and types of containers and holders continue to be controlled; but tinplate is now allowed for the manufacture of all permitted containers. (b) Packaging continues to be controlled if done in metal or glass containers or holders. (c) The restrictions on marking metal containers (other than collapsible tubes) and closures remain. B.S. Schedules Nos. 1012/1942 and 1163/1944 and parts of 1048/1942 and their revisions and amendments are no longer statutorily enforced, but their non-statutory use is not affected.

Threatened American Strike

Last week the New York correspondent of *The Times* reported that members of the Electrical Workers' Union in the works of the General Electric Co., the Westinghouse Co. and the General Motors Corporation decided by a large majority in favour of a strike throughout the United States to enforce their demand for a general wage increase of $2 a day to maintain pay levels established during the war. The Union has about 200,000 members. Union officials stated that no strike would be called before January 1st.

Santon Engineering Society

A meeting was held recently at Newport, Mon., to inaugurate the Santon Engineering Society, the object of which is to discuss, at monthly meetings, engineering in all its forms and applications. Discussions will be supplemented by lantern talks and "Brains Trusts," and once a quarter an outside authority will be invited to talk on some branch of engineering. For the moment it is intended that the Society shall be run entirely by the younger members of Santon, Ltd., from whom are chosen, at each meeting, the chairman and executives to act at the next gathering. The papers to be given are also to be restricted to members of the company's staff as far as possible.

Collier for Battersea

The *Sir Joseph Swan*, built by Hall, Russell & Co., Ltd., Aberdeen, to transport coal to Battersea power station, has completed successful trials and has now been handed over to the London Power Co., Ltd.

Dielectric Heating for Transformer Bushings

Drying time of high-voltage condenser-type transformer bushings has been reduced by eight to ten hours, it is claimed, at the Westinghouse works through the adoption of dielectric heating, which quickly removes the last trace of moisture by heat generated directly within the insulation. In addition to the time saved through not having to bring the bushing up to drying temperatures, bulky ovens and steam piping have been eliminated.

Current is supplied at 115 kV from 5-megacycle 10-kW electronic generators by means of a nitrogen-filled coaxial line to a tuning box for adjustment to each bushing. Moisture is carried off through a vacuum line at the top of the bushing and oil is forced under pressure from the bottom into the insulation while heat is still being applied.

High-frequency voltage is applied at the centre flange of the bushing, and temperature rise is measured by thermocouple or thermometer in the centre of the bushing conductor tube.

Trade Publications

Thomas Bolton & Sons, Ltd., P.O. Box No. 3, Widnes, Lancs.—Illustrated 20-page booklet (No. 114) containing tabulated data and particulars of "Ardoloy" cemented carbide dies for drawing wire, bar, tubes and other shapes as well as dies for extruding and heading bolts. Also general list (No. 116) of copper, brass and bronze products manufactured for the electrical and other industries.

Churchill Machine Tool Co., Ltd., Broadheath, near Manchester.—Illustrated pamphlets descriptive of (TG.1) thread grinding and (CRM.2) crankshaft re-grinding machines.

Applicants for copies of these publications should write on their firms' business notepaper.

Trade Announcements

In addition to their well-known automatic heat-controlled electric irons, Morphy Richards, Ltd., have now commenced production of iron stands and the "Cray" series of electric fires.

The Dover Engineering Works, Ltd., states that in future matters relating to accounts and purchases will be dealt with at Dover (telephone, Dover 545; telegrams, "Engines," Dover) and sales, inquiries, etc., at St. Stephen's House, Westminster, S.W.1 (telephone, Whitehall 2250; telegrams, "Catag Parl," London).

Lightweight Battery Charger

A battery charger which is claimed to be of unusual design, has been manufactured in large numbers for a Government Department by F. C. Heayberd & Co., Ltd., 28, Russell Square, London, W.C.1. It weighs less than 7 oz. and is 3½ in. high by 2 in. wide by 1¾ in. deep, yet it will charge a battery of 2 to 12 V, taking its input from any DC or AC source of any frequency at any voltage between 50 and 260 V without requiring adjustment or regard for polarity.

Commercial and Industrial Education

One of the most interesting and practical conferences yet held by the British Association for Commercial and Industrial Education was that organised recently by the Birmingham Regional Group to discuss the experience gained in the school in view of its bearing on the County Colleges to be established under the new Education Act.

TRADE MARKS

THE following applications have been made for the registration of trade marks. Objections may be entered within a month from December 12th.

G. MARCONI (design). No. 634, 888, Class 9. Wireless and television receiving sets and loudspeakers, all for use in wireless broadcast reception by the public; and electrical public address apparatus. The Marconiphone Co., Ltd., Blyth Road, Hayes, Middlesex.

LION. No. 635,214 Class 9. Electrodes for electric welding. G. D. Peters & Co., Ltd., Windsor Works, near Mill Street, Slough.

ELECTRICITY SUPPLY

Leicester Lighting Change-over. Aswan Dam Tenders.

Barrow-in-Furness. — CHANGE-OVER. — The Electricity Committee is changing over from DC to AC in the Vickerstown and Ferry Road areas at a cost of £1,629.

EXTENSIONS.—Supplies are to be provided to Boon Crag and cottages at Monk Coniston (£253), Briar Dene, Urswick (£90), and Pennybridge (£62). Modifications of the network in Blawith will cost £1,780. The Electricity Committee has obtained consent to the erection of overhead lines to Greystones, Emlin Hall and Beckstones, Torver.

LOAN SANCTIONED.—Sanction has been obtained to borrow £5,000 for mains and services.

Bradford.—SUPPLY TO MILLS.—The Electricity Committee has arranged to provide additional supply to Ira Ickringill & Co., Ltd., at Legram Mills at a cost of £7,475.

Burton-on-Trent — EXTENSIONS. — Arrangements have been made by the Electricity Committee to provide supplies to Derbyshire Gravel & Aggregates, Ltd., at new works at Stanton-by-Bridge and to various premises at Ticknall.

Dudley.—MARKET LIGHTING.—At a meeting of the Corporation General Purposes Committee application was made by the Market Tenants' Federation for lighting to be installed again in the market. Before the war this was provided by the gas company, which now stated that it was unable to resume the lighting this winter as no men were available. The Committee decided to approach the electricity supply company.

Glasgow.—ELECTRICAL PLANT FOR GASWORKS. —The general manager of the Gas Department is to arrange with the Electricity Department for the installation of a four-core cable, circuit-breaker, etc., at the central stores and workshops (approximate cost £1,200).

Halifax.—ELECTRICAL INSTALLATIONS.—The Light, Heat and Power Committee proposes to accept applications for installing electricity in premises not now supplied, provided that where the cost exceeds £10 the necessary licence has been obtained.

Hammersmith.—BULK SUPPLY TARIFF.—A report submitted by the borough electrical engineer, with a comparison of the costs of the bulk supply under the agreement with the London & Home Counties J.E.A. and under the existing and new tariffs of the C.E.B., shows that it is to the Council's advantage to continue a bulk supply from the J.E.A.

SUPPLY TO TEMPORARY HOUSES.—To provide a supply to 86 temporary houses to be built by the L.C.C. at Wormwood Scrubbs the Electricity Department is to lay a high-voltage main and equip a substation at a total estimated cost of £6,500.

Hove.—HIRE CHARGES.—The Electricity Committee recommends an increase of 20 per cent. in the charges for hired apparatus.

Hull.—LOANS.—The Electricity Committee has obtained sanction to borrow £4,000 for coal plant, £64,756 for buildings, mains and plant and £67,500 for consumers' electrical apparatus.

Leicester.—STREET LIGHTING CHANGE.—As soon as conditions allow a start is to be made on converting all gas-lighted streets to electric lighting. The scheme will take five years to complete.

Lewis.—BOARD'S PLANS.—Under the distribution scheme for the island prepared by the North of Scotland Hydro-Electric Board more than 90 per cent. of the people of Lewis will be able to obtain a supply of electricity. The Board is anxious to go ahead with the scheme at once, but it is not self-supporting, and must depend on progress made with some of the larger mainland schemes. The estimated loss per annum in Lewis will be of the order of £20,000. The map of the proposed scheme shows that power is to be derived principally from the Grimersta River while the River Creed will provide a subsidiary source of supply, and later power may be drawn from Loch Suainabhal and Loch Grunnabhat in Uig.

Reading.—SUPPLY TO HOUSES.—The Electricity Committee is applying for sanction to borrow £19,395 to supply houses to be erected on the Whitley housing estate.

Scarborough.—TARIFF REVISION.—The Electricity Committee recommends that the present increase of 10 per cent. on all charges shall be replaced by a general increase of 15 per cent. and that the basic "all-in" tariff and flat rate of 0·5d. per kWh shall be increased to 0·6d. and the mixed supply rate by 5 per cent.

Wallasey.—REVISED TARIFFS.—The Electricity Committee recommends a new domestic tariff consisting of the present floor area charge plus 4d. per week fixed charge, together with a "unit" charge of ½d., and also a new business tariff for lighting and heating of £9 per kW of lighting demand plus 0·66d. per kWh.

DEVELOPMENT SCHEME.—A comprehensive electrical development scheme approved by the Electricity Committee will cost £46,970.

LOANS.—Sanction has been obtained to borrow £15,206 for supplying housing estates. Application is also being sought to borrow £11,000 for ripple control apparatus.

CABLE-LAYING PLANT.—Mechanical cable-laying plant is to be purchased at an estimated cost of £2,100.

Overseas

Egypt.—ASWAN SCHEME.—Tenders for the erection of a hydro-electric generating station at Aswan Reservoir will be invited toward the end of this month, says the Egyptian Ministry of Public Works. The station is to have an initial installed capacity of 280,000 kW. Specifications are now being completed. Tenderers must be familiar with the site, it is stated, and facilities will be given for visits by representatives of interested firms. The estimated total expenditure is £20,000,000.—*Reuter.*

New Zealand.—FREE ELECTRICITY.—At a recent meeting of the Dunedin (N.Z.) City Council it was agreed, subject to certain conditions, to offer free hydro-electric power, for a period up to three years, to new industries commencing business in the city.

Home Wiring in America

Responsibilities of Utility Companies

By Ross Saunders
(New York)

DOMESTIC electrical consumption in the United States has shown a marked increase during wartime. Less domestic help, decrease in travelling caused by "gas" rationing, and the operation of many homes on a two or three shift basis because of war plant working schedules all contributed to greater use of residential lighting and appliances. In 1944 the average annual consumption per residence customer reached the record figure of 1,151 kWh.

Several indications show that large electrical consumption by residential units will continue. Manufacturers through re-design and better styling are planning to produce appliances that will have greater appeal and utility. Mass production techniques will be applied to such items as home freezers and room coolers. Complementing the plans of manufacturers is the heavy pent-up demand. Consumer surveys have revealed that of the eight leading items wanted by the consumer in the post-war period, six are electrical. The order of preference follows:—New homes, automobiles, radio sets, electric fans, electric ranges, vacuum cleaners, refrigerators and washing machines.

Scope for Modernisation

In view of the large potential increase in electricity consumption, electrical companies are vitally interested in the efforts of construction men to develop a sound post-war building programme. There were 32,500,000 wired homes in the United States in 1944, against about 29,000,000 in 1940. A recent survey of the American home indicates that it is, on the average, 29 years old. Many existing structures have been modernised with respect to plumbing, insulation, and other facilities. Electric service entrances and interior wiring have, however, all too frequently been allowed to remain as originally installed, and their limited capacity often prevents the liberal use of modern electrical conveniences. Of the many houses that were built during the war, many were of a temporary or emergency nature equipped with inadequate service entrances, switches, circuits, and wire capacities.

Close co-operation is called for between electrical companies and builders and architects responsible for planning new homes. The major responsibility for seeing that adequate wiring is installed will be that of the electrical company which will inform the local building fraternity of the advantages to them and their clients of modern electrical living and which will also take the lead in promoting the acceptance and use of electrical appliances among prospective clients. The formation of new families, obsolescence of old dwelling units and restricted building during the war have all created a need for new home building which is estimated will total about 10,000,000 units.

Co-operation with Housing Authorities

As the occupants of low-cost homes need electric service most, the plans of the electrical companies include co-operation with any federally financed projects in the early planning stages to ensure that new housing projects will reflect the latest developments in wiring and electrical facilities. In similar fashion, close working arrangements with the Federal Housing Authority and other lending agencies will impress these organisations that adequate electrical installations are important to their prospective clients, favourably affect property values, and are helpful in deferring obsolescence.

Some estimates have indicated that the prefabricated house may account for as much as 10 per cent. of all new construction. As it has been stated that the prefabricated home will leave the factory completely wired, electrical companies are concerned with the adequacy of these wiring plans and the possibility of complete "packaged" electric kitchens.

Apathetic Consumers

Customers have become complacent in their use of electric services and take the necessary facilities for granted. It is inconceivable, the Edison Electric Institute points out, that a family would start out to rent a house and fail to count the bedrooms and later, moving in find that they were one or two bedrooms short. Few customers realise that electric wiring is of equal importance and even if they do so, are frequently not sufficiently versed in the subject to enable them to make a proper

investigation of the prospective home. If, then, appliances do not work properly, or lighting is unsatisfactory, the customer either criticises the poor quality of the electric service or the value of the appliances themselves.

The need for additional wire capacity applies not only to owner-occupied homes, but to rented properties. The efforts that have been expended in this direction in the past have been good, but have generally been pointed towards additional outlets and switches. Additional outlets without increasing the service entrance may, however, bring about the use of more equipment than the service entrance facilities should handle, causing voltage drop with resultant inefficient operation of lights and household appliances.

Several plans have been used and discussed in attacking the problem of adequate wiring. A plan which has accomplished good results involves the installation of a three wire entrance switch and fuse block of substantial capacity in connection with the sale of a major appliance. This is based, according to the Edison Electric Institute, on the experience that there is less "sales resistance" to the installation of new entrance facilities when the desire for a new electrical appliance has been created. At that time, some spare capacity beyond that actually needed can be sold. Subsequent purchases of electrical equipment may then only require the installation of an additional circuit or an outlet.

In some cases, the electrical utilities have paid in whole or in part for the installation of the additional entrance capacity in connection with the sale of a range or other heavy duty appliances. Some thought has also been given to wiring plans of this kind in connection with the sale of automatic laundries and ironers. Even though the annual revenue from the individual appliances may not fully warrant the expenditure, the opportunity is created to sell additional load-building equipment without again bringing up the question of wiring.

The Aigle Barrage

(From Our Paris Correspondent)

THE French Minister of Industrial Production, M. René Lacoste, recently inaugurated the Aigle Barrage on the Dordogne. The dam is 300 ft. high and the reservoir is of 7,000 million cu. ft. capacity; the potential electrical output is 400 million kWh per annum. The station is to be linked with the Paris region by the construction of a 220-kV line.

A view of the Aigle undertaking

The two 60,000-kW 12-kV alternators are paralleled on the 220-kV side of 70,000-kVA air-blast-cooled delta-star transformers, to one of which each machine is directly connected. The transformers are in bomb-proof shelters. Their neutrals are insulated for line voltage and tappings give a range of from 210 to 246 kV. The turbine casing is sunk in the alternator foundation and can be removed without disturbing the remainder of the unit. Auxiliaries for each unit are supplied from a 3,500-kVA 12/5-kV regulator auto-transformer (connected to the main alternator through an isolator) and 800-kVA 5,000/220-V transformers. A 7,000-kV alternator driven by a Francis turbine is installed to supply the auxiliaries in emergency. A supply for control and emergency lighting is provided by two 120-V 500-Ah batteries.

B.C. Railway Purchase Abandoned.—Temporarily, at least, the proposal of thirty-one municipalities in British Columbia to take over the $123,000,000 British Columbia Electric Railway Company has been abandoned.

Electrical Fair Trading

Council's Annual Report

IN its report for the past year the Electrical Fair Trading Council says that at the 1944 annual general meeting, Mr. W. Finlay (E.C.A. of Scotland), who had acted as independent chairman of the Council since 1935 expressed a wish to relinquish that position owing to travelling difficulties. The Council placed on record its appreciation of Mr. Finlay's services and elected Mr. V. Watlington as chairman with Mr. T. W. Heather as vice-chairman.

During the period under review the membership was increased by the addition of the British Refrigeration Association (Sub-section A (i)—Manufacturers of Domestic Type Refrigerators) and the Electric Discharge Lamp Auxiliaries Council (E.D.L.A.C.). Eleven manufacturers' associations are now represented in addition to wholesale distributing, contracting and retailing organisations.

The report pays a tribute to the late Mr. J. Y. Fletcher who rendered valuable service to the cause of fair trading. Changes in representation are reported as follows:—Accessories Section of B.E.A.M.A.—Mr. F. C. Fuke in place of Mr. E. D. Ruddle; C.M.A.—Mr. W. Lewis Smith in the place of Mr. A. E. Tanner; E.L.M.A.—Mr. H. A. Lingard in place of Mr. W. H. Williams; and E.W.F.—Mr. W. H. Swain in place of Mr. A. G. Beaver.

Reference is made to a Press conference held earlier in the year at which the voluntary nature of the Fair Trading Policy was stressed and it was stated that it was not the intention of the Council to seek mandatory powers. Publication of a new edition of the Policy is also mentioned.

The General Purposes Committee is dealing with the work of revising the constitution and rules of procedure which is considered desirable as a result of experience and the admission of new member associations.

Labour Controls Relaxed

But Essential Work Orders Remain

LAST week the Minister of Labour and National Service announced the Government's intention of relaxing the present system of labour controls as from December 20th. Industries scheduled under Essential Work Orders will not be affected by the changes and men up to 65 and women up to 60 will have to remain in their present jobs. It is intended to keep these industries under review and control will be maintained only where it is necessary from the points of view of production and manpower. Three months' notice will be given of the withdrawal of any industry from the scope of the Orders.

In general men aged 31 and over and women of any age will be able to take positions without going through the Ministry of Labour and they will not be "directed," except in respect of a very few industries having high priority, or exceptionally, where they are needed for the administration of the Essential Work and similar Orders.

Employers are now free to advertise their labour requirements for persons covered by the Control of Engagement Order. There will be no further registration of girls when they reach the age of 18. The upper age-limits for control under these arrangements is, in general, the present maximum age-limit for call-up to the Forces, *i.e.*, up to and including the age of 30. When the call-up age is reduced this general age-limit for civilian control will also be lowered.

The Restriction on Transfer Order operating in the building and civil engineering industries is being modified so as not to apply to men over 50.

The following industries are among those covered by Essential Work Orders:—Aluminium (basic secondary and alloy smelting); building and civil engineering; carbons for A.A. searchlights; electric cables; electrical contracting; electricity and gas supply; heating, ventilating and domestic engineering (including installation); iron and steel production; lead production; non-ferrous metals (brass, copper and wrought bronze work); plastics (moulding and fabricating); railways; research associations; and sheet metal work.

Electronics in Engineering

Power Conversion and Control

SOME idea of the scope of electronics in heavy engineering is conveyed by DR. W. G. THOMPSON (assistant manager, G.E.C. mercury-vapour rectifier works, Witton) in a paper he has presented to the North-East Coast Institution of Engineers and Shipbuilders.

The first part of the paper is concerned with the different classes of thermionic valve and their electrical characteristics, with illustrations of the analogy between them and their hydraulic counterparts. A chart indicates the wide range of such devices and their variants. Their functions are current conversion, amplification, production of oscillations, circuit modification (changing output-wave shape from sine to rectangular) and control of circuits (null and compounding) when precision combined with high speed of response are desired.

The second half of the paper indicates the scope of electronic devices as aids to research and testing; in such manufacturing processes as electrolysis, high-frequency heating, arc and resistance welding and electric furnaces; and for the precise control of power and as safety appliances.

The first cost of control schemes is frequently relatively high, since the economic aspects of industrial electronics are often involved because all the factors that should be taken into account are not readily apparent. Nevertheless relatively high first cost is soon justified if the load factor is adequate.

Power and Voltage Measurement

A Precision AC/DC Comparator

CHANGING industrial requirements have markedly increased the demand for a more accurate means of commercially measuring AC power. Manufacturers, too, would like to test the sub-standard instruments they make with AC, which would inspire greater confidence than the present procedure of testing with DC against a potentiometer. The availability of an instrument that would fulfil these requirements, if it were officially approved, would render unnecessary the return of sub-standard instruments to approved laboratories for periodic checking.

A paper by MESSRS. G. F. SHOTTER (Northmet Power Co.) and H. D. HAWKES (Elliott Bros., Ltd.) before the Measurements Section of the Institution of Electrical Engineers reviews the sources of error common to dynamometer wattmeters and emphasises some of the inherent errors that have been less publicised.

The authors then proceed to describe the design of a new instrument for the measurement of AC power and voltage by direct comparison with a standard DC potentiometer. It has a scale equivalent to that of a deflectional instrument 18 ft. long and its accuracy is guaranteed to 0·05 per cent., stability of precision being maintained by self-standardisation; means of checking the accuracy of associated apparatus has been made available.

The principle of operation is a null method based on the balancing of two torques and the new comparator is independent of the eleven most annoying common errors, while the remaining five can be compensated for or avoided by design.

One of the specific uses of this comparator is for the initial calibration of precision wattmeters, rendering the procedure much simpler than when two potentiometers are utilised. The new instrument has been employed for this purpose since 1937 with considerable success as well as for testing 500 c/s wattmeters, the calibration figures so obtained being subsequently confirmed by the National Physical Laboratory.

Although one of the new instruments has been successfully tested on a normal supply circuit, stabilisation of the AC voltage is desirable for the maximum accuracy attainable. Mechanical robustness is a feature; the fitting of a new suspension can affect the sensitivity only. The instrument can be shipped abroad with the knowledge that, if mechanical damage occurs in transit, it can be repaired on site and the original accuracy of measurement restored.

Household Appliance Production

PARTICULARS extracted from the *Board of Trade Journal* were given in our issue of November 2nd of the production of domestic electrical appliances during the war period and for the first half of the current year. The latest figures have been revised and those for the third quarter of this year added. We reproduce the revised and new figures and for comparison purposes also give the production (where the figures are available) for 1937. It should be noted that the figures represent the *annual* rate of production; they do not include goods made against Government contracts or for the purpose of export.

ELECTRICAL APPLIANCES SUPPLIED TO THE HOME MARKET
(Annual rate of production in thousands)

Period	Cookers		Boilers, hotplates, grillers, etc.	Fires, radiators, etc.	Water heaters	Immersion heaters	Kettles	Irons	Vacuum cleaners	Bed warmers	Blankets and pads
	Over 3kW	3kW and under									
1937	250		—	1,250	—	—	350	1,250	400	—	—
April–June, 1945	33	13	22	296	12	73	133	455	75	5	16
July–Sept., 1945	39	14	75	484	11	97	158	876	130	20	29

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Tube Investments, Ltd.—Progress made by the company in the field of training and education was mentioned by the chairman and managing director (Mr. I. A. R. Stedeford) in his speech at the annual meeting, after reviewing the company's war work. He said that in addition to the university scheme and supplementary to vocational training for lads over sixteen years of age the company, with the help of local education authorities, was organising day continuation schools. In one district where the scheme had been in operation for six months 250 lads under sixteen attended school on one day a week. It was already evident that real benefit was being derived by them not only academically but mentally, physically and morally.

Having dealt with the accounts, he said that the company's first post-war objective was the modernisation of all its factories to bring them to the highest pitch of technical efficiency and its plans for all phases of its activities were estimated to cost ultimately £4,000,000. In the electrical division arrangements had been made to extend the company's manufacturing interests.

The group intended to make its full contribution to the export drive. Already its exports had reached a scale at least 50 per cent. greater than pre-war, but in view of existing opportunities this was not regarded as an achievement of any particular merit. Speaking of the importance of good design he welcomed the move to institute the Council of Industrial Design, but suggested that there was need to extend its scope. No standard existed for industrial designers; anybody could call himself one and the qualifications claimed might mean nothing. Drawing an analogy with architects, lawyers and doctors, he said that it should be possible to brief industrial designers with equal confidence.

Dictograph Telephones, Ltd.—At an extraordinary meeting resolutions to increase the capital of the company to £250,000 and to alter the articles of association were approved.

Mr. P. V. Summer (chairman), in his statement circulated with the report, explained that the modest increase in capital was needed for an expansion programme. Besides planning to expand the annual rental income from Dictograph installations the company proposed to introduce other allied products which could be marketed in a similar manner and through the same organisation. Arrangements had already been made for the supply and installation of equipment for music in industry, staff location, time recording and job costing. He also mentioned the steps being taken to increase the company's export trade. The subsidiary company, Grampian Reproducers, Ltd., had had another satisfactory year.

Joseph Lucas, Ltd.—Sir Peter F. Bennett (chairman and joint managing director) stated at the company's annual meeting that the closing down of war work had resulted in major upheavals, including structural alterations, complete changes in layouts, extensive re-tooling, and training of operatives. While the activities of those parts of the organisation mainly concerned with aircraft, in particular the Rotax Co., had contracted to less than 10 per cent. of their peak output, the C.A.V. section was if anything busier than ever.

Mr. Oliver Lucas (deputy chairman and joint managing director), referring to the company's war activities, said that employment had reached 40,000 and thirty-three factories had been operated. One of the special jobs undertaken and the one which undoubtedly occupied most of the company's research and development effort, was associated with the gas turbine. Another item of major importance was the application of electrical control to tank gun turrets.

Telephone Properties, Ltd.—Income from dividends and interest, etc., for 1944 amounted to £82,467 (against £87,309 for 1943) and the net profit, as already reported, was £29,322 (£30,968). Contingencies reserve receives £5,000 (same) and after payment of the preference dividend and an ordinary dividend of 6 per cent. (same) £43,002 (£42,549) is carried forward.

The chairman (Sir Alexander Roger), in a statement circulated with the report and accounts, says that the reduction in income is due to the sale in 1943 of part of the preference share holding in the Nacional Telephone Co. of Venezuela. During the war the Nacional Co., like other telephone concerns, suffered from a shortage of plant, but two years ago it secured high priority on the production schedule and new buildings are now in course of erection to house plant for expansion. Much material is already nearing completion and will be available for shipment in a month or so. While the cost of living in Venezuela is constantly increasing the Nacional Co. has made substantial reductions in its tariffs during the war.

British Rola, Ltd., reports a trading profit for the year to March 31st last of £67,718 (against £54,714) and a net profit of £62,767 (£45,304). From this £53,500 (£34,300) is provided for taxation and £1,347 (£1,275) for preference share redemption. There is this year no allocation to deferred repairs (against £2,000). The ordinary dividend is maintained at 15 per cent. and £2,105 (£2,132) is carried forward.

The Associated Equipment Co., Ltd.—Criticisms of the existing deterrents to trade expansion were voiced by the chairman (Mr. C. W. Reeve) at the annual meeting. After referring to the company's war production (including among many other items the design and manufacture of the fifty-seven generating sets for the Mulberry port) he said that with regard to the future they had a very full order book, both for this country and overseas, but nowadays this statement did not mean very much. For this country they were only allowed to deliver their output to operators able to obtain a licence from the Ministry of Transport, and for overseas they had to produce vehicles of a different length and width and with left-hand steering. They felt that a great deal of lip service was being paid by Ministers and Government spokesmen,

but not much practical assistance was obtained from the same sources. Manufacturers, especially in the engineering industry, were unimpressed by the desire expressed for a greater output while having to suffer the calling up of young and skilled employees before others had returned from the Services. Another matter affecting the company was that, being situated in the London area, they were not permitted to extend their factory facilities but must find another factory in a depressed area, which he described as a fine theory but an uneconomic one. At Southall a thousand more operatives could be employed with practically no additional capital investment, but to do so elsewhere would mean a very large expense.

Max Stone, Ltd.—For the year to June 30th last trading profits, etc., amounted to £75,725 (against £60,173) from which is deducted £5,269 (£5,190) amortisation of leases and £750 (same) directors' fees, leaving a balance of £69,706 (£54,233). Taxation takes £51,500 (£41,500). After payment of war damage contribution, allocating £5,000 (same) to general reserve and meeting the preference dividend, the ordinary dividend is raised from 10 to 15 per cent. and £7,820 (£5,021) is carried forward.

Turner & Newall, Ltd.—The trading profit of the parent company for the year to September 30th last, including dividends from subsidiaries, was £2,493,142 (against £2,513,915) and there was a net profit of £629,462 (£545,665). It is proposed to pay a final ordinary dividend of 8¾ per cent. (less tax at 9s.), again making 12½ per cent. for the year. General reserve receives £100,000 (same) and the welfare fund £10,000 (same), and £209,787 (£112,847) is carried forward.

Marco Refrigerators, Ltd.—The accounts for the year ended September 30th last show a trading profit of £38,289 (against £33,641) and a net profit of £31,525 (£29,060). Tax provision absorbs £27,745 (£25,597) and, as already announced, it is proposed to pay a first and final dividend of 5 per cent. (against 2½ per cent.), the carry-forward being raised from £7,078 to £8,234.

The Electric Furnace Co., Ltd., announces an interim dividend of 3½ per cent., the same as last year.

The Madras Electric Supply Corporation, Ltd., has declared an interim dividend of 2 per cent.

The London Electric & General Trust, Ltd., is maintaining its interim dividend at 2 per cent., less tax at 9s. 6½d.

New Companies

Airmec International Sales, Ltd.—Private company. Registered December 3rd. Capital, £10,000. Objects: To carry on the business of merchants for the export and import of the products and requirements of engineers of all kinds, electricians, mechanical engineers, manufacturers of, and dealers in, electrical apparatus, etc. Directors: L. D. Bennett, Commonwood House, near Chipperfield, Herts. (chairman of the Philco Radio and Television Corpn. of Great Britain, Ltd.), and four others. Registered office: Wadsworth Road, Perivale, Greenford, Middlesex.

Armstrong, Grigson, Ltd.—Private company. Registered November 30th. Capital, £2,000. Objects: To carry on the business of manufacturers and distributors of, agents for, and wholesale and retail dealers in, wireless and television sets, accumulators and batteries, electric and other lamps and electrical plant, etc. Directors: F. X. J. Armstrong, 2, Heath Court, Park Road, Uxbridge, and W. Grigson, 112, Swakeleys Road, Ickenham, Middlesex. Registered office: 229, High Street, Uxbridge.

Essential Electric Equipment, Ltd.—Private company. Registered November 30th. Capital, £5,000. Objects: To carry on the business of electrical, motor, aeronautical and wireless engineers, etc. Directors: R. B. Whittingham, 21, Shalden Way, Walton-on-Thames, and two others. Registered office: 78, Victoria Road, Surbiton.

Geo. Williams (Willenhall), Ltd.—Private company. Registered December 6th. Capital, £5,000. Objects: To carry on the business of electricians, mechanical, consulting and general engineers, workers of, and dealers in, electricity, etc. Directors: F. Harper, "The Gables," Albert Road, Wolverhampton, and three others. Solicitors: Rowland Tildesley & Harris, Willenhall.

Electrical Services (Cornwall), Ltd.—Private company. Registered December 6th. Capital, £5,000. Objects: To carry on the business of electrical engineers, and general electrical installation contractors, lighting specialists, wireless engineers, etc. Directors: L. F. Kent, 3, Arundel Way, Newquay, and two others. Registered office: 6, London House, Newquay.

Mortgages and Charges

National Electrical Supplies Co., Ltd.—Deposit on November 8th, 1945, of deeds of 89 and 91, Whitechapel, and 60 and 62, Victoria Street, Liverpool, to secure all moneys due or to become due from the company to National Bank, Ltd.

Salmic & Co., Ltd.—Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated November 29th, 1945, to secure all moneys from time to time lent to the company. Holders: Metropolitan General Trust Co., N.W.2.

Wright Electric Motors (Halifax), Ltd.—Mortgage and charge on Century Works, Pellon Lane, Halifax, and the company's undertaking and other property, present and future, including uncalled capital, dated November 16th, 1945, to secure all moneys due or to become due from the company to Midland Bank, Ltd. Satisfaction in full on November 1st, 1945, of mortgage dated August 31st, and registered September 10th, 1929.

Mec-Electric, Ltd.—Particulars filed of £3,750 debentures, authorised November 13th, 1945, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Bankruptcies

H. Beaumont, electrical engineer and radio dealer, 207, Luck Lane, Paddock, Huddersfield. —Order made November 7th adjourning generally an application for discharge, with liberty to restore.

STOCKS AND SHARES

MONDAY EVENING.

STOCK Exchange markets are dominated at the present time to an unusual extent by politics. The acrimonious discussions which arose last week around the Anglo-American loan and Bretton Woods proposals cast a temporary shadow over the gilt-edged departments. The tap which had been running for years past with a supply of Government war loans was turned off last Saturday. At the moment, there is no official issue in front of the public other than the Post Office Defence Bonds and National Savings Certificates. This should prove a bull point for existing securities, but politics intervene, and, until the turn of the year, it is thought unlikely that prices will settle down to what may be called more normal conditions.

Dollar Loan and Markets

Publication of the terms of America's loan to Britain has still made no marked impression on the prices of industrial shares. In part, of course, this absence of much reaction either way has been due to the uncertainty felt about the attitude of the United States Congress. Apart from that, opinion has yet to come down one side or the other in summing up all the implications of the bargain. Few people are in two minds about the benefit of a very large number of dollars becoming immediately available to ease the country's crying need for the goods and equipment that America can supply. Beyond that, however, it seems generally felt that concessions to be given by Britain in return for the loan will lead the country further into the field of experiment. In this field, the markets have already had, in the shape of the Socialist policies, as much as they could comfortably digest for the time being. Bullish and bearish interpretations of the loan have roughly cancelled each other out, so far as their effect on industrial share prices is concerned. Mr. Bevin's journey to Moscow may prove a greater influence.

Home Electricity Supply

Prices of ordinary shares in the Home electricity supply market have arrived at a level where demand practically balances supply. It is worth recording, from the point of view of the Stock Exchange and the investor, that on no day since the share market was disturbed by the General Election result, has it been impossible to dispose of shares. The sellers have had to take lower prices it is true, but they could always get out if they wished to do so, and this is more than can be said for certain other markets in the industrial group. A trickle of selling still takes place ; there is, however, sufficient demand to meet it and to keep prices steady. The consequence is that the ordinary shares in the Home electricity supply list are unchanged since a week ago.

Price Fluctuations

Manufacturing and equipment ordinary shares show no striking changes on the week. Henley's are a little lower at 26s., and General Electrics at 94s. British Insulated Callenders are unaltered at 44s. 6d., and Siemens at 37s. Telegraph Constructions are 1s. down at £3. Amongst other changes, Walsall Conduits at 55s. have lost 6d.; Electric Constructions put on a few pence at 61s. 3d. Crompton Parkinsons are 1s. up at 30s. 6d. Burco continue their steady advance and at 20s. 3d. show a further gain. Veritys have strengthened to 8s. 6d. De la Rue fell back to 10¼.

The radio section is moderately active. Cossors, after being a quiet market at 44s. 9d., had a sharp rise to 47s. A new subsidiary controlled by Cossor, is to be formed to work in agreement with an American electrical company, to develop radar for peace-time use. Philco at 10s. 9d. are a trifle harder. E. K. Cole at 37s. 6d. advanced ¼. The Americans are said to be buyers of shares in a number of our radio, wireless and cinema concerns. And television is coming into the near prospect.

Cable & Wireless

Cable & Wireless ordinary at 105 and the 5½ per cent. preference at 111 are better on the week. Some of the buyers are taking the stocks in the proportion of 1 to 3 respectively. The argument is that the simultaneous purchase of £1,000 ordinary and £3,000 preference—or other amounts in this proportion—cannot fail to prove profitable whether the combine, as a result of partial nationalisation, goes into liquidation or carries on in its present shape. This view obtains support in some quarters, and deserves attention at a time when it is difficult to find satisfactory security giving a reasonable yield.

Johnson & Phillips

Johnson & Phillips wanted to make an issue of 200,000 ordinary shares of £1 each at £3, of which 43s. stood for assets, and the balance for goodwill. The company applied for permission to the Capital Issues Committee, who replied saying that they had no objection to the principle, but as they considered the proposed issued price to contain the element of bonus, they would not consent to the terms. The company accordingly made a further suggestion of 65s., offering one new share for every four shares held by the proprietors, but once more the C.I.C. turned down the proposal.

The company has laid the matter before the shareholders, notifying them that an expansion of borrowing powers must be sought in the absence of increased issued share capital. The bankers are to be asked to continue their financial assistance, and the directors add their firm intention of increasing the capital by an issue of shares as soon as they are able to do so. The price of the shares has fallen a florin, to 77s. Three weeks ago the price was 81s. 6d.

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.

ADEL Precision Products Corporation.—"Conduit supporting clip." 15471/43. February 15th, 1943. (573701.) "Supporting clip for conduits." 18763/43. November 2nd, 1942. (573708.)

Akt.-Ges. Brown, Boveri, & Cie.—"Continuously adjustable choking coils." 21420/43. December 23rd, 1942. (573679.) "Continuously adjustable choking coils." 3127/44. February 27th, 1943. (Addition to 573679.) (573680.)

Automatic Electric Laboratories, Inc.—"Frequency changers." 8616/44. May 6th, 1943. (573717.)

British Insulated Cables, Ltd., and A. E. Jones.—"Process of preparation of diamond dies for wire drawing." 9556. May 18th, 1944. (573683.)

British Thomson-Houston Co., Ltd.—"Electronic devices particularly for X-ray apparatus." 20235/43. December 7th, 1942. (573587.)

Brush Crystal Co., Ltd.—"Piezo-electric acoustic devices." 5225/40. March 20th, 1939. (573687.) "Connecting devices for electrical apparatus, for example, piezo-electric acoustic and like devices." 16316/41. March 20th, 1939. (Divided out of 573687.) (573688.)

E. J. Clarke and Murex Welding Processes, Ltd.—"Welding rods." 14607. October 19th, 1942. (573595.) "Electrodes or welding rods and the production of shaped articles therefrom." 16042. November 13th, 1942. (573598.)

A. P. Clouez.—"Electro-magnetic razors.') 5068/42. March 19th, 1941. (573568.)

J. J. Davis.—"Screening of electrical devices to prevent interference with wireless signals." 17077. November 29th, 1940. (573660.)

Ferranti, Ltd., and A. L. Chilcot.—"Coating of part of the interior of electric-discharge devices." 5201. April 18th, 1942. (573570.)

Ferranti, Ltd., A. L. Chilcot and S. Jackson.—"Mounting of electrodes in electric-discharge tubes." 5200. April 18th, 1942. (573569.)

Ferranti, Ltd., A. L. Chilcot and J. L. Miller.—"Mounting of electrodes in electric-discharge tubes." 5202. April 18th, 1942. (573571.)

Ferranti, Ltd., A. L. Chilcot, S. Jackson and F. W. Taylor.—"Mounting of electrodes in electric-discharge tubes." 5203. April 18th, 1942. (573572.)

General Electric Co., Ltd., V. J. Francis and A. H. Willoughby.—"H.p. mercury-vapour electric-discharge lamps." 4958. April 16th, 1941. (573590.)

P. A. H. Mossay.—"Current collectors for induction regulators and like devices." 17814. October 28th, 1943. (573675.)

Patentverwertungs-Patelhold & Elektro-Holding Akt.-Ges.—"Apparatus for transmitting speech signals by means of defining signals obtained from the speech oscillations." 17241/42. December 3rd, 1941. (573629.)

J. H. Rawlings and Automatic Coil Winder & Electrical Equipment Co., Ltd.—"Coil winding machines." 20932. December 14th, 1943. (573639.)

Redfern's Rubber Works, Ltd., F. E. Brown and A. J. Hignett.—"Battery boxes." 17027. November 30th, 1942. (573628.)

Siemens Bros. & Co., Ltd., C. F. Edwin and R. J. Willis.—"Electric dry batteries." Cognate applications 19790/43 and 22601/44. November 26th, 1943. (573582.)

Standard Telephones & Cables, Ltd., and R. R. Back.—"Methods of activating cathodes for electron discharge devices." 20393. December 3rd, 1943. (573612.)

Standard Telephones & Cables, Ltd., and W. T. Gibson.—"Electron discharge devices." 18158. November 2nd, 1943. (573605.)

A. H. Stevens (Board of Regents of the University of Texas).—"Apparatus for treating gases with electric glow discharges." 14353. September 2nd, 1943. (573699.)

Vandervell Products, Ltd., and D. F. Green.—"Bonding of electroplated layers." 20863. December 13th, 1943. (573636.)

Vandervell Products, Ltd., and J. E. Salmon.—"Electroplating the inner or concave surfaces of segments of cylindrical and like structures." 20862. December 13th, 1943. (573635.)

E. R. Wigan.—"Electrical networks." 20788. December 11th, 1943. (573615.)

H. Wood & Co., Ltd., and A. Hayes.—"Sockets of electric cable plug-and-socket connections." 18134. November 2nd, 1943. (573604.)

Australian Notes

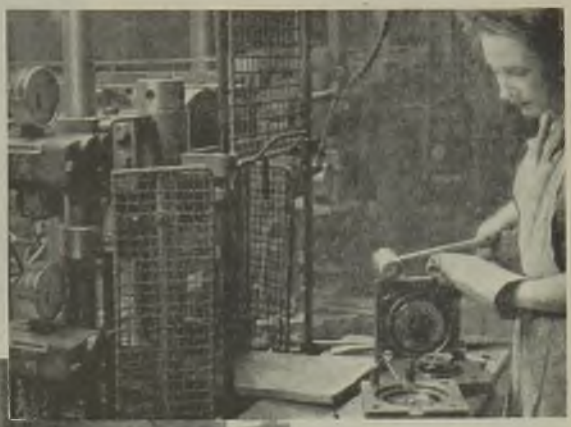
Suggested National Advisory Council.—A proposal to establish a National Electricity Advisory Council has been postponed until the next Premiers' Conference. The Secondary Industries Commission suggested that since the generation and transmission of electricity is very largely in the hands of governmental authorities, the State and Commonwealth Governments should jointly set up a permanent authority to assess the potentialities for power production, and to guide and co-ordinate the development of electricity supply throughout the Commonwealth.

Adelaide Bill.—Introducing the Electricity Trust Bill to provide for the taking over of the assets of the Adelaide Electricity Supply Co., the Premier of South Australia (Mr. Playford) said that under the Bill shareholders would be paid either in cash on the basis of the value of their shares on August 1st, 1945, or alternatively in 4 per cent. debentures issued by the Trust. Since the introduction of the Bill, however, a petition has been presented for its rejection. The petition asks the House to affirm the principle that if any undertaking is compulsorily acquired by the State the owners shall be compensated to the full value of the assets, and also contends that the State should not acquire a well-established privately owned undertaking unless it is first shown that the proprietors have failed to fulfil their obligations or that acquisition is essential in the public interest, and this, the petitioners claim, has not been established.

Instrument Manufacture

Progress of a Northampton Firm

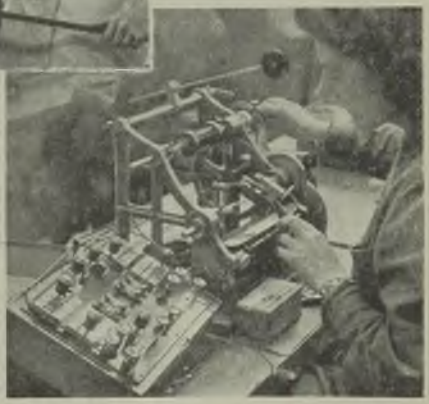
FEW firms can claim such a rapid growth as that of Painton & Co., Ltd., of Kingsthorpe, Northampton. When the late Mr. P. R. Painton established the company in 1935, it consisted of three directors and three operators, and functioned in small premises in the centre of Northampton. To-day the company gives employment to well over 400 and possesses an up-to-date factory operating under healthy conditions in garden surroundings. Mr. C. M. Benham (formerly with Standard Telephones & Cables, Ltd.) became managing director in 1937, when Mr. Painton died.



Bakelite panel for stud type attenuator or fader being moulded

Above: Sifting vitreous enamelling powder on to resistances during treatment in electric furnaces Right: Winding a 100-ohm resistance with 0·001-in. wire, the resistance being measured during winding by the instrument on the left

Vitreous enamelled resistors of 150-W rating were the company's first product, and at the time were not of the tropical variety. The company was the first to obtain Air Ministry approval for a tropical grade vitreous resistor in January, 1937, and production of this type was started in the same year. The range now covers ratings of from 1 W to 150 W, with resistance values up to 100,000 ohms. Normally the resistors are manufactured to a tolerance of ± 5 per cent. of the nominal value, but limits of ± 1 per cent. can be obtained when required. Special arrangements are employed which enable the resistance value to be measured during winding and wire as fine as 0·0006 in. diam. is used for some of the higher values in the miniature range.



Owing to certain conditions peculiar to the process, one of which is the necessity for firing at 800 deg. C., the vitreous enamelling is carried out in a special section of the factory. This arrangement makes possible the provision of air conditioning without high air velocity which would result in thermal shock to the resistors during the processing. Some of the larger resistors are enamelled by the dusting process, successive coats of enamel being sifted on to the resistor between furnacing. For the smaller resistors a continuous tunnel method of firing is employed, and some 10,000 units per week are produced by this method.

Under batch sampling methods a percentage of each week's production is subjected to various tests, one of which includes 100 hours in a steam chamber to ensure that units are capable of withstanding this without alteration of more than 0·5 per cent. from the original resistance value. The resistors are also subjected to mechanical stress by means of a machine specially designed to detect fractured ceramic formers.

Faders and Attenuators

To-day, however, vitreous resistors form only a portion of the company's output. In 1936 the first stud type fader was designed and produced, and the standard range now covers faders and attenuators which can be offered with any of the usual types of network, both unbalanced and balanced, with impedances ranging from 25 to 600 ohms. A radical departure from conventional practice is represented in an edgewise model fader unit, designed for use in mixer panels for broadcasting or recording circuits.

A special feature of the stud type attenuators and faders is that the studs are moulded into the panels. The company undertakes its own bakelite moulding, and for the smaller intricate units, the latest technique of transfer moulding is used, so that distortion is avoided and the highest degree of dimensional accuracy maintained. Other products include tubular wire-wound resistors, pre-set resistors, rotary stud switches, fixed attenuators, continuously variable wire wound potentiometers from 2 W up to 25 W rating, knobs and dials, and plugs and sockets ranging from 2- to 35-way models.

During the war considerable development work was carried out in connection with scanner and range potentiometers for radar application. These are wire wound instruments, similar to the 15-W and 25-W continuously variable controls and have been in production for the last two years. These instruments possess linearity characteristics of better than 0·2 per cent.

A good deal of attention has recently been given to the production of miniature com-

Checking the linearity of scanner potentiometers for radar work

ponents, such as the 2-W continuously variable potentiometer, which is $\frac{7}{8}$ in. in diameter by $\frac{3}{4}$ in. deep. Even smaller is the push-button switch, with one pair of make and one pair of break contacts, and finally a wire wound vitreous enamelled resistor $\frac{1}{4}$ in. in diameter and only $\frac{13}{32}$ in. long.

Diesel Engine Costs

THE customary report on the operation of heavy-oil engines, compiled by the Working Costs Sub-Committee of the Diesel Engine Users' Association, has been presented for discussion at the annual general meeting. It is concerned with the year 1943-44 and is a record of facts without any expression of opinion by the Committee upon the information furnished by members. All the tabulated data have been brought up to date, excepting those relating to renewals and replacements, the cost of which is at present abnormal. Records from 52 stations are included, compared with 55 last time, the decrease being due to the receipt of fewer returns from overseas; though there are two additions from home stations, one each from electricity and water undertakings.

A considerable part of the discussion which took place on the previous report was directed to the form in which the tabulated information is set forth, some of the larger tables being awkward to manipulate. After much deliberation the compiling Committee has concluded that the existing style is more advantageous than any of the alternatives proposed.

NEW BOOKS

Electricity Distribution Practice. Splitting the Atom.

Distribution and Utilisation of Electricity. By E. Openshaw Taylor. Pp. 162; figs. Blackie & Son, Ltd., 66, Chandos Place, London, W.C.2. Price 6s.

This is an excellent book and any electrical engineer of student who buys it will have no cause to regret his purchase. In the small compass of 162 pages the big subjects of distribution and utilisation are dealt with. This is made possible by giving the cream of the matter only. In distribution the chapter headings are: Layout and construction; circuit calculations; voltage regulation and control; faults—prevention, clearance and location; tariffs and metering. In utilisation the chapter headings are: Industrial electric drive; electric heating; illumination; factory power supply.

The treatment is naturally condensed and for this reason would scarcely be suitable for a beginner without the aid of lectures. On the other hand, for anybody acquainted with the subject, the matter is just what he needs as a book of reference. It is particularly valuable on account of the number of worked examples. One point the author might make clear in fig. 5 is whether the cables shown have a metal sheath or not, otherwise a student might be misled by the illustration of a single-core cable. Strangely enough, we cannot find the date of publication, which seems to be an important matter in a scientific work.—S. P. S.

The Story of the Atomic Bomb. By C. H. Douglas Clark. Pp. 52; figs. 29. Published by the Machinery Publishing Co., Ltd., 83-113, Euston Road, London, N.W.1. Price 3s. 6d. net.

The sensational splitting of the atom as a war measure has made a vast number of people "atom conscious." These, as well as electrical engineers wishing to revive their knowledge of something that is fundamental to their work, will find much informative matter in this introduction to the subject and also in the account it gives of the work of pioneer physicists. Starting with atomic theory, the reader is taken on to the electron, radio-activity, the nucleus, isotopes, the neutron to reach atomic fissure by bombardment with alpha particles and to the, at present, final phase in the production of the atomic bomb. The possibilities of putting the discovery to constructive uses are considered in a postscript. At the head of each of the ten chapters is a summary of conclusions.—C.O.B.

The Penguin Handyman. By Foster Wiseman. Pp. 81; figs. 76, with index. Penguin Books, Ltd., Harmondsworth, Middlesex. Price 9d.

The foreword to this addition (PH9) to the little green books suggests that the prevailing scarcity of skilled labour available for effecting simple repairs has urged the author to furnish the householder with the little knowledge (*sic*) necessary to keep his domestic apparatus in good working order. This is done in a doubtful way in Chapter I, of 20 pages and 12 sketches. It begins with the definition of terms and states that one of the four possible causes of short circuit is "faulty insulation in appliance allowing electricity to *pass to earth*." Although the chapter is headed "The Repair of Electrical Domestic Appliances," apart from repairing flex, the only instruction given is for the dismantling and re-assembling of a clothes iron. Wattage calculations are included for re-fusing, without a word of warning about overloading 5-A circuits until the last page of the chapter, while a length of flex (connected to a lampholder and plug) with bared ends is hardly the kind of "simple apparatus" ordinary householders should be advised to employ for testing the continuity of circuits.—W.O.F.

Welding Manual. First Edition. Pp. 168; figs. 65. Quasi-Arc Co., Ltd., Bilston, Staffs. Price 3s. 6d.

This pocket size book is divided into five parts of 36 chapters, some of them quite short. The two first sections provide elementary and advanced instruction; the third is concerned with the welding of materials other than mild steel and the fourth with the equipment of the welding shop, including heat treatment, while the last is devoted to drawing office procedure, loads, stresses, data tables, a short glossary of terms and an index. The object of its compilation has evidently been threefold. First, to offer advice to the novice. The trainee who masters the first eight chapters of 31 pages should be able to do useful work in the shops where jobs are turned round so that they can be welded downhand. Secondly, to help the welder who has concentrated too narrowly to widen his knowledge and develop his practical ability. Thirdly, to guide the shop supervisor and designer of fabricated structures.—W. O. F.

Books Received

An Experimental Course in the Fundamental Principles of Radio. By R. H. Humphrey and George Patchin. Pp. 197; figs. 122. Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 12s. 6d.

Alternating Current Motors and Control Gear. By C. H. Claude Cooke. Second edition, revised. Pp. 88; figs. 20. Crosby Lockwood & Son, Ltd., 20, Tudor Street, London, E.C.4. Price 5s.

A Dictionary of Metallography. By R. T. Rolfe. Pp. 242. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 15s.

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.

Blackpool.—January 3rd. Electricity Committee. Batteries, charging equipment and associated switch and fuse gear. (December 14th.)

Edinburgh.—February 15th. City Council. 33-kV switchgear and accessories for Portobello power station. (December 14th.)

Kettering.—January 4th. Electricity Department. Six transformers, switchgear and sheet steel kiosks. (December 14th.)

Maesteg.—January 1st. Electricity Department. L.v. mains, services and public lighting. (December 7th.)

Manchester.—December 31st. Electricity Committee. 6·6-kV switchgear and one 20-ton road weighbridge and frame. (December 7th.)

Rochdale.—January 16th.—Electricity Department. Quarterly and prepayment meters and transformers. (See this issue.)

Sheffield.—January 28th.—Electricity Department. One fourteen panel auxiliary switchboard. (See this issue.)

Southend.—February 1st. Electricity Department. One 800-kW alternator. (See this issue.)

Tredegar.—December 29th. Urban District Council. Two 250-kVA and one 500-kVA transformers. (December 7th.)

Orders Placed

Blackpool.—Housing Committee. Accepted. Electrical installations at 14 houses at Lostock Gardens (£258).—Lawrence Lee.

Electricity Committee. Accepted. Cables for transmission lines from Peel to Bispham.—B.I. & Callender's. Transformers.—English Electric Co. Fire protection installation.—Walter Kidde Co.

Bradford.—Electricity Committee. Accepted. 500 meters (£1 15s. 3d. each).—Sangamo Weston and English Electric Co. Crane for Valley power station (£3,645).—John Smith (Keighley).

Wallasey.—Electricity Committee. Recommended. 250 prepayment meters (£5 13s. 6d. each).—Landis & Gyr. Cable laying.—Britannic Cable & Construction Co. Switchgear (£1,537).—A. Reyrolle & 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.

Aberdeen.—Improvement and development of harbour including installation of coal handling plant, cranes, etc. (£500,000); Aberdeen Harbour Board.

Airdrie.—Factory for Eldorado Ice Cream Co., Ltd.; secretary, New Industries Committee.

Anglesey.—Extensions, secondary schools; E. Rees, county architect. County Offices. Llangefni.

Bolton.—Transformer house, Lostock Mills; W. Heaton & Sons, Ltd.

Bridgend.—Permanent houses (50), Llangewydd Road site (£49,234), for U.D.C.; R. B. Thomas, builder, 2, Mackworth Road, Porthcawl.

Cardiff.—Houses (62), Highmead; city architect.

Rebuilding Scandinavian Sailors' Home, Bute Street; Norwegian Consul.

Chesterfield.—Warehouse, Pottery Lane; Pearson & Co., Ltd.

Works additions, Wheatbridge Mills; Robinson & Sons, Ltd.

Chipping Norton.—Houses (28), Leafield and Charlbury (£32,713), for R.D.C.; B. Blake, builder, Charlbury.

Consett (Co. Durham).—Houses (40); T. M. Francis, builder.

Dumfries.—Factory extensions (£4,000), College Road, for General Milk Products, Ltd.; manager.

Great Barr.—Houses (33); J. Wistance, Ltd., builders, Leicester Buildings, Walsall.

Hinckley.—Permanent houses (£54,000), for U.D.C.; F. Garner & Son, builders, 181, Loughborough Road, Leicester.

Hove.—Flats (32), Furze Hill and York Avenue for Mutual Flats Building Association; W. Morley Park.

Ilkeston.—Houses (122), Cotmanhay estate (£142,088); F. Sisson & Sons, Ltd.

Lichfield.—Houses (100), Stowe Street estate; city engineer.

Maltby.—Permanent houses (30), Manor Park estate (£27,990), for U.D.C.; Mollekin Bros., builders, Rotherham Road.

Norwich.—Houses (400), in 17 groups, Tuckswood Lane estate; city architect's office, City Hall.

Paisley.—Additions and alterations to works for Brown & Polson, Ltd., Royal Starch Works; manager.

Pontefract.—Houses (134), Chequerfield site; J. G. L. Poulson, architect, 29, Ropergate.

St. Albans.—Permanent prefabricated houses (50), as first instalment of scheme; S. H. E. Crane; town clerk, 38, St. Peter's Street.

Stockton-on-Tees.—Hutments, Richard Hind School, for the Education Committee (£3,500); borough engineer.

Tynemouth.—Factory, West Chirton; Tyne Plywood Works, Ltd.

Extensions, Moor Park Hospital (£21,500); borough engineer.

Wallasey.—Kitchen and dining room at Oldershaw grammar school; F. R. B. Grundy, borough engineer, Town Hall.

Walsall.—X-ray department, Manor Hospital (£2,264); Edgar Crowther, Ltd., Birmingham.

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. *(See notice below for Christmas.)*

THE CHARGE for advertisements in this section is 2/- per line (approx. 7 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 this counts as six words and 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.

CHRISTMAS SCHEDULE

CLASSIFIED ADVERTISEMENTS

Our issue of **December 28** closed for press on **Thursday, December 20.**

OFFICIAL NOTICES, TENDERS, ETC.

SHEFFIELD CORPORATION

Electricity Department

Contract No. 715

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

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

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

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

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

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

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

JOHN R. STRUTHERS,
General Manager and Engineer.

Commercial St.,
Sheffield, 1.
December, 1945. 3719

COUNTY BOROUGH OF SOUTHEND-ON-SEA

Electricity Department

TENDERS are invited for the supply, delivery and erection of one 800-kW Alternator. Specifications, etc., are obtainable from the undersigned. Tenders are to be delivered to the Town Clerk, Municipal Buildings, Southend-on-Sea, not later than February 1st, 1946, in an envelope endorsed " Tender for Alternator."

A. C. JOHNSON,
Engineer and Manager.

Electricity Works,
London Rd., Southend-on-Sea. 3730

COUNTY BOROUGH OF ROCHDALE

Electricity Department

TENDERS are invited for the supply, during the ensuing twelve months, of—

(A) Alternating current, single-phase, 5-ampere and 25-ampere Quarterly Meters, and 5-ampere and 25-ampere Prepayment Meters.

(B) 3-phase, 6,000/400-volt Distribution Transformers.

Duplicate copies of General Conditions, Specifications and Form of Tender in respect of either section may be obtained from W. G. Coates, Borough Electrical Engineer, Electric House, Smith Street, Rochdale, upon payment of a deposit of £2 2s., which will be refunded on receipt of a bona fide tender. Additional copies may be purchased at a cost (non-returnable) of 10s. 6d. per copy.

Sealed tenders in plain unmarked envelopes, endorsed (A) Tender—Electricity Meters, or (B) Tender—Transformers, must be addressed to the Town Clerk and delivered not later than noon, January 16th, 1946.

The Corporation does not bind itself to accept the lowest or any tender.

G. F. SIMMONDS, M.A., LL.B.(Cantab.),
Town Clerk.

Town Hall,
Rochdale. 3712

TO WHOM IT MAY CONCERN

THE INDUSTRIAL ELECTRICAL CO. LTD., Offord Street Works, Offord Road, London, N.1, Electrical Power Plant Engineers, hereby give notice that they have no connection with any other firm trading under a similar title, or an abbreviation of such title.—10th December, 1945.

3720

SITUATIONS VACANT

COUNTY BOROUGH OF SOUTHPORT

Appointment of Shift Charge Engineer

APPLICATIONS are invited for the position of Shift Charge Engineer at the Corporation's " Selected " Generating Station. Candidates at present serving with H.M. Forces will receive every consideration.

Candidates must have received a good technical training and have had experience in the operation of Central Station plant, including Turbo-Alternators, Water Tube Boilers and E.H.T. Switchgear.

Salary will be in accordance with the N.J.B. Schedule, Class F, Grade 8. The appointment will be subject to the provisions of the Local Government Superannuation Act, 1922; medical examination necessary.

Candidates should give particulars of their qualifications, experience and age, together with copies of two recent testimonials.

Applications, endorsed " Shift Charge Engineer," should be addressed to the Borough Electrical Engineer, 188, Lord Street, Southport, and must be received by Monday, 7th January, 1946.

R. EDGAR PERRINS,
Town Clerk.

Southport.
5th December, 1945. 3736

CORPORATION OF GLASGOW

Transport Department

Chief Electrical Engineer

THE Corporation invite applications for the appointment of Chief Electrical Engineer in the Transport Department. The salary scale for the position is £750 rising by annual increments of £15 to £900 per annum, plus war increase, which is at present £60, but is subject to modification.

The person appointed will be responsible to the General Manager for the general supervision and efficient control of the Power Station operated by the Department for the generation of the electrical current for the Tramway system and for the distribution arrangements throughout the Undertaking, including the supervision of substations.

Applicants must be Associate Members of the Institution of Electrical Engineers, and experience in power station control (while not essential) will be of advantage.

The appointment is subject to the provisions of the Corporation Superannuation Scheme, and the successful candidate will require to pass a medical examination. Applicants must be under 50 years of age, except as regards employees of the Corporation.

Applications, stating date of birth and full particulars of qualifications and experience, accompanied by copies of not more than three recent testimonials, must be received by me in an envelope endorsed "Transport Department—Appointment of Chief Electrical Engineer," not later than 31st January, 1946.

Persons at present serving in H.M. Forces are invited to make application for the appointment.

WILLIAM KERR,
Town Clerk.

City Chambers, Glasgow.
30th November, 1945. 3612

METROPOLITAN BOROUGH OF SHOREDITCH

Appointment of Borough Electrical Engineer

APPLICATIONS are invited for the appointment of Engineer and Manager of the Council's Electricity Undertaking from engineers who are experienced in electricity supply and in the management and administration of an electricity undertaking.

The salary will be in accordance with the agreement dated 9th July, 1941, made by the National Joint Committee of Local Authorities and Chief Electrical Engineers. The present full salary, according to scale, will be £1,250 per annum, plus the appropriate bonus, which is at present £59 16s. per annum, and this salary will be paid from the date of taking up duties.

The appointment will be subject to the provisions of the Shoreditch and other Metropolitan Borough Councils (Superannuation) Acts, and the person appointed will be required to pass a medical examination.

Application forms and particulars and conditions of the appointment may be obtained from the undersigned.

The completed form of application, with testimonials, must be delivered to the undersigned not later than noon on Saturday, 19th January, 1946, in an envelope marked "Borough Electrical Engineer."

R. CYRIL RAY,
Town Clerk.

Town Hall,
Old Street, E.C.1. 3727

CITY AND COUNTY OF KINGSTON-UPON-HULL

Telephone Department

APPLICATIONS are invited from suitably qualified persons for the post of Assistant Engineer in the Corporation's Telephone Undertaking. Candidates should possess experience in the control of workmen and sound knowledge of the planning, installation and maintenance of junction and subscribers' distribution networks for a public automatic telephone system.

The post carries a salary of £300 rising to £420 per annum by annual increments of £18, thence to £550 by annual increments of £25, plus war bonus, at present £60 per annum. The starting salary will be fixed in accordance with the qualifications and previous experience of the selected candidate.

Application forms may be obtained from H. V. J. Harris, Manager, Telephone Department, 74, Newland Park, Hull, Yorkshire, and should be returned with copies of recent testimonials not later than Monday, 14th January, 1946. 3706

COUNTY BOROUGH OF WIGAN

Appointment of Electrical Engineer and Manager

APPLICATIONS are invited for the position of Electrical Engineer and Manager at a salary in accordance with the scale set out in the agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers, dated 9th July, 1941. In accordance with clause 10 of such 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 present unit assessment of the Corporation's Electricity Undertaking is 50,000,000.

Applicants should be Corporate Members of the Institution of Electrical Engineers.

The Corporation have received an intimation from the Central Electricity Board that a direction will shortly be issued to build a new power station at or near Wigan, with an ultimate capacity of four 30,000-kW sets.

Full particulars of the duties, terms and conditions of appointment may be obtained from the undersigned, and any further information which may be desired by applicants may also be obtained from the undersigned.

Applications (stating age, qualifications, experience, present and previous appointments, and accompanied by not more than three recent testimonials) must be delivered to the undersigned on or before the 14th January, 1946.

WILLIAM HENRY TYRER,
Town Clerk.

Town Clerk's Office,
Municipal Buildings,
Library Street, Wigan.
14th December, 1945. 3716

BOROUGH OF CHEPPING WYCOMBE (High Wycombe)

Electricity Undertaking

Appointment of Assistant Demonstrator (Female) (Amended Advertisement)

APPLICATIONS are invited from suitably qualified persons to instruct consumers in the use of cookers and other electrical appliances, to give practical demonstrations, and to assist in the showroom.

The salary will be in accordance with the Southern Provincial Whitley Council Scale, namely £155 to £240, plus war bonus of £48 2s., with commencing salary according to age. The appointment will be subject to the Council's Conditions of Service and to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

Applications, giving full particulars of age, training, qualifications and experience, together with testimonials, should be forwarded to the undersigned not later than Monday, January 7th, 1946.

HENRY ROBSON,
Borough Electrical Engineer.

Electricity Offices,
Frogmoor,
High Wycombe, Bucks. 3645

BOROUGH OF MANSFIELD

Electricity Department

Appointment of Meter Engineer

APPLICATIONS are invited for the position of Meter Engineer from qualified engineers with experience in testing and repairing all types of direct current, single and polyphase meters, etc., together with standardisation of instruments, etc., and general meter department routine.

The conditions of the appointment are in accordance with the National Joint Board Schedule, Class E, Grade 8, commencing at £371 per annum.

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, with copies of three recent testimonials, and giving particulars of qualifications, experience and age, should be addressed to the Borough Electrical Engineer, Lime Tree Place, Mansfield, not later than January 5th, 1946.

A. C. SHEPHERD,
Town Clerk.

Carr Bank, Mansfield,
6th December, 1945. 3678

COUNTY BOROUGH OF WARRINGTON

Electricity Department

Appointment of Station Combustion and Efficiency Engineer

APPLICATIONS are invited for the above appointment from persons with a wide technical and operation experience of a modern Boiler House attached to a Selected Generating Station, to take charge of the operation of such a Boiler House.

The successful applicant will not normally be required to undertake shift work.

The appointment will be subject to the provisions of the Agreement of the National Joint Board of Employers and Members of Staff for the Electricity Supply Industry, being in Grade 7, Class H, in the Schedule to that Agreement. The basic salary will be £424 per annum for two years, £432 per annum for the third and fourth years, rising to £440 per annum after the fourth year; the present value of the salary according to the cost of living adjustments provided for in the above-mentioned Agreement is £485 per annum for two years, £493 per annum for the third and fourth years, rising to £501 per annum after the fourth year.

The appointment will be subject to satisfactory medical examination by the Council's Medical Officer, to the provisions of the Local Government Superannuation Act, 1937, and to determination by one month's notice on either side.

Forms of application will not be issued, but candidates should give particulars of age, present position and duties, particulars of past service and all other essential information, including the fullest particulars of qualifications applicable to a post of this nature.

Candidates must disclose in writing whether to their knowledge they are related to any member of the Council or any co-opted member of a Committee or any officer of the Council. Failure to do so will lead to disqualification.

Applications must be accompanied by copies of not more than three recent testimonials and must be addressed to the undersigned and delivered in sealed envelopes endorsed "Application for Station Combustion and Efficiency Engineer," not later than Monday, 31st December, 1945.

Canvassing, either directly or indirectly, will disqualify.

NORMAN T. SMITH, M.I.E.E.,
Electricity Works, Borough Electrical Engineer.
Warrington. 3710

STEWARTRY OF KIRKCUDBRIGHT COUNTY COUNCIL

Electricity Department

Appointment of Junior Mains Assistant

APPLICATIONS are invited for the above post from suitably qualified Engineers who have had previous experience of mains work, preferably in a Rural Electricity Undertaking. Duties will include the survey and profiling for 11-kV overhead lines, maintenance of substations and switchgear, and generally acting as Assistant to the Mains Engineer.

Salary and conditions of appointment will be in accordance with the National Joint Board Schedule, the present salary being £268 rising to £279 per annum (Class D, Grade 9a).

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

Applications, stating age, and giving full particulars of training and experience, together with copies of testimonials, to be forwarded to the undersigned not later than 5th January, 1946.

A. L. BUSHNELL,
County Offices, County Clerk.
Kirkcudbright.
10th December, 1945. 3707

ARMATURE Winder for repair work, A.C. and D.C. Permanent position, good prospects, small growing business. Lancaster area. Write giving full details of experience, etc.—Box 3596, c/o The Electrical Review.

ARMATURE Winder required. Reply details experience and wages required.—Box 8107, c/o The Electrical Review.

ARMATURE Winders used to repair work, for S.W. London. All classes A.C. and D.C. jobs. Good conditions. Permanency for right type of men.—Box 3611, c/o The Electrical Review.

COUNTY BOROUGH OF WALLASEY

Electricity Department

Appointment of Deputy Borough Electrical Engineer and Manager

APPLICATIONS are invited by the 12th January, 1946, for the above appointment at a salary in accordance with Class F, Grade 1, of the National Joint Board Schedule—at present £723/755 p.a.

A form of application and further particulars will be supplied by the Electrical Engineer, Wallasey Road, Wallasey, on receipt of a stamped and addressed foolscap envelope.

EMRYS EVANS, Town Clerk.
December, 1945. 3713

ASSISTANT Technical Manager required, having detailed knowledge of the design, manufacture, testing, installation and use of all classes of electric cables. Apply, in writing, stating age, training, experience, etc., to—Scottish Cables Limited, Deanside, Renfrew. 3732

BATTERY Erectors required, or men with electrical experience to be trained; must be prepared to travel and assist on contracts in all parts of the country. Apply—Box 8133, c/o The Electrical Review.

CENTRAL London Contractors require experienced Storekeeper; permanency to right man. Full particulars to—Box 3700, c/o The Electrical Review.

CHARGEHAND Engineer required for shift work by industrial undertaking in West Midlands. Lancashire boilers and reciprocating engines generating A.C. Permanent post with pension. Salary £400 to £450. State age and experience. Men due for early release can apply.—Box 3675, c/o The Electrical Review.

CHIEF Draughtsman, experienced in radio and electrical engineering. Write giving experience and salary required.—Box 3641, c/o The Electrical Review.

CLERICAL Assistant for Stores Office. Must have thorough knowledge of all electrical material. Apply—London Electrical Co., 92, Blackfriars Road, S.E.1. 24

CLERICAL Assistant required by manufacturers of electric light fittings, London district. One with previous knowledge of the trade, and who is adaptable, preferred.—Box 3570, c/o The Electrical Review.

DESIGNER required for 33,000-volt switchgear. State age, experience and salary required to—Box 3734, c/o The Electrical Review.

DIE-Maker required, able to take charge of die-casting shop. Staff. Urgently required in N.W. London area. Please reply to—Box No. 148, Phillips Advertising Ltd., 15, Wilton Road, London, S.W.1. 3650

DRAUGHTSMAN with experience in design of domestic electric light fittings required for London office. Write giving details of experience, age, and salary to—Box 3571, c/o The Electrical Review.

DRAUGHTSMEN (2) required immediately, London. Good opening in important medium-size company with U.S.A. connections specialising in light electro-mechanical equipment. Applicants should have electrical or telecommunications experience and good general knowledge of workshop practice. Permanent. Write stating age, experience, salary required.—Box 3651, c/o The Electrical Review.

EDITORIAL Assistant required by prominent electrical company. Must have practical knowledge and theoretical attainment equivalent to degree standard. Knowledge of publicity dept. routine an advantage. Apply, stating qualifications and salary required, to—Box 3725, c/o The Electrical Review.

ELECTRICAL contractor, Birmingham, requires services of Supervising Engineer. Must be capable of preparing own schemes and quoting on specifications, etc. Sound knowledge of electrical contracting business essential, permanency to right man. State salary required.—Box 8131, c/o The Electrical Review.

ELECTRICAL Maintenance. Wanted, an experienced man for the maintenance of electrical equipment in printing works in Home Counties. The successful applicant would be required to work under the supervision of maintenance overseer and to undertake cleaning, repairs, line laying and erection of starting and other equipment as necessary. State age and experience and if married.—Box 3722, c/o The Electrical Review.

ELECTRICAL manufacturing company's patent department in London area requires Assistants for General Patent Work. Applicants should possess a good Honours degree in General Science, Physics or Engineering. A knowledge of patent work would be an advantage, but is not essential. Applications should be addressed to—Box 3726, c/o The Electrical Review.

ELECTRICIAN-Wiremen for general electrical work. Permanencies to suitable applicants.—J. W. Russell Ltd., Electrical Contractors, 18, Queens Rd., Watford. 3708

ELECTRICIANS and Assistants wanted. Permanency to right men.—J. H. Plant Ltd., 99, St. Martin's Lane, Charing Cross, W.C.2. 8073

ELECTRICIANS and Mates required for installations in Midlands. Rates of pay 2s. 9d. and 1s. 9d. per hour.—Box 8135, c/o The Electrical Review.

ELECTRICIANS and Mates wanted, Central London, for general installation and repair work. Every consideration and permanent job to reliable and conscientious workers.—Waddington & Goodwell Ltd., 34/35, Hatton Garden, E.C.1. 8091

ELECTRICIANS and Wiremen wanted urgently for A.C. and D.C. installations of lighting and power in Central London area. Apply—Arco Electrical Ltd., 55, Hatton Garden, E.C.1. Holborn 3179. 3637

ELECTRICIANS for installation work required in London, Manchester, Birmingham, Bournemouth, Southampton, Hull and Sheffield. Write full particulars to head office—Messrs. F. H. Wheeler & Co. Ltd., 39, Victoria Street, S.W.1. 3586

ELECTRICIANS wanted. Good conditions. Apply to—H. Feiner & Son, 50, Alie Street, Aldgate, E.1. Phone, Royal 5748. 8140

ENGINEERS and Draughtsmen, becoming available for civil employment under Class A demobilisation, are invited to apply for positions in the heavy electrical plant departments (comprising electrical machines and transformers of all kinds) of a large electrical engineering manufacturer in the Midlands. Applications, stating age, appropriate technical qualifications and industrial experience, and order of salary required, to—Box 71, c/o The Electrical Review.

ENGINEERS and Draughtsmen, becoming available for civil employment, under Class A demobilisation, are invited to apply for positions in the Switchgear Department of a large electrical engineering manufacturer in the Midlands. Applications stating age, appropriate technical qualifications and industrial experience, and salary required, to—Box 69, c/o The Electrical Review.

ESTIMATOR wanted, capable of preparing own schemes in addition to quoting on consultants' specifications, etc. Sound knowledge of electrical contracting business essential; able to organise and operate own contracts; permanency to right man. State salary required, experience and when available to—Box 3581, c/o The Electrical Review.

EXPORT Estimator required. Should have knowledge and experience of electrical engineering and administration, and have had service abroad. Reply stating age, experience, and salary required to—Box 3567, c/o The Electrical Review.

FOREMAN Assembly Department required for works in Birmingham, F.H.P. motors and similar light electrical work. Salary not less than £7 weekly, depending on experience. Apply, giving full particulars of training and experience, to—Box 3731, c/o The Electrical Review.

FOREMAN for Coil Winding Department, small electrical engineering works in Yorkshire, with sound working knowledge coil winding machines. Able to set up and take complete control. State salary, age and qualifications.—Box 3735, c/o The Electrical Review.

FOR steelworks in the North-West, Assistant Electrical Engineer, with experience of heavy electrical plant and automatic control gear. Age about 30. Technical training, B.Sc. or I.E.E. Permanent and progressive position. Full details of technical qualifications, age, previous experience and salary required, to—Box 3733, c/o The Electrical Review.

IMPERIAL Chemical Industries Ltd., Plastics Division, invite applications for the appointment of Illumination Engineer to undertake development work on the application of plastics in the lighting field. Knowledge of plastics is not essential, but good technical appreciation, coupled with practical experience of design and layout, is required. Minimum qualification H.N.C. Experience of laboratory control would be an advantage. Write, quoting D.1629XA, to Ministry of Labour and National Service, Appointments Department, Technical and Scientific Register, Room 367, York House, Kingsway, London, W.C.2, for application form, which must be returned completed by 28th January, 1946. 3702

LIGHTING Technician required for preparation of schemes and estimates for stage and colour lighting, preferably with drawing office experience. State age, experience fully, salary.—W. J. Furse & Co. Limited, Traffic Street, Nottingham. 3668

MANAGER required for electrical contractors, London area.—Box 3721, c/o The Electrical Review.

REQUIRED 2 or 3 men for construction, assembly, and wiring of electronic equipment, amplifiers and test gear. Sound film equipment company, London. Applications invited from Class A ex-Servicemen with suitable experience. State age, experience and wages required.—Box 3623, c/o The Electrical Review.

SALES and Order Correspondent required at head office of London manufacturers. Must be experienced in electrical accessories sold to wholesalers, supply authorities and contractors and capable of dealing with technical correspondence. Some knowledge of small switch and fuse gear an advantage. Full particulars and salary required. Write—Box A.6522, Samson Clarks, 57/61, Mortimer Street, W.1. 3738

SALES Engineer Representative required for London area for switchgear and power transformers. Switchgear engineering knowledge essential. Reply to—Box 3682, c/o The Electrical Review.

TECHNICAL Sales Representative with knowledge of radio and electronics required by established cable company in the London area. Details of age, qualifications and experience and salary required to—Box 3632, c/o The Electrical Review.

TRACTION Control Designer, technically trained and with good shop experience, required for the handling of contracts and designing of schemes and apparatus. Any design engineer with D.C. experience would be considered. Apply—Box 3630, c/o The Electrical Review.

VACANCIES are available for men released in Class A who have had experience on Instrument Work. Preference will be given to those who possess some theoretical knowledge. Apply, stating experience, training, age and wages required, to—Cambridge Instrument Company Ltd., Sydney Road, Muswell Hill, N.10. 46

WANTED, experienced Tracers (Female), also juniors with some experience (not learners). Apply, stating age, experience and salary required, to—Box 3631, c/o The Electrical Review.

WAREHOUSEMAN required for electrical dept.; must have some knowledge of trade. Apply—Farmer, Stedall & Co., 145, St. John Street, E.C.1. 3701

WORKS Manager required for important electrical manufacturers, North-West London. Knowledge of labour control, machine tools and modern production methods essential. Replies treated in strictest confidence. Write full particulars, age, experience and salary.—Box 536, Dorlands Ltd., 18/20, Regent Street, S.W.1. 3705

YOUNG ex-Naval ratings, with some electrical experience, to train as Armature Winders. Highly skilled trade, good employment conditions and prospects. Two or three required early 1946. Might also take two ex-Wrens for similar but lighter work. Write—Industrial Electrical Co. Ltd., Offord Street Works, London, N.1. 3737

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.

BOX 3440—Manager; St. Austell & District Electric Lighting & Power Co. Ltd.—Assistant Mains Engineer. All applicants are thanked.

SITUATIONS WANTED

FOR THE ATTENTION OF CONTROL GEAR MANUFACTURERS

ELECTRICAL Engineer, age 27, desires appointment as Junior Sales Engineer. Having had considerable experience in the installation and maintenance of steelworks plant, advertiser appreciates the meaning of SERVICE, and is NOT afraid of soiling his hands for commissioning and servicing.

Ordinary and Higher National Certs. in Elec. Eng., with endorsements in Indust. Admin., etc. D.O. experience and knowledge of Manufacture and Sales. Now studying Electronics.

Prospects more important than initial remuneration. Release obtainable.—Box 8139, c/o The Electrical Review.

A capable and energetic Engineer, with sound electrical and mechanical experience on the widest range of equipment of all makes and types, desires a responsible position in an established firm. Class A released Flight Lieutenant, twice mentioned in despatches for successful development work and organizing ability.—Box 8088, c/o The Electrical Review.

ABOUT to be de-mobbed, young man, 32, keen and conscientious. Comprehensive experience, 10 years with three leading electro-mechanical instrument firms. Including 5 year apprenticeship in all shops and latterly in test room, experimental and inspection departments, desires permanent post offering good prospects.—Box 8127, c/o The Electrical Review.

ADVERTISER, desiring change, seeks Managerial Post. Over 25 years' experience with manufacturers, contractors and wholesalers. Energetic worker. Excellent references.—Box 8094, c/o The Electrical Review.

ADVERTISER (age 35), recently demobilised (major, R.E.M.E.), is desirous of obtaining post as executive (Sales Manager or Works Manager) in light or medium engineering or electrical firm. Requires position where enterprising initiative and organising ability are desirable, leading to rapid advancement and permanency. 15 years' experience in electrical and general engineering practice. Excellent personality. Scotland area preferred, but would go anywhere. Would require to give present employers one month's notice, but could probably arrange less. Associate of the Electrical and Mechanical Institutions. Replies to—BM/MMK, London, W.C.1. 8110

ADVERTISER seeks position. Branch Manager or Salesman with electrical manufacturer, wholesaler or contractor. Fully experienced, including accounts and administration.—Box 8115, c/o The Electrical Review.

A.I.E.E., 38, free, extensive experience, adaptable, seeks post, London.—Box 8089, c/o The Electrical Review.

BUYER M.P.O.A., seeks position with concern manufacturing engineering and electrical equipment. Fully experienced in buying and modern stock control methods, and stores routine etc., salary required £500 p.a. Available Jan. 1st. 1945.—Box 8113, c/o The Electrical Review.

CLASS A leave: Electrician, 12 yrs.' varied experience, maintenance, repairs, A.C./D.C., refrigerators, lifts, signs, aircraft, perm. position required.—Box 8096, c/o The Electrical Review.

DOMESTIC Appliance, Cooker and Thermostat Engineer wishes to contact firm with view to position Works, Production or Sales Manager on demob. within 6 months. Would consider certain Colonies or Dominions under agreement.—Box 8093, c/o The Electrical Review.

ELECTRICAL Engineer, available soon, seeks permanent responsible position with Supply Undertaking or large firm. Six years as officer in Services. Experienced in generation (steam and Diesel), distribution E.H.T. and L.T. (D.C. and A.C.), and utilisation of electric power.—Box 8118, c/o The Electrical Review.

ELECTRICAL Engineer, officer R.A.F. (23), H.N.C., Class A release January, no civil experience, seeks post, training desirable, preferably mains, installations or marine.—Box 8068, c/o The Electrical Review.

ELECTRICAL Engineer (24), Higher National Certificate, ex-B.T.H. apprentice, experience on illumination, seeks position with small progressive firm.—Box 8081, c/o The Electrical Review.

ELECTRICAL Engineer (38), London graduate, extensive experience in design, development, industrial research, modern mass production methods, public address equipment, radio components, precision electrical instrument manufacture, sales, business management, requires a responsible executive position. Now free.—Box 8102, c/o The Electrical Review.

ELECTRICAL Superviser, 20 years' experience in the practical application of electrical installations for all purposes; own car.—Box 8138, c/o The Electrical Review.

ELECTRICIAN (29), Class A release, December, requires permanent situation with prospects. Experience installation and maintenance D.C. and A.C. machine tools, lifts, cranes, generators, alternators, power and lighting circuits; fault-finding ability. South or East Coast areas preferred.—Box 8108, c/o The Electrical Review.

ELECTRONIC Designer seeks supervisory position in firm starting on industrial electronics. Good qualifications. £350-£400 per annum.—Box 8099, c/o The Electrical Review.

ENGINEER, measurements, communication and industrial electronics, requires highly technical sales appointment. Well known in the field, reputation established, travel welcomed, age 31. Principals only. Please reply to—Box 8120, c/o The Electrical Review.

EX-Army officer (36), released November, seeks position as Combustion or Steam Plant Test Engineer: 14 years' experience in power station operation and testing. Trained in boiler fuel economy.—Box 8136, c/o The Electrical Review.

EX-Merchant Navy Electrician, desires permanent post, offering good prospects, experience of installations, repairs, maintenance, motors, generators. British, American and lighting and heating.—Box 8114, c/o The Electrical Review.

FOREMAN Electrician desires change. Experience contracting, maintenance, all systems, estimating, control of labour.—Box 8067, c/o The Electrical Review.

MAINTENANCE Engineer, A.M.Inst.B.E., 25 years in charge of works, extensive practical and technical experience in electrical, mechanical, steam plant, drawing office, etc., A.C., D.C., H.T., L.T. equipment, competent to plan and supervise complete works or factory installations, building construction and extensions, desires appointment where initiative and ability is required. Complete knowledge of factory regulations, management of staff and efficient running of plant. Would entertain post with installation engineering firm.—Box 8072, c/o The Electrical Review.

STORES Manager, age 39 years, specialist in stores organisation and stock control, desires appointment with progressive company, London preferred, but will consider provincial appointment.—Box 8097, c/o The Electrical Review.

FOR SALE

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

MODERN DIESEL GENERATING PLANT

280-b.h.p. PETTER VERTICAL 4-CYLINDER COLD STARTING "ATOMIC" DIESEL; New 1934, speed 300 r.p.m., direct coupled to 200-kW METRO-VICK 400-volts, 3-phase, 50-cycles Alternator with switchgear.

144-b.h.p. PETTER VERTICAL 4-CYLINDER COLD STARTING "ATOMIC" DIESEL; New 1937, speed 500 r.p.m., direct coupled to 96-kW E.C.C. 230-volt D.C. Generator and switchgear.

84-b.h.p. CROSSLEY VERTICAL 4-CYLINDER COLD STARTING DIESEL; New 1940, speed 1,000 r.p.m., direct coupled to 50-kW, 220-volt D.C. Generator by E.C.C., with switchgear. (2 available.)

60-b.h.p. RUSTON VERTICAL 3-CYLINDER COLD STARTING DIESEL; New 1936, speed 450 r.p.m., direct coupled to 45-kW CROMPTON PARKINSON 250-volt D.C. Generator with switchgear.

30-b.h.p. LISTER VERTICAL 3-CYLINDER HAND STARTING DIESEL; New 1941, speed 1,000 r.p.m., direct coupled to 20-kW, 400-volts, 3-phase, 50-cycles Alternator wtih switchgear.

14-b.h.p. LISTER VERTICAL TWIN-CYLINDER HAND STARTING DIESEL; New 1941, speed 1,000 r.p.m., direct coupled to 9.4-kVA Alternator, 400 volts, 3-phase, 50 cycles with switchgear.

7-b.h.p. LISTER VERTICAL SINGLE-CYLINDER HAND STARTING DIESEL; New 1941, speed 1,000 r.p.m., direct coupled to 4.4-kVA Alternator, 400 volts, 3-phase, 50 cycles, with switchgear. (2 available.)

6-b.h.p. CROSSLEY VERTICAL SINGLE-CYLINDER HAND STARTING DIESEL; New 1940, speed 1,000 r.p.m., direct coupled to 3-kW, 220/110-volt D.C. Generator with switchgear.

3-b.h.p. COVENTRY VERTICAL AIR-COOLED SINGLE-CYLINDER PETROL ENGINE; New 1944, speed 1,800 r.p.m., direct coupled to 700-watt, 25-volt D.C. Generator.

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

LEAD-covered and Armoured Cables, P.I. and V.I.R., various special lines at low prices.—Edwardes Bros., 20, Blackfriars Road, London, S.E.1. 04

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

MONOMARK. Permanent London address. Letters re-directed. 5s. p.a. Write—BM/MONO53, W.C.1. 68

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

MOTORISED ½" Bench Drilling Machine, 13 speeds, £12 2s. 6d.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 31

MOTORS, almost new, 3-phase, ¼ h.p., 400/440 v., 1,400 revs. Details and offers to—Box 8137, c/o The Electrical Review.

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SELF-Priming Electric Pumps, 300 g.p.h., £12.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 33

SEVERAL Telescopic Tower Ladders ready for essential work. Extensions, Trestles and Steps to order.—Shaftesbury Ladders Ltd., 453, Katherine Road, E.7. Grangewood 3363. 15

SPECIAL fine Bell and Telephone Wires, also screened wires, large quantity, clean.—Edwardes Bros., 20, Blackfriars Road, London, S.E.1. 07

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

STEAM Driven Alternator by Brownett Lindley/Westinghouse, 360 kVA, 3/50/400 volts, 2-crank compound Engine with Hick Bregnet Condenser.—Thomas Mitchell & Sons, Limited, Bolton. 3615

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5 tons of new condition V.I.R. Cable, also 2 tons lead-sheathed.—Box 3709, c/o The Electrical Review.

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250-kVA Alternator, 400 volts, 3-phase, 50 cycles, 750 revs., with direct-coupled exciter; also two 250-kW Rotary Converters, with transformers and switchgear, input 6,600 volts, 3-phase, 50 cycles, output 420/210 volts D.C.—Midland Counties Electrical Engineering Co. Ltd., Grice Street, Spon Lane, West Bromwich. 30

500 Electric Motors, Dynamos, Transformers, Convertors, etc., etc., at low prices.—S. C. Bilsby, A.M.I.C.E., A.M.I.E.E., Crosswells Road, Langley, near Birmingham. Phone, Broadwell 1359. 21

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REQUIRED, AUTOMATIC COIL WINDING MACHINES FOR ELECTRICAL COIL WINDING.—Box 38, c/o The Electrical Review. 38

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REPRESENTATIVES with stores and electrical connections required to market appliance in universal demand as side line. All areas. Commission.—Box 3704, c/o The Electrical Review.

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ELECTRICAL Engineers and Contractors, fully licensed by Ministry of Works and Board of Trade, comprising shop, workshop, counters, show cases, fittings, fixtures, radio test equipment, megger, valve tester, avometers, tools, etc. Shop situated in main London road. To be sold as a going concern. Stock valued at approx. £400. Breakdown in health causes sale.—Ring G.L.A. 4577 for appointment. 5132

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REPRESENTATIVE of J. B. Shah & Co., Electrical Engineers and Machinery Merchants, 31, Forbes St., Fort, Bombay (India), is in this country for contacting manufacturers or representatives for Diesel Power Plants, Electrical Motors, Switchgear, Transformers, Instruments, Wires, Cables, Electrical Accessories and Household Appliances. Please contact—c/o Messrs. Nathan & Allen Ltd., 131, Victoria Street, London, S.W.1. 3667

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IT is desired to secure the full commercial development in the United Kingdom of British Patents Nos. 478225, 486975, 539900, 540858 and 564379, relating to pipe couplings, by way of the grant of licences on terms acceptable to the patentees. Interested parties desiring copies of the patent specifications and further particulars should apply to—Stevens, Langner, Parry & Rollinson, 5-9, Quality Court, Chancery Lane, W.C.2. 81

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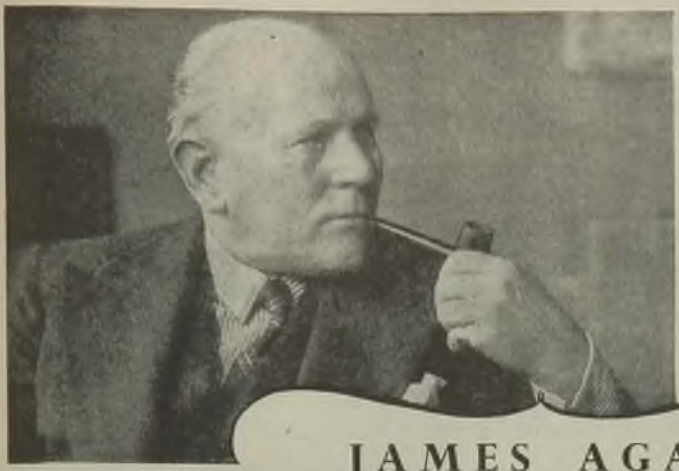
EDUCATIONAL NOTICES—*Continued*



★

CELEBRITY SERIES

We have asked a number of celebrities to write and devise advertisements for us. Here is the first of the series by Mr. James Agate, the famous critic and man of letters.

★

JAMES AGATE
on
SECOND-HAND MACHINERY

"If a thing is worth doing," said Chesterton about golf, "it is worth doing badly." The joy of the game sets off poor performance. But life is not a game, and things must be done perfectly.

No-one prefers the second-hand article to the new any more than a boxer prefers to be thirty instead of twenty. But how if the new is not available? Say I must choose one good bicycle out of six second-hand ones. First I reject the obviously worn-out. Then I take the best of the others and recondition it *thoroughly* before applying the new coat of paint. If I have done the work well I have got a machine as good as new in the sense that though not new its work is as good.

The argument applies equally to ocean liners, perambulators, and wrist watches. The work turned out by second-hand machines? I have been a weaver, and know that second-hand looms properly conditioned will turn out cloth every bit as good as that turned out by looms straight from the makers. With this advantage, that the second-hand looms are "run in" and have found themselves. As with looms so with all other kinds of machinery.

James Agate.

Modern Secondhand and Reconditioned Plant and Machinery of the highest grade available from the largest stocks in the country :—
Generating Sets, Motors, Switchgear, Transformers, Diesel Engines, Boilers, Pumps, Air Compressors, Cranes, Locomotives, Power Presses and Sheet Metal Working Machinery, Track and Wagons, Tanks, Steel Sections, Tubes and Fittings, and virtually every kind of modern Secondhand Works' Equipment.

GEORGE COHEN, SONS & CO. LTD

ONE OF THE 600 GROUP

Est. 1834. Wood Lane, London, W.12 (Phone: Shepherds Bush 2070), and Stanningley, Near Leeds (Phone: Pudsey 2241).

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Out of the darkness of days better forgotten comes the clear bright dawn of a new era, shedding its welcome beams that must forever glow to the glory of all mankind.
Illumination . . . REALUMINATION is the order of the day and

R·E·A·L

Industrial Lighting Equipment is designed to meet every modern requirement. Our team of experts will advise on every illumination problem.

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CROMPTON PARKINSON
LIMITED

ELECTRA HOUSE, VICTORIA EMBANKMENT, LONDON, W.C.2 *and Branches*

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