

3.58/45

ELECTRICAL REVIEW

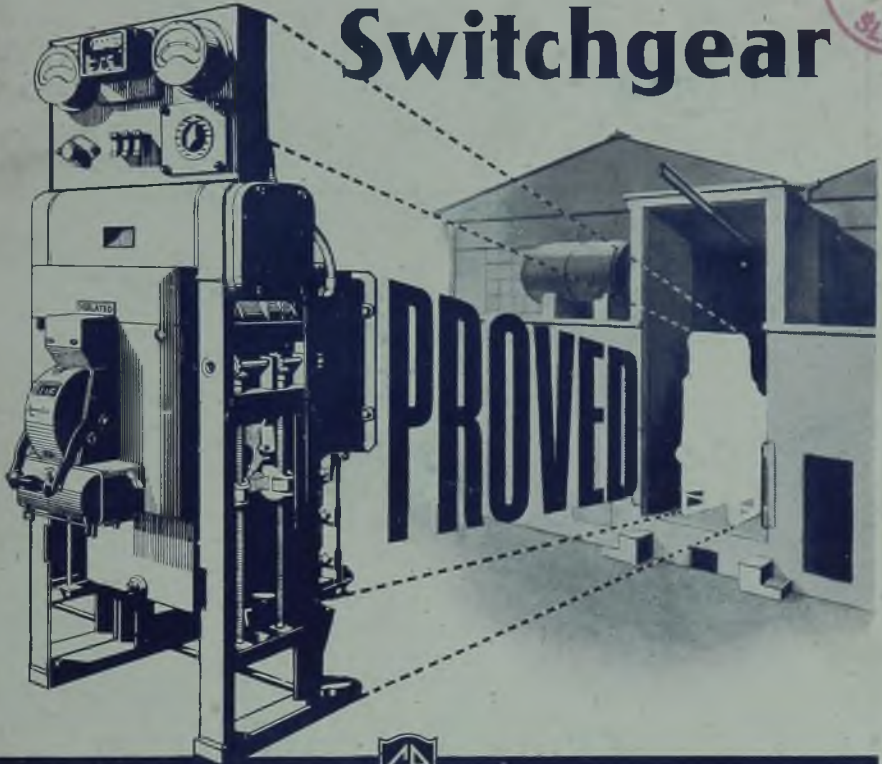
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1872

Vol. CXXXVI. No. 3515

APRIL 6, 1945

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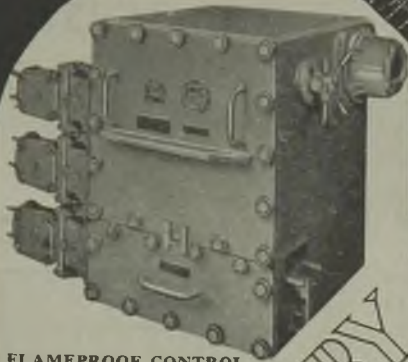


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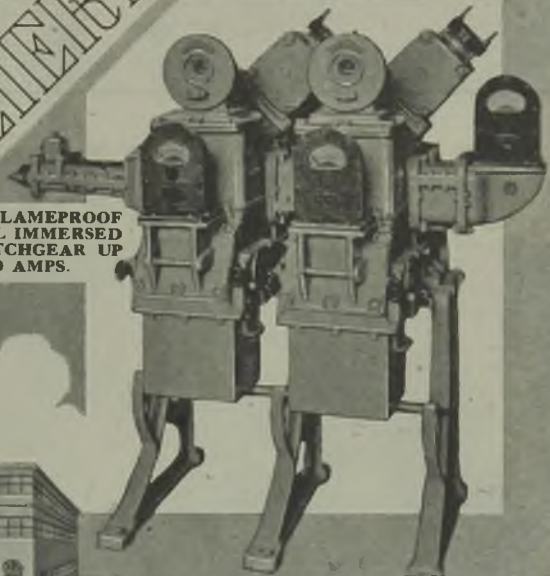


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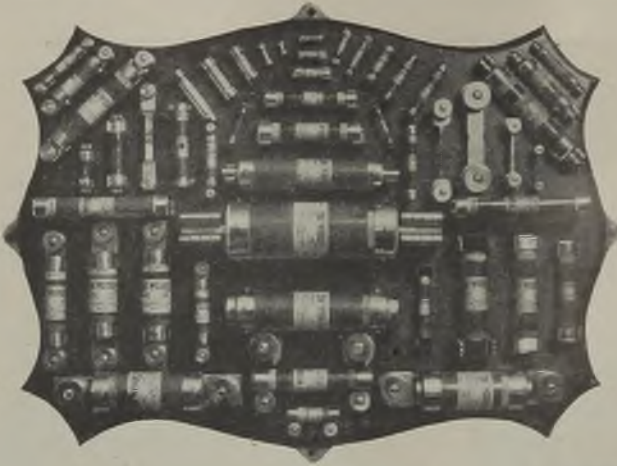


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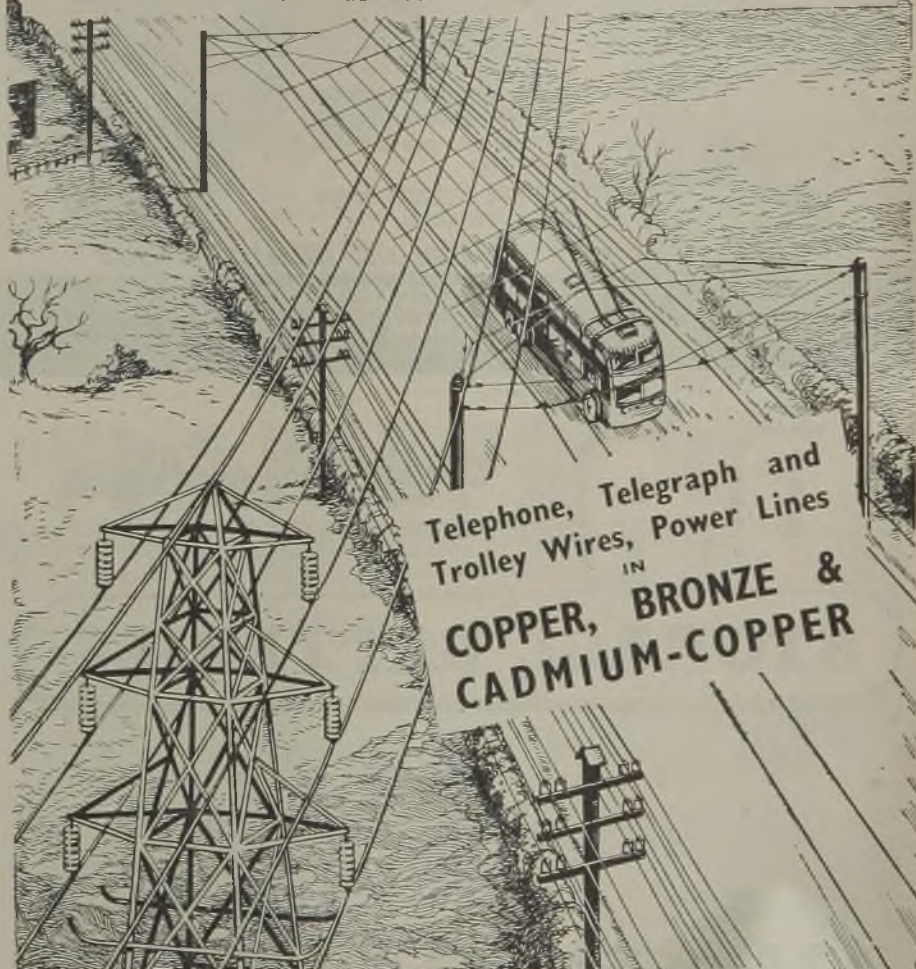
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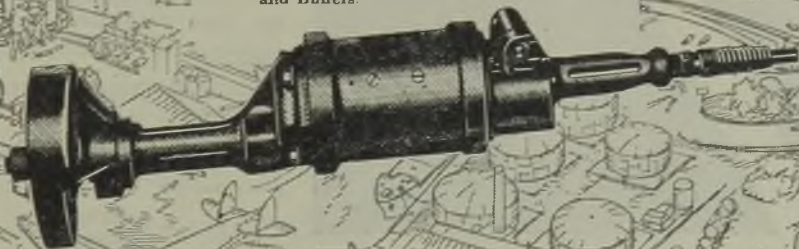


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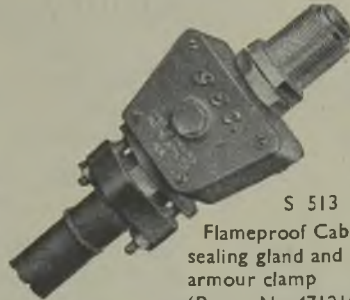
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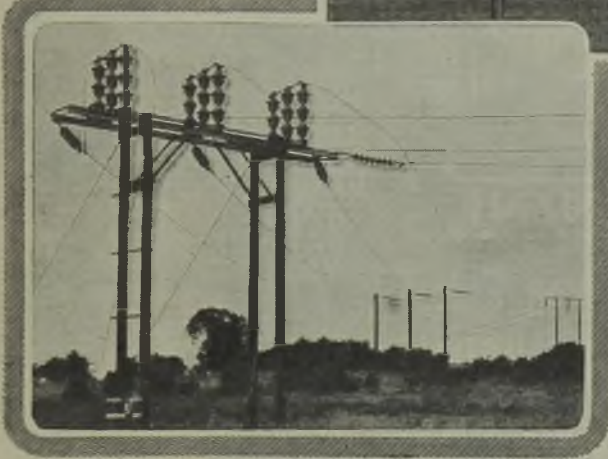
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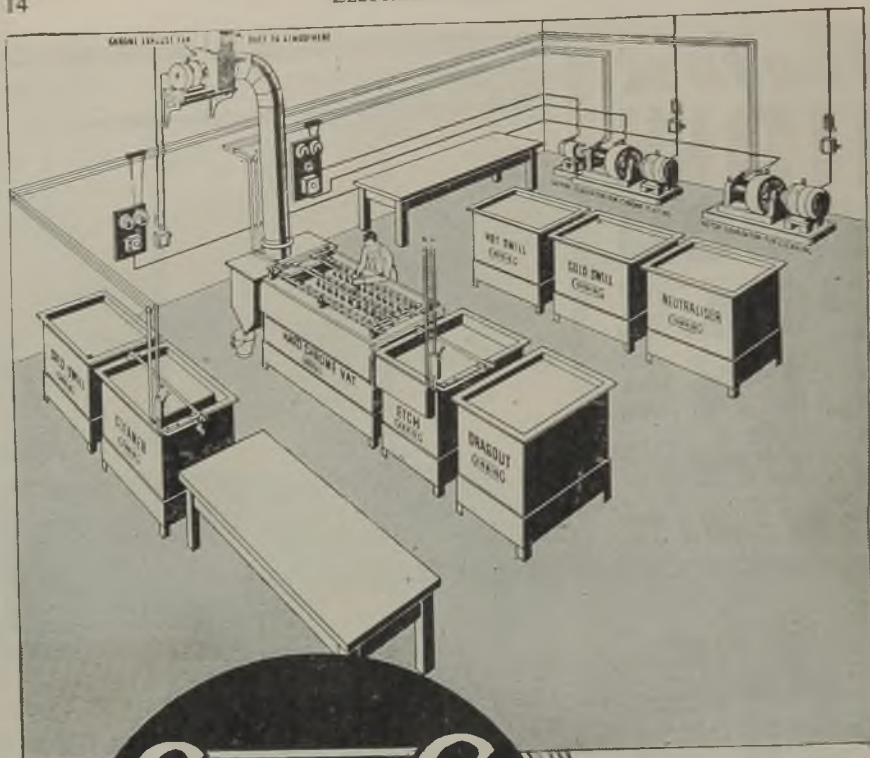
The lower illustration shows one of the several switching structures.

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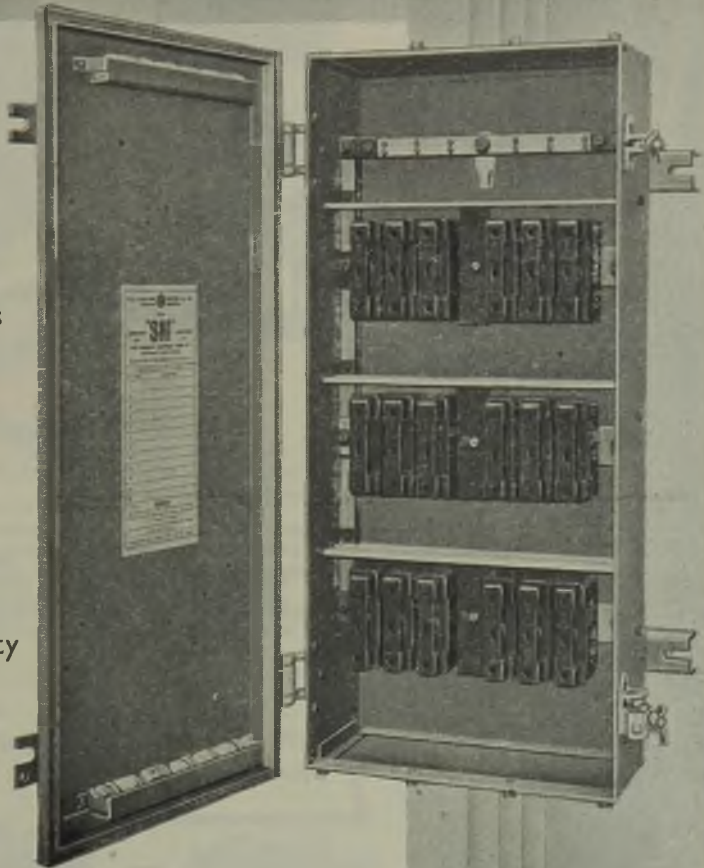
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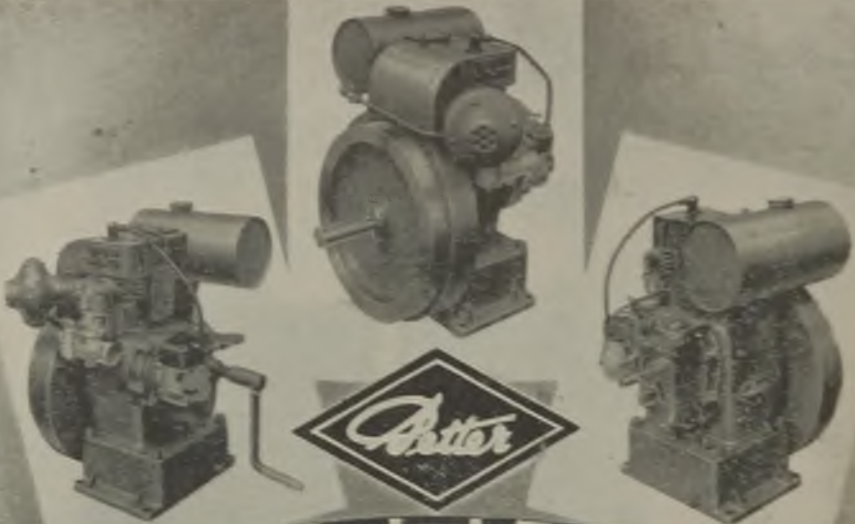
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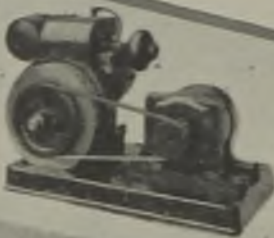
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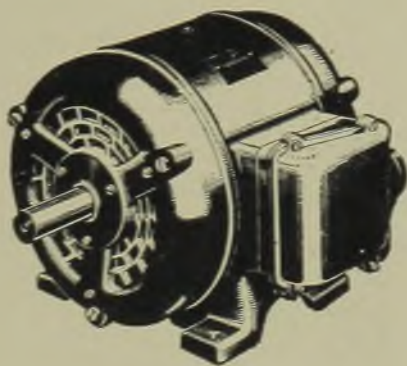


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abolishes trip-gears.

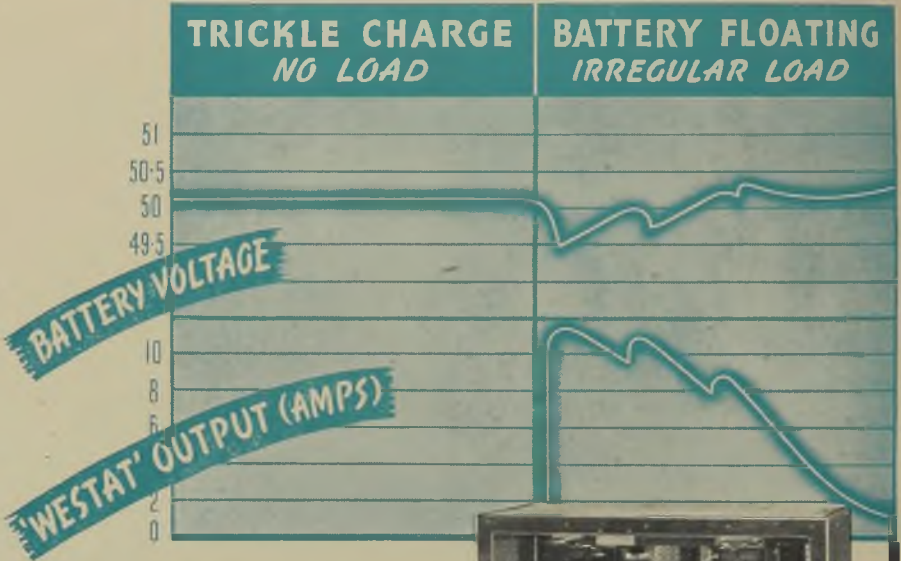
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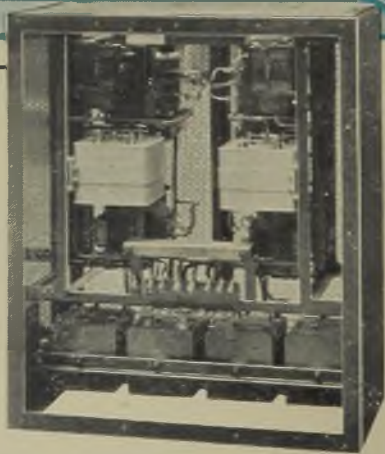
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Electrical Review, April 6, 1945

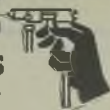


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Spiced Cake

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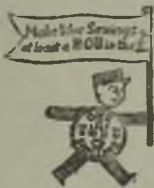
- 8 ozs. flour (self-raising).
 - 4 ozs. margarine.
 - 3 ozs. sugar.
 - 1 tablespoonful of treacle or golden syrup.
 - 2 reconstituted eggs.
 - $\frac{1}{2}$ teaspoonful of spice.
 - $\frac{1}{4}$ teaspoonful of ground cloves.
 - $\frac{1}{4}$ teaspoonful of ground ginger.
 - $\frac{1}{4}$ teaspoonful of ground cinnamon.
 - 6 ozs. dried fruit (or more).
 - $\frac{1}{4}$ teaspoonful of salt.
- Milk to mix stiffly.



Cat., No. 192J.

Method :

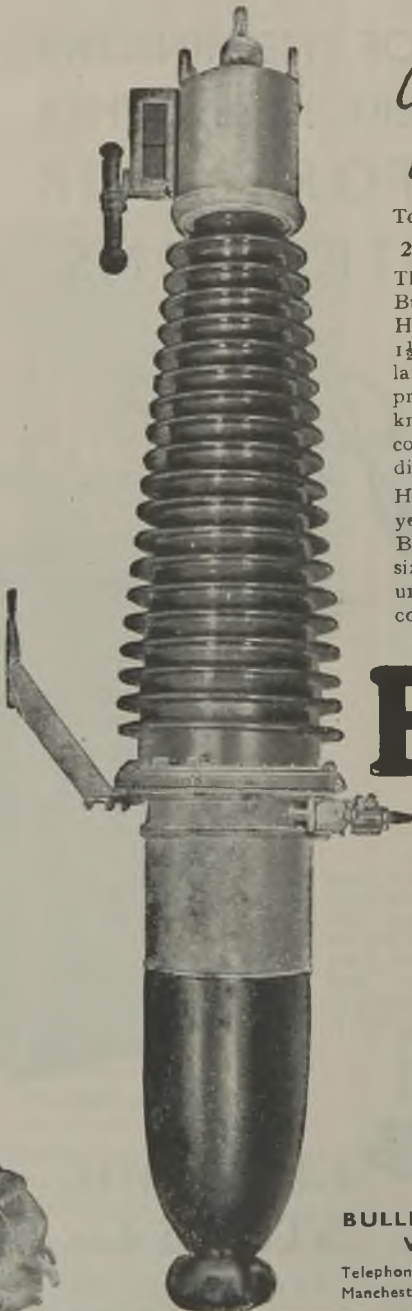
Cream the sugar and margarine. Beat in the syrup or treacle, add the eggs. Mix flour, spices and salt and rub through a sieve. Add to the margarine and sugar. Add the fruit and mix with milk or water. Bake at 425° F.



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9

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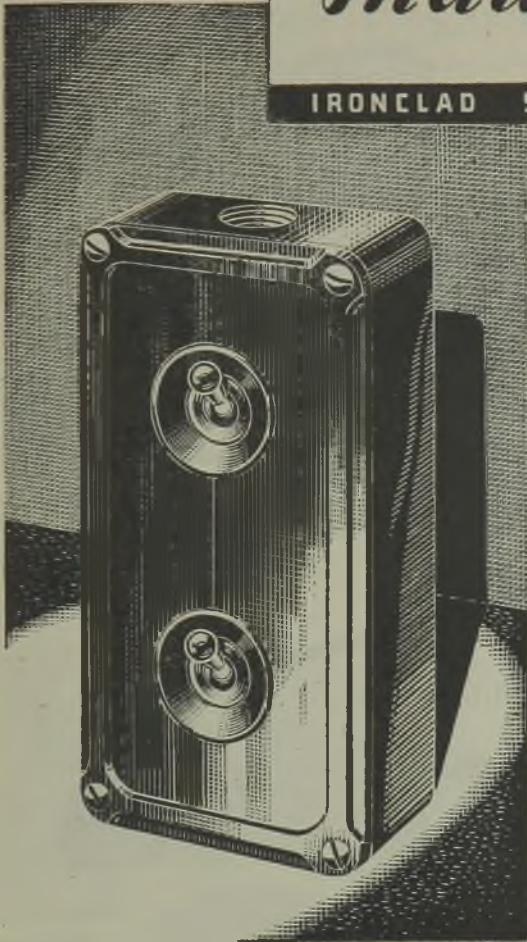
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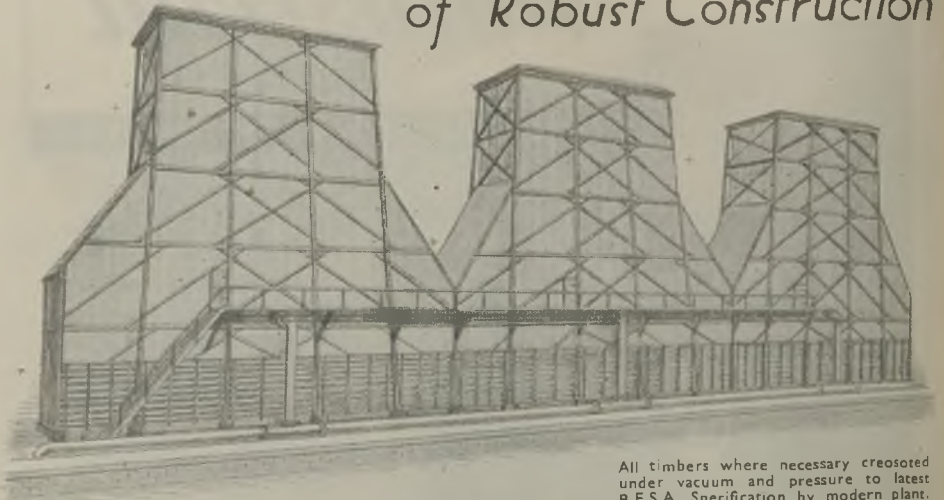
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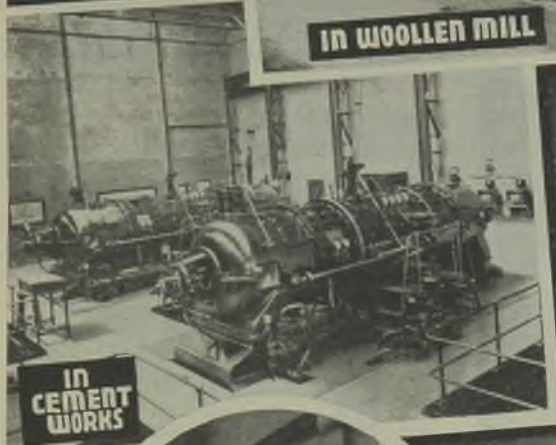
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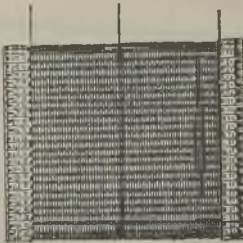


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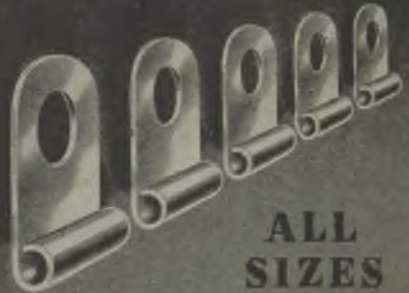
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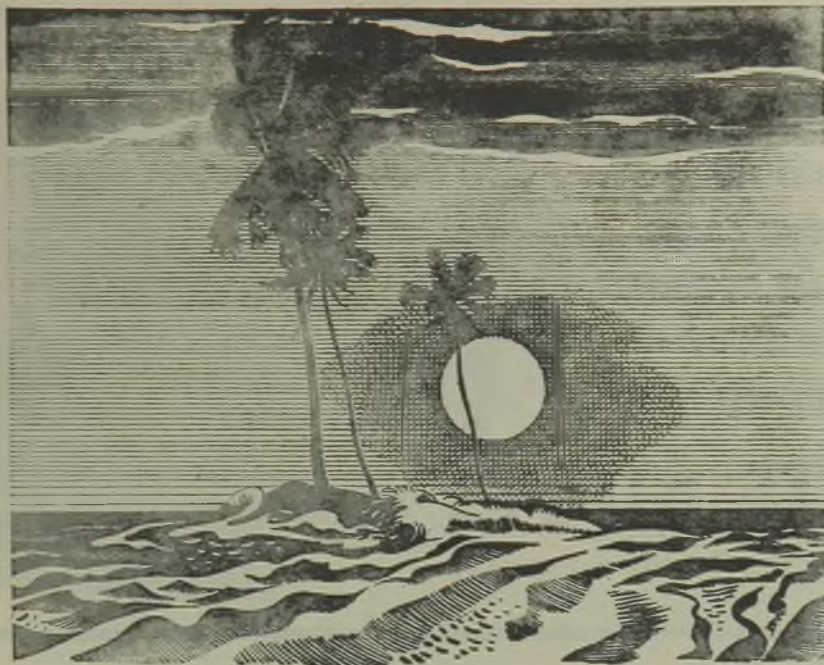


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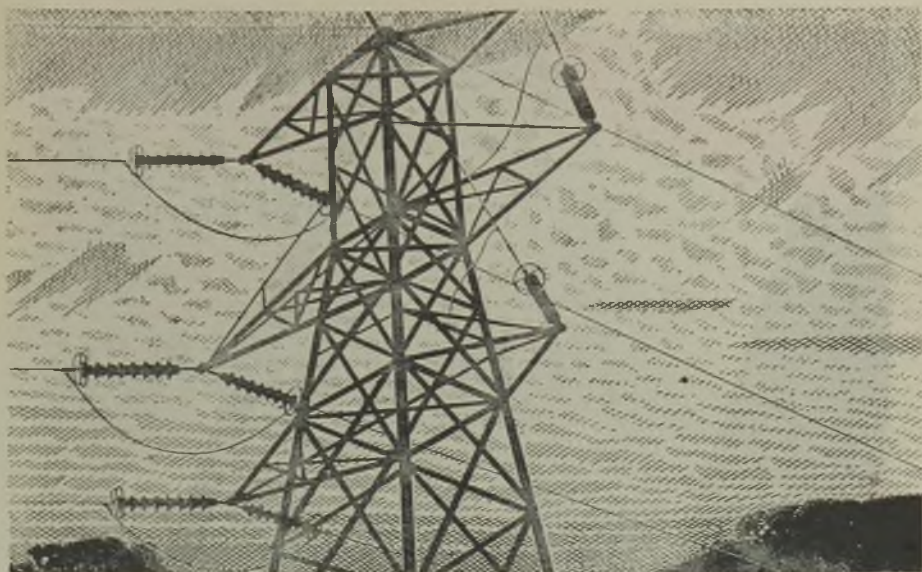
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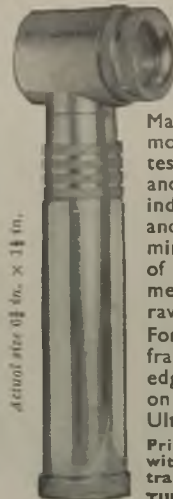
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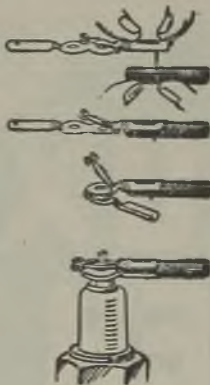
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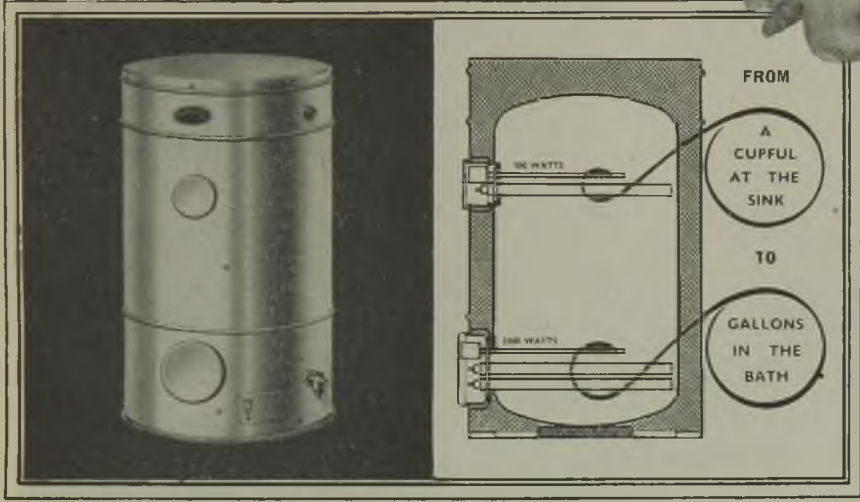
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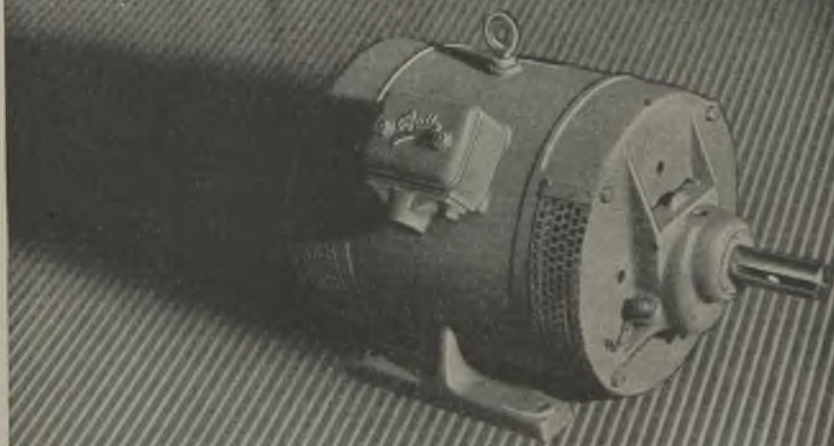
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ELECTRICAL REVIEW

April 6, 1945

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EDITORIAL, ADVERTISING & PUBLISHING OFFICES : Dorset House, Stamford St., London, S.E.1

Telegraphic Address : " Ageekay, Sedist, London." Code : ABC. Telephone No. : Waterloo 3333 (35 lines).

Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.

Annual Subscription, Post free : British Isles, £2 7s. 8d. ; Canada, £2 3s. 4d. ; Elsewhere, £2 5s. 6d.

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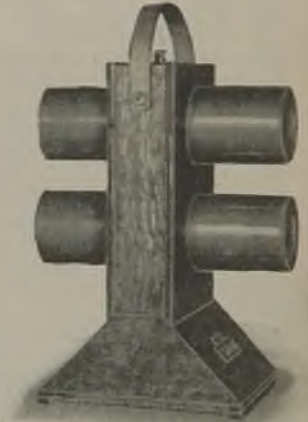
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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872



Vol. CXXXVI. No. 3515.

APRIL 6, 1945

9d. WEEKLY

Oil-Engine Stations

Limited Scope for General Service

REPLYING to a question in the House recently as to whether oil-engined generating plants kept for emergency service were employed to assist the main power stations during the past winter's cold spell, the Minister of Fuel and Power said that such plants would only partly meet requirements and that there would be serious technical difficulties in running them in conjunction with the public supply system.

The Minister was, in our view, correctly advised. The kW of oil-engine plant installed (a large part of it DC) in about a hundred stations of authorised undertakings formed rather less than one per cent. of the generating capacity of the whole country in 1938 and produced less than 0.3 per cent. of the total output. Even if it could now be utilised to the full, the proportion borne either to the present output or kW installed would still be insignificant.

Paralleling Complications

These small stations are not usually situated where peaks are most baneful. To parallel them with the grid or to use any surplus AC plant they may have to feed back into the grid would involve the provision of machine switchgear of high rupturing capacity and synchronising gear, as well as elaborate means for protection, such as that required for small alternators having low inherent reactance on picking up load or coping with short-circuits when running in parallel with high-reactance alternators of perhaps a hundred times their rating, to name only a few of the

factors that have to be taken into account. Such operating problems are apart from those involved in staffing and maintenance and in building up stocks of oil fuel.

Particulars of private plants are less readily available, but here again the margin of reserve is unlikely to be material. These are, of course, in the areas of distributing undertakings, and it is reasonable to assume that any help they could give to the latter under agreements for reciprocal supplies would be afforded.

Stand-by Arrangements

Another arrangement is for the local plant to be retained—sometimes in order to avoid expenditure on duplicating service apparatus—for running up only in such an emergency as an interruption in supply from the public mains, such breakdowns being too rare and too brief to call for constant skilled attendance or maintenance. To operate this plant in conjunction with the undertaking's system would be open to the objections that apply in the case of public Diesel stations and the grid, in addition to causing possibly serious disturbances of voltage on the local network.

Major Lloyd George in the course of his reply promised an investigation into the possibility of using oil-engine plant on future occasions when it might become necessary to shed load. Shortcomings evident at the opening of this year are now known to have been due mainly to the use of unsuitable coal and to the lack of labour for adequate maintenance of plant in the main power stations and no doubt steps will be taken before the autumn to improve

matters in these respects. For the reasons stated above, and others beside, it may be surmised that these investigations will not have to be pursued very far before it becomes quite clear that much less of the restricted national resources of labour and material would be occupied by the construction of large generating sets for permanent use in major power stations than in refurbishing and operating a multiplicity of small local units to cope with situations usually beyond their capabilities.

Export Market Research EVERYBODY will applaud the objects which the new British Export Trade Research Organisation has set out to achieve: all that can be done to improve our knowledge of overseas customers' requirements should be done. Until the new body commences operations it will not be easy to judge how far it meets the needs of particular industries. There are of course factors common to all, but specialist reports will be required. There is a strong electrical representation among the founder members which should be reflected to some extent in the investigating personnel. It is not quite clear how "B.E.T.R.O." stands in relation to the Department of Overseas Trade whose representatives include market study among their duties but no doubt satisfactory liaison will be arranged.

Purchase Rights THE case against the breaking-up of well organised, large and varied electricity supply undertakings was cogently put by Sir Robert Renwick at the Bournemouth & Poole Company's meeting last week. Apart from the greatly enhanced market price which the acquiring local authorities would have to pay, there is the question of the adjacent rural areas which the company serves but would not be taken over by the local authorities unless this was definitely made a condition of purchase by the Government. But, above all, the experienced organisation behind the company, that is the County of London Co. group, would be lost to the municipalities and their consumers. Sir Robert maintained that in all the circumstances the people in the area could hardly hope for cheaper electricity, which is the only valid reason for a change of ownership.

Demand-Related Cost

WHILE running and consumer costs of electricity supply can be readily measured, the large proportion of the total amount that is directly related to maximum demand presents some difficulty in this respect. The exact contribution to the system maximum demand and hence to the associated standing costs made by any consumer or class of consumer is usually obscure in view of the characteristics of modern load curves. The method proposed by the E.R.A. of allocating costs (it is not concerned with tariffs) which is described in this issue has the merit of combining as much simplicity as the subject allows with a close adherence to basic cost of giving a supply.

Industrial Heating

MORE rapid progress would no doubt have been made in the adoption of electrical heating in industry if the method employed were always the most suitable in each instance. An insight into the variety of methods available and the large number of applications awaiting full exploitation and the relationship between the two aspects was given in the I.E.E. Installations Section paper presented yesterday by Messrs. L. J. C. Connell, O. W. Humphreys and J. L. Rycroft. Electric heating has undoubtedly proved its merits during the war. The extent to which, with possible modifications in view of changed circumstances, its extended use in similar ways will be commercially justifiable offers a hopeful prospect.

Television Studios

ORDINARY illuminating problems appear simple in comparison with those encountered in the lighting of studios designed for high-definition television. In addition to such utilitarian needs as an adequacy of lumens on the working plane and an absence of glare there are such other considerations (mainly æsthetic in intent) as the use of contrasts and shadows. The question is not merely one of getting better results but of the difference between success and failure in production. Experience of the kind covered in the I.E.E. Radio Section paper of Messrs D. C. Birkinshaw and D. R. Campbell should materially influence the development of illumination in its decorative aspects generally.

Metal Recovery

Swarf Handling at a Large Works

THIS article relates to a modern system of swarf handling, designed for the recovery of large quantities of metals and oil, installed at a large Rolls Royce factory. The installation may be regarded as a continuous con-

veyor system interspersed with various process equipments at appropriate points. All the power-driven sections travel at 30 ft. per minute. The swarf is collected throughout the factory in bins specially designed to fit the conveyors, and the full bins from the various buildings are brought to a loading point outside the swarf house. The bins are colour coded, according to the classes of material for which they are used. The loading point is a short length of roller at the foot of the first section of the system consisting of an inclined power conveyor which raises the bins to a point above the receiving level. This conveyor is driven by a 5-HP 1,000-RPM squirrel-cage motor located just under the top end of the conveyor. Transmission is by V-belt and spur gearing, the latter driving two large sprocket wheels engaging links in the conveyor proper. En route to this conveyor the bins pass a photo-electric cell relay equipment which records on a solenoid-operated counting mechanism in the checkers' office the number of bins "breaking" the lamp rays at this point.



The installation may be regarded as a continuous conveyor system with the loading and unloading ends near one another outside the factory

veyor system interspersed with various process equipments at appropriate points. All the power-driven sections travel at 30 ft. per minute.

The swarf is collected throughout the factory in bins specially designed to fit the conveyors, and the full bins from the various buildings are brought to a loading point outside the swarf house. The bins are colour coded, according to

switches which are operated by the bins so as to shut down the first conveyor motor when the gravity conveyor is fully loaded with bins.

The six hydro-extractors are on an elevated



Above: Oil carried on the swarf is thrown off while in the "whizzing" baskets of the centrifugal machines

Left: In the case of steel swarf the baskets are emptied by the crane into special pens from which the swarf crushing machines are fed



floor and the swarf is fed into the "whizzing" baskets of these

machines by suitable tipping gear. The empty bins are passed along level and rising continuation sections of the conveyor system, and on to a gravity conveyor which serves a power conveyor leading to the unloading point at ground level near the loading point outside the swarf house. This unloading conveyor restricts the lowering rate of the empty bins to 30 ft. per min. and is driven by a 2-HP 1,000-RPM s.c. motor with power trans-

housing as an integral part of the machine, with direct coupling to the basket. Oil carried by the swarf is thrown outwards by the centri-



Above: On the first conveyor section the bins pass photo-electric cell equipment (indicated by arrows); guard removed for photograph
Left: From the bins the non-ferrous metals are bagged and put on to a slat conveyor



fugal force through perforations in the walls of the basket to be collected in an outer container from which it flows by gravity into settling

tanks through a pipe line. In each of these tanks is a magnetic separator over which the oil flows and which arrests any particles of iron which may have found their way so far into the oil. The separators are permanent-magnet equipments and were supplied by Philips Industrial.

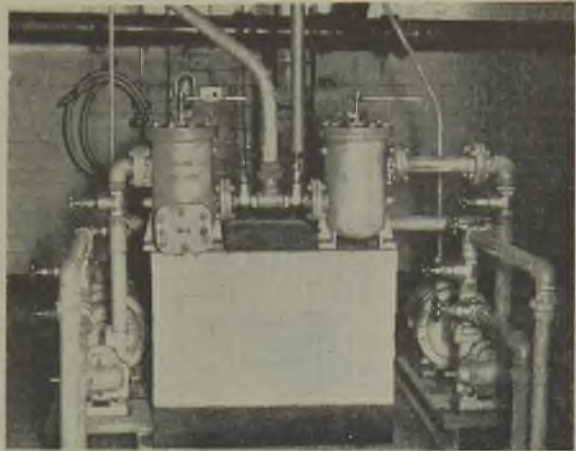
mission similar to that for the first section after the loading conveyor. The bins are then sent back to the factory buildings for refilling.
Each of the hydro-extractors is driven by a 15-HP 720-RPM slip-ring motor which is mounted under and within the centrifuge

A conveyor and a chute deliver the filled bags to a straight run from which they are elevated to an unloading platform. Note conveyor drive at conveyor top on right; guard removed for photograph



A conveyor and a chute deliver the filled bags to a straight run from which they are elevated to an unloading platform. Note conveyor drive at conveyor top on right; guard removed for photograph

From the settling tanks partly cleaned oil is pumped to "cookers," i.e., tanks in which the oil is thinned and prepared for further cleaning treatment by being heated by hot-water coils within the tanks. This pumping is effected by a Wayne pump which has a capacity of 35 gal. per min. and is directly driven by a 2-HP 950-RPM s.c. motor. From the "cookers" the oil is gravity fed directly to De Laval centrifugal machines in which oil, water and solid impurities are separated on the centrifuge principle. Incorporated in each of these centrifugal machines is a pump which conveys the oil to tank reservoirs.



One motor-driven pump delivers partly cleaned oil from the settling tanks to the "cookers," and the other pump removes oil from the reservoirs to clean-oil storage



Incorporated in each of the centrifugal machines is a pump which conveys the oil to tank reservoirs; pump and centrifuge drive by the same motor

Both this pump and the centrifuge proper are driven by a 2-HP 1,455-RPM motor, transmission to centrifuge being through a slipping clutch to gear which gives the machine a high speed.

In the pipe line between the centrifugal machines and the reservoirs is another magnetic separator similar to those in the settling tanks. Another and similar Wayne pump removes the oil from the reservoir to the main clean-oil storage tanks ready for re-use throughout the factory. After the operation the baskets are lifted from the extractors by means of a one-ton overhead travelling crane which serves the elevated floor accommodating the hydro-extractors, crushing machines and non-ferrous metal bins. This Paterson Hughes crane has travel,

traverse, and hoist motions which are driven by 4-HP, 935-RPM; 1-HP, 690-RPM; and 5-HP, 935-RPM slip-ring motors respectively.

All the crane motors are controlled from a suspended driving cabin by means of drum-type controllers. The crane motors are all slip-



Gauges on the central control board have contacts which operate relays and, in turn, pilot lights and audible alarms

ring machines and are supplied by trolley wires running along one of the crane travel girders, with special protection on account of the low headroom. On one of the traverse girders is a limit switch which prevents long travel except when the crane carriage is over a slat conveyor running along the front of the bins. This also is necessary on account of the low ceiling of the bay. From the bins the non-ferrous metals are bagged and put on to the slat conveyor which is driven by a 3-HP 1,000-RPM motor with transmission arrangements similar to those of the other conveyor motors. A $1\frac{1}{2}$ -HP motor-driven conveyor and an associated chute deliver the filled bags to another conveyor which at first carries them along a straight run at near ground level and then elevates them to an unloading platform from which the bags are lowered into lorries or railway wagons for transport to the remelting works. This last conveyor is driven by a 4-HP 1,000-RPM motor, and again transmission arrangements are similar to the others described.

In the case of steel swarf the extractor baskets are handled by the crane so as to deliver the swarf to special pens from which it is fed by hand to the crushing machines, thus giving the operator an opportunity to examine the turnings for tramp metal. One crushing machine is driven by a 50-HP 950-RPM slipping motor with V-belt transmission to the crushing-machine rotor. On the periphery of this rotor are many hammers which crush the swarf as they revolve. The other crusher, which has similar transmission arrangements, is a smaller equipment and is served by a 30-HP motor. From the crushers the steel swarf is delivered directly to railway wagons below. The railway wagons are marshalled by an electrically driven capstan operated by a 15-HP motor which is situated in a pit below the floor level. The motor is foot-pedal operated.

The settling and reservoir tanks are all fitted with ball floats which operate contents gauges on the hydraulic principle *via* small-bore tubing. The gauges, which are mounted on a central control board, make and break relay circuits at the high and low levels and thereby operate corresponding pilot lights and audible alarms. All the motors through-

out the installation are locally controlled by push buttons which remotely operate Igranic contactor starting equipments in a central control and distribution room where the contactor cabinets are neatly arranged along one side and the back of the room, and an English Electric switch-fuse distribution board has been erected along the other side.

The distribution board carries two tiers of 60-A ironclad switch fuses which are fed from a bus-bar chamber below and serve the various motors through a wiring cabinet at the top. Below the bus-bar chamber is a 300-A main incoming switch-fuse and a 150-A



All the motors are controlled by push-buttons which operate contactor equipment in a central control distribution room; distribution equipment on right

switch-fuse for the larger crusher motor. The motors are all totally enclosed on account of prevalent loose material and oil, and the majority are Brook machines.

Damages for Jointer

AT the Sussex Assizes recently Mr. Justice Charles awarded Mr. J. Yeomans, cable jointer, £500 damages, with costs, against Horsham Urban District Council. The plaintiff's case was that while he was jointing a cable in October, 1943, he received severe facial injuries. He said that he had replaced the lid of the cable box and was pouring in liquid bitumen when an explosion occurred. The cable was in a bad condition; the jute had rotted away, the lead was pitted and the insulating paper damp. A witness said that the armouring of the cable from 15 to 20 ft. away from the box had broken off in his hand. Another witness said that the plaintiff had reported the matter to the mains superintendent. In evidence, the latter said that he had examined the cable by the box and it was satisfactory although after the accident when a further stretch was opened up the cable was found to be in an unsatisfactory condition.

Television Requirements

Use of Colour. Cameras and Lighting.

AT a meeting of the I.E.E. Radio Section on March 13th a discussion on "Colour Television" was opened by Mr. L. C. JESTY, B.Sc., who considered it inevitable that a colour television service would ultimately be established. Therefore influence should be directed towards agreement on the technical methods to be employed, particularly with regard to the colour analysis and synthesis of the picture, and the standard of definition to be achieved before colour was introduced.

Television being electronic and therefore practically inertialess and instantaneous, enabled the older "additive" colour principles to be used more advantageously than in cinematography. All demonstrations so far given, by Baird in this country, and in America, had employed scanning processes embodying various colour sequences for analysis and synthesis. It was now taken for granted that at least three primary colours were necessary for acceptable reproduction.

Scanning Methods

Mr. Jesty reviewed three types of scanning sequences and mentioned methods of producing the necessary primary colours. All additive colour systems resulted in a loss of sensitivity in the transmitter camera, and loss of brightness in the received picture. These must be restored by improvements in cameras and cathode-ray tubes. Additive systems fell into two main classes: those employing optical or electron-optical superposition of the colour images, and those employing sequential projection or scanning of the colours. Both had disadvantages but in the latter time lags could be made imperceptible provided the colour sequence was fast enough.

It would appear that the only immediately practicable system was the "sequential-colour frame-scanning" system, unless some unpublished device had been perfected, such as a method of altering the colour of a fluorescent screen at will, or receiver picture storage, or the simultaneous transmission of all picture points instead of scanning.

With regard to the standard of definition Mr. Jesty said that a 405-line colour picture would require about three times the video band-width, and with vestigial sideband transmission about twice the ether space of the pre-war 405-line transmission. On this basis, a 500-600-line colour picture was not inconceivable as a long-term development. Should it be demonstrated, however, that higher definition—say, 800-1,000 lines—was necessary on purely visual grounds, then it would seem that colour television was only a remote possibility, until much greater experience of

the higher transmission-frequency bands had been obtained. During the course of his remarks, Mr. Jesty gave demonstrations of the synthesis of white light from three primary colours.

Comparison with Black-and-White System

In the discussion which followed, several speakers commented on the apparent improvement in contrast in the colour pictures and it was agreed that less range of tone was required in colour than in a black-and-white system. On the other hand the brightness level of an additive colour television picture would be less than that of monochrome, and there was need for further development in projection type tubes by an increase in the efficiency of screen fluorescence. One speaker thought that a mechanical system of scanning might provide a solution; small high-speed motors were now available with a useful life of the order of 4,000 hours. Point-by-point scanning was held to be the ultimate goal.

In a written communication, Mr. J. L. BAIRD, who was unable to be present through indisposition, expressed the opinion that point-by-point scanning did not offer sufficient advantages over line-by-line scanning to counterbalance the increased difficulties involved.

Other speakers held that colour reproduction should not be attempted until adequate definition was assured, and that the problem of colour should be set as a separate objective. In his concluding remarks the chairman (Mr. H. L. KIRKE) said that colour television was not likely to become an established service for some years, but when it did it would be of great value as there were many subjects which could not be adequately portrayed in monochrome.

Studio Technique

TELEVISION studio technique is described in a general way in a paper prepared by Messrs. D. C. BIRKINSHAW and D. R. CAMPBELL (B.B.C.) for submission to the I.E.E. Radio Section this week.

The authors have restricted themselves largely to principles. They discuss the operation of television cameras and lighting apparatus, outlining the principles on which the work of the production engineer is based. A detailed description of the method of applying the technique to a particular play is included by way of illustration. The paper concludes with an account of tests and adjustments that are made before transmission commences and after the studio scene

has been set up, and with the actual handling of the transmission.

There are three main studio requirements. First, the light pattern and, secondly, the sounds emanating from the scene must be picked up and translated into electrical signals, which mean that equivalents of the human eye and ear must be provided, bearing in mind that light travels in straight lines, whereas sounds do not. In consequence the cameras and lamps must be given priority of position with the microphones taking second place.

The third studio requirement is that the scene must be suitably illuminated by artificial means. Whereas sounds are generated within the scene (speech of performers taking part) the associated visual aspect is not intrinsic. Consequently before light can be picked up from the scene, it must be projected on to the scene. Not only must the amount of light received by the camera be technically sufficient, but it must also be so arranged as to create so far as may be possible the illusion of a third dimension (depth of picture) in order partially to compensate for the monocular character of television. Thus the success of the picture conveyed and viewer's satisfaction will

greatly depend on the skill of the lighting engineer, who has to maintain a careful balance between technical and artistic aspirations.

A rectangular object of an area equal to 25 scanning spots is about the smallest detail that can be reproduced with retention of shape. The authors examine the effects of hard and soft lights which play such important parts in the illumination of studio scenes. Unfortunately the generation of soft light of high intensity involves the consumption of 100 times more power than that required to produce hard light of equivalent intensity and area. Although not of primary need when a scene is viewed directly by the eye, "back lighting" is an important feature of monocular monochrome reproduction and so is used in nearly all televised scenes.

Illuminators are not described, as standard film-studio lamp housings, projectors and reflectors are employed. Metal-filament lamps operated at 105/115 V alone satisfy the requirements specified by the authors. Bulbs of six sizes ranging from 100 to 5,000 W are the only sources of light normally employed at the B.B.C. Alexandra Palace studios.

Control of German Power Plant A Franco-American Proposal

ONE of the most controversial topics of the day is what to do with Germany after the war, and how to prevent her from ever again becoming a powerful aggressor nation. Among the mass of literature on this subject, a book, published in America recently, entitled "The Control of Germany and Japan," makes some interesting proposals.

By H. J. Booth,
Graduate I.E.E.

international company which would purchase power in France, Belgium, Italy, and the rest of the countries surrounding Germany, and sell it to the German distributing corporations.

Such a scheme, they say, should enable us to prevent Germany from breaking any terms forbidding the manufacture of certain materials such as synthetic oil and aluminium, and control the peacetime production of those goods which are essential to war, e.g., hydrogen and nitrogen. It would also be necessary for the international company to know the situation of all large plants in Germany so that no new ones could be operated without its knowledge.

Disadvantages of Economic Control

The co-authors of the book are Dr. Moulton, an American political economist, and Mr. Marlio, a French engineer and industrialist. The authors set out to show that economic control of Germany would lead to chaos in international trade relations, and would be dangerous to the self-interest of the controlling nations and the world's economic security. They arrive at the conclusion that the only means to prevent future German aggression is by the use, or threat, of force when it first becomes imminent. But they advocate the suppression of both the commercial and manufacturing sides of the aircraft industry and the control of Germany's power plant.

They propose to institute this control by eliminating a large part of Germany's electric power industry, by not allowing her to repair war-damaged power stations or to construct new ones. They then suggest organising an

Paralysing War Production

This type of control of power resources would have the virtue of being invisible to the German people and therefore would not cause resentment, and, moreover—and this is the *pièce de résistance* of the whole scheme—if Germany threatened aggression, the power supply could be shut off and thus the war production would be paralysed.

The idea is very attractive but seems to be highly impracticable. It will be some years after the war before the European countries have anything like a surplus of power to export, if ever, and what is Germany going to do during this period?

Views on the News

Reflections on Current Topics

INDICATIONS are that after the war there will be a shortage of staff in the electricity supply industry. This, from the employment point of view, may not be considered a bad thing but it is likely to throw increased strain upon the present staffs and may be a brake upon development. The subject has been considered by the Electrical Power Engineers' Association, which makes proposals for meeting the situation. One is the "upgrading" of engineers by transferring them from small to large stations into positions of greater responsibility. This seems to be something like a speeding up of the present system. It is also suggested that men who have gained mechanical and electrical experience in the Services should be given an intensive course of training for some positions in the industry.

* * *

The foregoing are emergency measures to produce more or less immediate results. But it is necessary to plan for the future staffing of undertakings. Most of the larger and more-enlightened industrial undertakings are giving attention to the education and training of young men as engineers for various branches of industry and there is every reason for electricity supply undertakings to follow a similar course. At present there are very few indeed who have gone beyond allowing the chief engineer to take a pupil or two, notably Bradford, whose scheme was mentioned in the *Electrical Review* of September 10th, 1943. There seems to be a need for a wider, properly-organised scheme and in the view of the E.P.E.A. this can properly be tackled by the N.J.B. and N.J.I.C. of the industry. I am sure that the matter would have the sympathy of Sir William Walker who wrote on the training of engineers for higher positions in the *Electrical Review* of August 20th, 1943.

* * *

I am glad to see that the London J.E.A. is taking up with the Surbiton Borough Council the question of the equipment of the eighty-eight temporary houses which are being erected in the borough. The Council decided in January that these houses should have gas cookers, refrigerators and wash-boilers, and having made this decision suggested to the J.E.A. that together they should discuss the provision of electricity services—apparently for lighting and other small uses only. It was obvious to the J.E.A. that this would involve the responsible employer in comparatively heavy capital cost and the tenants in comparatively high charges

on an unremunerative basis. Accordingly it has asked the Council to widen the scope of the discussions, and I hope that the result will be a better show for electricity.

* * *

The Advisory Committees in three of the London J.E.A.'s areas have drawn attention to the fact that some local authorities are not consulting the electricity and gas suppliers in their districts before deciding upon the nature of the services to be provided in temporary houses. This goes against the "guidance" given by the Minister of Health and is obviously not satisfactory. I note that the Area Committees have all passed resolutions, to be transmitted to the local authorities concerned, expressing the opinion that in future there should be consultation with the J.E.A. or other supply authority before decisions on the equipment of temporary houses are made.

* * *

Among the latest decisions which I have noted in the matter of gas or electricity for temporary houses are those at Colchester, where a half-and-half arrangement is being adopted. At Grimsby a decision of the Housing Committee in favour of electricity was confirmed although it was stated that the Ministry of Health had sanctioned a separation of the houses into two blocks—one gas and one electric. The necessity of avoiding further delay was given as the reason for the decision.

* * *

Referring to my recent comments on the respective prices of gas and electricity, a Scottish correspondent suggests that conditions in regard to gas have been different in London from those in other centres, and that "over the whole country there is very little doubt that gas consumers have fared better than electricity consumers as regards price advances since 1939." It is probably true that there are gas undertakings that have not increased their prices since the beginning of the war but I have yet to be convinced that generally the increases in gas charges have been less than those for electricity; it is one of those things that cannot be easily ascertained. I am, however, prepared to accept my correspondent's explanation that gas charges would have been higher but for the fact that some of the extra price of coal is recovered in the selling price of coke. Which is another way of saying that coke consumers, who are not necessarily gas consumers, are paying more than they should to keep down gas bills.—REFLECTOR.

CORRESPONDENCE

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

The Grouping of Cells

IN Volume 1 of Monk's "Classified Examples in Electrical Engineering" (6th ed.) one question asks for an arrangement of cells and resistances to give maximum current output and also for the maximum current and power output obtained. My answer to the latter was 0.693 A and 0.649 W at this current, whereas the book gave 0.667 A

with $n = 6$, $e = 1.3$, $r = 3.6$ and $R = 1.35$. The numbers underlined show the minimum value of $pR + sr$, the maximum value of I , and the best grouping according to the three rules.

The table shows that only my rule A, gives the correct answer; rule B states that all cells must be connected in parallel (Monk), while Rule C incorrectly implies that both of the arrangements given by the

s	p	sr	pR	pR + sr	I	Rule A			Rule B		Rule C	
						$pR \sim sr$	$\frac{R}{p}$	$s \sim \frac{pR}{r}$	$\frac{rs}{p}$	$R \sim \frac{rs}{p}$	$\sqrt{\frac{nr}{r}}$	$s \sim \sqrt{\frac{nr}{r}}$
1	6	3.6	8.1	11.7	0.667	4.5	2.25	1.25	0.6	0.75	1.5	0.5
2	3	7.2	4.05	<u>11.25</u>	<u>0.693</u>	<u>3.15</u>	1.125	<u>0.875</u>	2.4	1.05	1.5	<u>0.5</u>
3	2	10.8	2.7	13.5	0.578	8.1	0.75	2.25	5.4	4.05	1.5	1.5
6	1	21.6	1.35	22.95	0.34	20.25	0.375	5.625	21.6	20.25	1.5	4.5

and 0.6 W, in accordance with the commonly accepted belief that the internal resistance of the battery must be as nearly as possible equal to the external resistance in order to get maximum current output.

My answers were worked out on the theory that the difference between sr and pR should be as small as possible, where $r =$ internal resistance of a cell, $R =$ external resistance, $s =$ number of cells in series and $p =$ number of groups of cells in parallel. For, if $I =$ current output in amperes, $n =$ number of cells ($= ps$) and $e =$ e.m.f. of a cell we have

$$I = \frac{se}{R + \frac{rs}{p}} = \frac{ne}{pR + sr}$$

The numerator is constant, whatever the arrangement of the cells, and the current will therefore be a maximum when the denominator $pR + sr$ is a minimum. This will be when the difference between pR and sr is a minimum, because the squares of these two expressions differ by the constant quantity $4psRr$ or $4nRr$. The maximum current from a group of cells is therefore obtained when, as nearly as possible, $sr = pR$ or $s = \frac{pR}{r}$. Calling this rule (A), the usual rules are (B) that R should equal $\frac{rs}{p}$ as nearly as possible and (C) that s should equal $\sqrt{\frac{nR}{r}}$ as nearly as possible (see pp. 11 and 12 of Perren Maycock's "Electric Circuit Theory and Calculations," 1944). The table above gives all possible groupings required by the question

other two rules will give a maximum current and therefore an equal current. Rule C is, I believe, regarded as equivalent to Rule B but it is evidently not.

In any problem, if the internal resistance can be made exactly equal to the external resistance, maximum current output will be obtained, but Rule A gives the correct grouping in this case also.

Bradford.

C. HARGREAVES.

Meter Readers' Qualifications

WHETHER or not a meter reader should report the defects of a service or installation has recently come to the fore in a case where several people lost their lives owing to a leakage of gas. Recent correspondence on the subject indicates that a review of the responsibilities and duties of a meter reader is timely.

It goes without saying that the meter reader must be able consistently to read all types of meters with accuracy. The emphasis is to be laid on his ability to become an accountant-cum-technician when, as the representative of his large undertaking, he comes into contact with a great many consumers in their own homes.

His personality, efficiency and general bearing will be taken, in general, to be a measure of the organisation he represents, and, rightly or wrongly, the majority of consumers will expect him to advise them on everything connected with electricity supply. In this capacity, the trouble taken in his training will pay handsome dividends to his employers, especially if diplomacy and dis-

cretion have been developed. He must realise that while his primary duty is to read a specific quantity of meters per day, he must be ready to answer innumerable questions in a concise and confident manner.

Untrained, he can, to save his face, give incorrect answers to his questioners. This method has its repercussions upon the goodwill of the undertaking, for sooner or later a repetition of what he has said will be received at head office, only to be contradicted or amended by someone who must also offer an apology and an excuse. The meter reader cannot, of course, be expected to go deeply into technicalities, but he can show enough familiarity with each branch of the subject to inspire confidence, and when he sees his limit being reached he can point out that the authority's specialist on that subject would be pleased to advise further.

His primary interest and knowledge should be meters—to know what is inside them, how they work, how to test for no-load creep, to test for stopping and starting, to look for tampering, to know the proper sealing devices, and the connections necessary from service to meter to main switches. He should be able to give a balanced opinion as to what does or does not constitute a danger, that is regarding broken switches, lampholders, socket-outlets, or any exposed live conductors or terminals. Further, if the danger is acute, he should be competent to advise the consumer how best to avoid accidents until the faulty apparatus has been repaired, and in extreme cases, he should himself make it dead forthwith.

The loadings of all popular electrical apparatus should be known to him, or alternatively he should know where to find the information, so that the number of hours usage per unit can be readily given. Tariffs should be a strong point and he should be able to ascertain and explain possible variations in the current account as against the corresponding quarter of the previous year. In this, however, experience has dictated that, where possible, details of accounts should be avoided, as it is very easy to make errors on the spot. A better way is merely to compare the units quarter by quarter, avoiding delicately any reference to pounds, shillings and pence.

Unavoidably, the meter reader will at times be faced with queries that surpass his knowledge, and it is for this reason that he is issued daily with a "Meter Reader's Report Sheet" which exactly fits inside the cover of the reading book. Unanswered questions, or reports of defects, are entered by him on this sheet and the sheet is handed in each night to his foreman, who passes the complaint or inquiry to the department concerned. Automatically the organisation deals with the matter picked up by the meter reader, and once he has handed in his sheet, his responsibility is finished.

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It may truly be said that a really good meter reader earns goodwill for his undertaking and can be instrumental in expanding business to a considerable extent. This potentiality should be recognised and encouraged.

Bedford.

S. A. DAINES, A.M.I.E.E.

MR. BUTLER agrees with me that the meter reader is the link between the consumer and the supply authority, but wishes to know what proportion of meter readers possess any technical qualifications. The majority, of course, do not, but I would like to point out that the duties of meter readers vary in different undertakings. In industrial areas, where the power load is heavy, the readings are more complicated, and the business manager or engineer at a large works frequently expects the reader to be able to answer technical questions concerning the supply and efficiency of the meter. He tends to expect the meter reader on the spot to be in a position to advise him, and thus save time in getting into contact with the supply authority.

I agree with Mr. Butler that the majority of meter readers are unable to answer such questions, but some are both competent and able to do so. Hence it does seem to me that a grading of meter readers is desirable and would be the solution to this problem.

London, N.W.6.

A. E. IZANT.

Modern Lift Practice

UPON reading the report of the discussion on this subject appearing in your issue of March 16th, mentioning the number of reported accidents due to lifts, I wondered how many of these accidents were due to lift defects, as my experience teaches me that quite a lot of work goes on in lift shafts that has nothing to do with the lifts themselves. It is not uncommon to find water pipes, soil pipes, gas pipes, and refrigeration pipes in a lift shaft, to say nothing of electric wiring of every description—lighting and power runs, telephone, bell wiring and P.A. systems; in fact anything that needs running to the floor above or below.

Some of these services cause grave defects to lifts (burst water pipes and stoppages, tubing not efficiently earthed), and what of the people that run and maintain these services? Some of these leave the dogs in and locks shorted out; limit switches out; tie back and tear off trailing cables; leave obstructions in the shaft; and finish up by breaking the glass in the top of the car.

The maintenance engineer when called to a breakdown usually commences his diagnosis of the breakdown by asking if anyone has been in the shaft. I will not comment on the various replies given, or why there are not more accidents, but it's surprising what some of the stair users will tell you. Usually the lift is out of order, yet, most likely, the

engineer who maintains the lift knows nothing about these things. May I appeal to architects, post-war designers, and all others interested, to provide adequate space and means for the running of these services independently of lift shafts and keep these shafts for their proper purpose, so ensuring efficient service.

London, N.18.

GEORGE E. CHALK
(Maintenance Engineer).

Pressure upon Space

IN your leading article of last week you said your "feelings are not soothed" by my suggestion that the journal of the Electrical Power Engineers' Association should publish general electrical news because many members do not read any electrical paper. You are quite entitled, and have every right, to deprecate any encroachment upon your field (that of the technical and trade press); you are peculiarly fitted to a claim in that field, and whilst frankly admitting this I must also acknowledge twenty-five years of your hospitality and encouragement to myself as free-lance writer.

Actually, the "Electrical Power Engineer" (the E.P.E.A. journal in question) has been faced with just the same wartime publication difficulties as the *Electrical Review*, so that, though your weekly feat of squeezing a quartful of matter into a pint of space should be somewhat relieved by my proposal, the unfortunate Editor of the "Electrical Power Engineer" would find his own problem worsened! But in point of fact I agree with you that the organs of specialist organisations and the like should circumscribe their activities. All I had in mind was this—a column of news snips, or very brief press-cuttings, appearing each month. I am sorry your feelings have been exacerbated and hope my explanation duly soothes them.

Sunderland.

G. E. MOORE,
President, E.P.E.A.

Supply Authorities as Electrical Contractors

IN his letter appearing in your issue of March 9th, Mr. J. Mortimer Hawkins goes very much to the point when he says "the function of supply authorities is to supply electricity at the lowest economical rates." But does Mr. Hawkins go far enough? This should be their only function: they are operating in a highly protected trade where there is no fear of any electricity supply competition, but a lot of them are not satisfied with their strictly reserved market but must enter the fields of contracting and retail sales.

It is high time this lop-sided method of trading was stopped. Supply authorities, municipal and company, have plenty to do in their proper sphere if they will stick to it,

without poking their noses into the installation and retail sides of the electrical industry.

Some Corporation Committees will encourage, as far as they can, all sorts of activities to build up huge socialistic undertakings, whether they affect a body of hard-working ratepayers or not, but in such cases one would think that in these so-called enlightened days electrical engineers of the station engineer class, would be sufficiently educated to take a stand against such proposals, to concentrate on their job of generation, distribution and supply and leave the balance to the legitimate traders who do it to earn a living.

Bradford.

HARRY MOSS.

English Electric Dinner

THE annual dinner and dance of the Fusegear Section of the English Electric Co., Ltd., which had not been held since 1940, was revived recently at the Station Hotel, Stafford, when members of the sales, engineering, commercial and works staff, wives and visitors, also technical representatives from London and Manchester, attended one of the most successful departmental functions yet organised. Mr. H. Simmonds, who recently succeeded Mr. A. M. Pooley as manager of the Section, presided. The toast of the "Fusegear Section" was proposed by Mr. L. A. Fry. Mr. Simmonds, in his reply, referred to the Section's continued prosperity and paid tribute to his predecessor, Mr. Pooley, under whose leadership it had attained its present position.

The toast of "The English Electric Co., Ltd." was proposed by Mr. W. Coggings. Mr. J. W. C. Milligan (manager, Stafford Works), in responding, stressed the problems that lay ahead, and the necessity of keeping quality and service supreme. The health of "The Visitors" was given by Mr. L. R. J. Martinelli in rather amusing terms, and in his acknowledgment Mr. E. B. Banks (deputy commercial manager of the company) recounted some of his experiences during his recent flying visit to the East when he covered 17,000 miles in eight weeks. Bouquets were presented to Mrs. A. M. Pooley and Mrs. H. Simmonds by Miss G. M. Shopland and Miss D. Morris, respectively, on behalf of all members of the Section. A musical interlude was provided during the dinner by Mrs. L. R. J. Martinelli and during the dance which followed Mrs. H. Simmonds presented several "spot" prizes to the winners and gifts for the wives of the Section's technical representatives from London and Manchester who were unable to be present.

Electron Guns

A JOINT meeting of the North-West Branch of the Institution of Electronics and the Manchester and District Branch of the Institute of Physics will be held at 6.30 p.m. on Friday, June 1st, at the Reynolds Hall, College of Technology, Manchester, when Dr. H. Moss will give a lecture on "Design of Electron Guns of Radial Symmetry." Non-members can obtain tickets on application to L. F. Berry, 14, Heywood Avenue, Austerlands, Oldham, Lancs.

PERSONAL and SOCIAL

News of Men and Women of the Industry

WE have already reported the election of Mr. G. E. Moore as president of the Electrical Power Engineers' Association. At the recent annual meeting of the Association Mr. J. C. Welburn became president-elect and Messrs. G. O. James and F. Lumby were elected vice-presidents. It was stated at the meeting that the membership of the E.P.E.A. is now 7,125—an increase of 331 during the past year.

Lord Vansittart was the principal speaker at last week's meeting of the Radio Industries Club. Sir Noel Ashbridge, president, was in the chair and a vote of thanks to Lord Vansittart was moved by Mr. H. de A. Donisthorpe, chairman of the club.

Dr. Norman Feather, F.R.S., of the Cavendish Laboratory, Cambridge, has been appointed Professor of Natural Philosophy at Edinburgh, in succession to the late Professor C. G. Barkla.

Mr. A. A. Yardley, A.M.I.E.E., has been appointed London Area meter sales manager to Ferranti, Ltd. Mr. Yardley was with the Hove Electricity Department for three years where he gained experience in meter testing, house testing and connecting, etc. He joined Ferranti's in 1924 and since then has been engaged in meter testing, as supervising testing engineer and inspection engineer, and he has represented the Meter Sales Department in Scotland and Ireland and before the war covered the North-East England Area for some years. During the war he has been engaged upon liaison work with Government Departments.



Mr. A. A. Yardley

Mr. T. Thomson, late of the Sun Electrical Co., Ltd., Newcastle, has been appointed to the board of A. E. Dees, Ltd., Newcastle, as director and sales manager. Mr. Thomson has been associated with the electrical and radio industries in the Northern Counties for the past thirty-six years.

Mr. Alec M. Perry, of Birmingham, personal assistant to the chief engineer of the London and Home Counties Joint Electricity Authority, has been recommended by the Southwark Borough Council for the position of deputy electrical engineer at a salary of £732 per annum.

Dr. W. Wilson, manager of the development laboratory of the General Electric Co., Ltd., Witton, addressed members of the Nottingham Society of Engineers, at Nottingham, on March 19th, on electronics in the engineering industry.

Mr. C. H. Grindrod, chief electrical engineer of the Manchester Corporation Transport Department, has just retired after forty years' service. He commenced his career with the Corporation's Electricity Department in 1899. Five years

later he was appointed assistant electrical engineer to the Stalybridge, Hyde, Mossley and Dukinfield Board, but returned to Manchester in 1905, being appointed technical assistant in the Transport Department. He became electrical engineer to the undertaking in 1920 and chief electrical engineer in 1935. His anti-flash device for overhead trolley-wires was adopted by a number of other transport undertakings during the early days of the war.

Mr. G. E. Taylor has been appointed a managing director of the Electric Furnace Co., Ltd., jointly with the present managing directors, Mr. D. F. Campbell and Mr. W. S. Gifford. Mr. J. A. Monks and Mr. J. C. Howard have also joined the board. Mr. Monks is already a director of the subsidiary company, the Electric Resistance Furnace Co., Ltd., and Mr. Howard was the local director of the Electric Furnace Co.'s Sheffield office.

Mr. G. S. Samways has been released by the Minister of Supply from his appointment as Director of Electricity Supplies. Mr. Samways was responsible for the negotiations for electricity supplies to the many war factories under the control of the Ministry, and was concerned with the programmes for heavy electrical plant for Russia. He will continue to be available to the Ministry of Supply in an advisory capacity.

Mr. J. F. Gibbons, technical secretary of the Institution of Production Engineers, has been appointed general manager of the North-Eastern Engineering Bureau, Newcastle-on-Tyne, which was formed some time ago to help in the expansion and scientific development of the light engineering industry.

Mr. A. Kelso, borough electrical engineer of Harrogate, has been nominated for the chairmanship of the I.E.E. North Midland Centre for the 1945-46 session. The vice-chairmen nominated are Mr. A. G. Connell, electrical engineer and manager at Halifax, and Mr. R. H. Coates, deputy general manager and engineer at Sheffield.

After forty-one years' service with London's transport, Colonel E. T. Brook retired last week. On joining the Underground Railway in 1904 he was given charge of the linking up of substations, cable works, lighting and drainage pumps. In 1921 he took charge of lifts and escalators, and in the following year he was appointed superintendent of rolling stock. Colonel Brook helped in the construction of the Moscow Tube Railway when, in 1932, the Soviet Government invited London Transport to send representatives to Moscow. The Soviet Government signified its appreciation by conferring the Decoration of Merit on them. In 1940 Col. Brook formed, and was given the command of the Home Guard of London Transport comprising seven battalions, with a roll of 18,000.

A recent presentation by the Henley Dramatic Society of "The Housemaster," by Ian Hay, raised over £45 for the British Red Cross & St. John Fund. This is the third wartime production by this Society, the previous efforts

being Shaw's "Pygmalion" and Priestley's "Laburnum Grove." Production was in the hands of Mr. A. S. Brewer, of Henley's Advertising Department.

Mr. F. E. Stacey, district docks machinery engineer to the London & North Eastern Railway at Hull, has been appointed resident engineer for traction work, Chief Electrical Engineer's Department. His assistant, **Mr. R. B. Waddington**, succeeds him at Hull.

Mr. R. E. Fordham, O.B.E., M.I. Mech.E., has been elected a director of Lightalloys, Ltd.

Mr. J. W. Darling was presented with silver entrée dishes recently upon his retirement from the post of chief electrical engineer at John Baker & Bessemer's Kilnhurst Steelworks, which he had held for twenty-seven years.

Mr. A. C. Yeates has been appointed a director of Crossley-Premier Engines, Ltd.

Air Chief Marshal Sir Wilfrid Rhodes Freeman, G.C.B., D.S.O., M.C., has been appointed a director of Babcock & Wilcox, Ltd.

Mr. J. A. Foulds, assistant secretary, has been appointed secretary of Thomas Bolton & Sons, Ltd., in succession to **Mr. T. J. Tait** who has been elected to the board of the company.

Mr. S. B. Turner, who has been with BX Plastics, Ltd., since 1931, has joined its subsidiary, the Expanded Rubber Co., Ltd., Mitcham, as sales manager.

The Electrical Apparatus Co., Ltd., announces that in view of the expansion of its business, **Mr. J. R. Walton**, A.M.I.E.E., M.I.P.E., has been appointed managing director in order to relieve the chairman, **Mr. R. H. Barbour**, M.A., M.I.E.E., of some of his executive duties.

Mr. A. G. Cooper's services as electrical engineer to the Thornton-Cleveleys U.D.C. are to be extended until September 30th. **Mr. H. Carpenter**, his deputy, is now in the Forces.

Alderman Sir William Walker, M.I.E.E., M.I. Mech.E., has been nominated for the presidency of the Incorporated Municipal Electrical Association for 1945-46. **Mr. J. S. Pickles**, county electrical engineer, Dumfries, has been nominated as vice-president.

Councillor H. Berry (London County Council) has been elected chairman of the Conjoint Conference of Public Utility Associations for 1945-46.

The Electrical Power Engineers' Association is advertising for an assistant secretary.

The following awards have been made by the Faraday House Electrical Engineering College:—**Mr. R. A. A. Newman** (Raynes Park County School).—"Faraday" Scholarship of 80 guineas a year for two years; **Mr. D. J. Thorpe**.—"Maxwell" Scholarship of 60 guineas a year for two years; Exhibitions of the value of 20 guineas for two years have been awarded to:—**Messrs. A. F. Durham** (Kingston Grammar School); **D. J. Newnham** (Penzance County School); and **D. J. Norton** (Aldenharn).

Increases in the salaries of a number of the principal officials are recommended by the Bradford Estimates, etc., Sub-Committee. They include a rise of £250, to £2,000, for the city electrical engineer (**Mr. T. H. Carr**).

Mr. H. M. Pike, M.I.E.E., was recently appointed chief engineer of the New Zealand

Post and Telegraph Department. His position as deputy chief engineer is taken by **Mr. E. H. R. Green**, M.Sc. (Hons.), M.I.E.E. **Mr. Pike** is local hon. secretary of the Institution of Electrical Engineers.

Obituary

Lt.-Commander H. M. Ellis.—We very much regret to learn from **Mr. H. S. Ellis**, general manager of the West Gloucestershire Electric Power Co., that his eldest son, **Lt.-Commander (A.) Henry Mosely (Peter) Ellis** has been reported missing and is presumed killed on active service. **Lt.-Commander Ellis** was on the staff of a Gloucester engineering firm before he joined the Fleet Air Arm in 1938. He was awarded the D.S.C. for operations in the Mediterranean and a Bar for an attack off the Norwegian coast. For a daring attack on an enemy convoy trying to reach Tripoli he was awarded the D.F.C. and was mentioned in despatches for reconnaissance work before the battle of Matapan. **Lt.-Commander Ellis's** twin brother lost his life in the R.A.F. in 1939.

Mr. J. Robinson.—The death occurred on March 27th of **Mr. James Robinson**, a director of Mather & Platt, Ltd. **Mr. Robinson** joined the company over sixty years ago upon leaving the Manchester Grammar School and rose to the position of managing director of the department producing dyeing, bleaching and finishing machinery. In this sphere he became a leading expert and in the course of business travelled widely. **Mr. Robinson** was a foundation member of the Manchester Engineers' Club and for many years was chairman of the committee. He was in his seventy-seventh year.

Mr. H. W. E. Hall.—We regret to announce that **Mr. Henry William Edward Hall**, manager of the Sheffield office of the British Thomson-Houston Co., Ltd., died suddenly on March 23rd in Sheffield at the age of sixty-three. **Mr. Hall** was born in Sheffield and joined the B.T.H. Co. in 1899. For many years he occupied a responsible position at the Sheffield office, being chief assistant to both **Mr. A. Lucas** and **Mr. O. S. Nichols**. On the death of the latter, he himself was appointed manager. In earlier days he was a keen cricketer,



The late
Mr. H. W. E. Hall

tennis player and follower of Association football.

Mr. H. M. Taylor.—We regret to report the death of **Mr. H. M. Taylor**, of the Birmingham branch of Simplex Electric Co., Ltd. **Mr. Taylor** was with the Simplex Company from its formation and before that was with the Perfecta Tube Co., which was incorporated with Simplex.

Mr. T. J. Hulme, head of the firm of Hulme & Son, electricians, Derby, has died at the age of eighty-five. He retired from active work in the business three years ago. The firm, which was established in 1843 as locksmiths, bell-hangers and whitesmiths, is one of the oldest electrical contracting concerns in Derby.

Steel-Conductor Lines

Advantages and Drawbacks for Overhead Systems

IN spite of the very wide choice of conductors now available for use as overhead lines, galvanised steel conductors are often employed, although obvious disadvantages are thereby introduced. Their use is generally restricted to lightly loaded rural lines owing to the poor voltage regulation obtained, but even in this sphere of work many authorities consider low initial cost to be outweighed by higher ultimate cost due to comparatively short life.

The lower cost of such a line is due not only to the reduced cost of steel as a conductor, but also to its high tensile strength which enables it to be erected with a smaller sag, thus making longer spans possible. This reduces the number of supports, insulators,

By F. R. Haigh,
B.Sc., A.M.I.E.E.

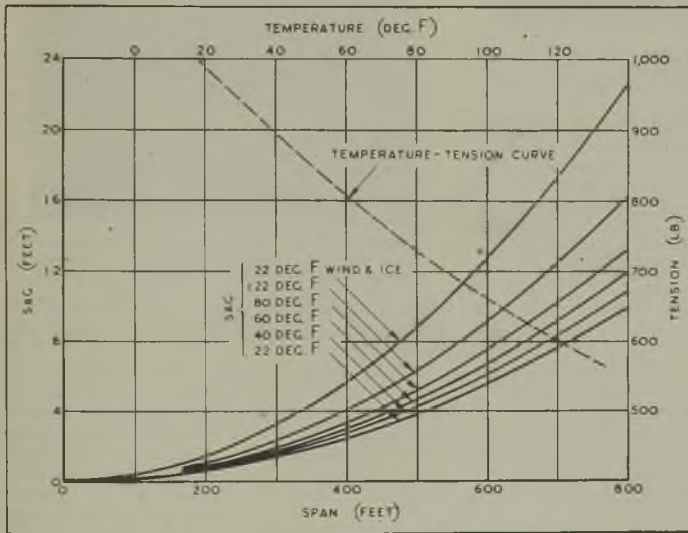
approximately 3.8 lb. per ft. run to break a 300 ft. span of 7/12 SWG steel conductor and an ice loading of approximately 2.2 lb. per sq. in. copper conductor, the probable alternative. For a 400-ft. span the figures are approximately 3.0 lb. and 1.7 lb. respectively. Ice loads of this magnitude are not covered by the factors of safety laid down in the Electricity Commissioners' Overhead Line Regulations, El. C. 53 (revised), in which the worst probable but not the worst possible ice loading conditions are specified. The recent severe winters with their abnormal icing conditions caused widespread damage, especially at altitudes of over 800 ft. above sea level; this damage would doubtless have been

mitigated by the use of conductors having a higher ultimate strength. Since the steel employed for stranded conductors has a tensile strength of the order of 180,000 lb. per sq. in. compared with 60,000 and 25,000 for hard-drawn copper and hard-drawn aluminium respectively, it is desirable to use either steel conductors or composite conductors with a high steel content where weather conditions are likely to be severe, even at the expense of obtaining poor voltage regulation.

It is probable that the most important advantage of steel conductors is that

they enable supplies to be taken to remote rural farms and hamlets at the lowest initial cost without adversely affecting reliability. Additional stimulus in this direction was given when the Electricity Commissioners issued a circular letter, No. M.2854 dated September 24th, 1937, authorising the factor of safety in the case of small conductors to be based upon an ice loading of $\frac{1}{16}$ in. radial thickness instead of $\frac{1}{8}$ in.

The chief drawbacks to the use of steel are

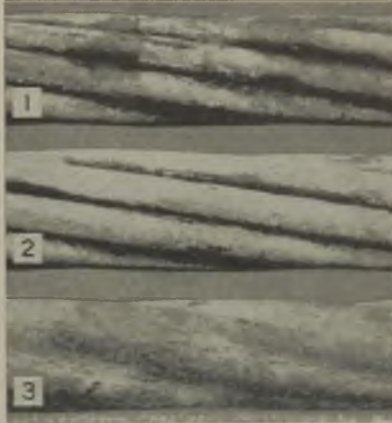


Sag and tension chart for 7/14 SWG steel conductor
Factor of safety = 2 based on a 475-ft. span under wind (8 lb. per sq. ft.) and ice ($\frac{1}{16}$ in.) conditions. Conductor breaking load = 3,200 lb. All spans have a constant erection tension

cross-arms and fittings and the number of possible flash-over points.

In addition to the beneficial effect on maintenance due to fewer insulators, steel-conductor lines are able to withstand severe weather conditions. As indicated by Pickles,¹ experience in Scotland suggests that it is often advantageous to employ them in districts subject to blizzards. This is borne out by theoretical considerations, as it requires, for example, an ice loading of

its limited current-carrying capacity and its liability to corrode when exposed to the atmosphere for long periods. The former is due not only to its comparatively high resistivity but also to the internal reactance and



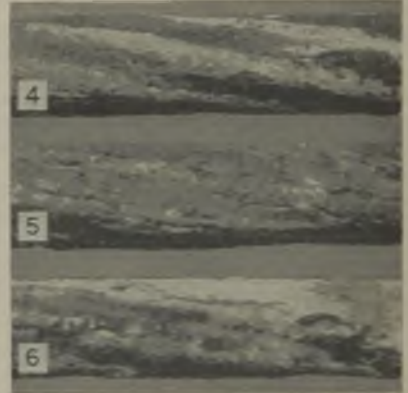
Galvanised steel conductor with hemp core after : 1, continuous acid spray ; 2, intermittent acid spray ; 3, continuous salt spray

hysteresis losses characteristic of magnetic types of conductor. The permeability of the material, upon which the internal reactance depends, varies with the composition of the steel and, since it is dependent upon the magnetic-flux density, it varies in value to a very great extent during each cycle and also throughout the cross-section. In addition, the influence of skin effect is difficult to predict. Further details in connection with this can be obtained from investigations made by Walton.² The poor current-carrying qualities of steel conductors have in consequence limited their use almost entirely to lightly loaded high-voltage lines.

Another disadvantage of lines designed for steel conductors is that their current-carrying capacity cannot be increased afterwards by substituting hard-drawn copper conductors without drastic alteration to the span lengths or the height of the supports. In certain cases, however, it may be possible to use cadmium-copper conductors.

Trouble due to corrosion is of major importance, since it is on account of rapid conductor deterioration that steel conductors are in many cases looked upon unfavourably. In a rural district a conductor life of approxi-

mately fifteen to twenty years may be obtained, but it is not uncommon for five years' exposure in an industrial atmosphere to constitute a safe working life. Galvanising by the hot-dip process to a standard which satisfies the requirements of the usual copper-sulphate test is the normal method of protection. In addition, a hemp core impregnated with grease is sometimes provided to ward off the ill effects of the atmosphere, whilst a method which is now used to a considerable extent consists of impregnating the stranded conductor with a bitumastic compound. The corrosive effect is, of course, greatly accelerated by atmospheric pollution and consequently the use of



Galvanised steel conductor with bitumenised core after : 4, continuous acid spray ; 5, intermittent acid spray ; 6, continuous salt spray

steel conductors in the vicinity of towns and large manufacturing concerns should be curtailed.

There exists a remarkable diversity of opinion regarding the adverse effect of the atmosphere on the various conductors used in practice. One of the most frequent questions which arises is whether steel or light-gauge copper should be employed for lines of low current-carrying capacity. Hence,

while some undertakings employ steel conductors on their lightly loaded lines, others have decided on the strength of past experience that the additional initial outlay on copper is justifiable. The nature of the local atmosphere is of considerable moment since, with unfavourable conditions, conductors made of any material will suffer from corrosion.

In order to examine and thus compare the



Copper conductor after : 7, continuous acid spray ; 8, intermittent acid spray

corrosion resistance of steel and copper conductors, a series of artificial ageing tests were carried out in sulphuric acid and brine sprays for a period of eight weeks. Short lengths of the following conductors were tested in this manner: Seven-strand galvanised-steel with hemp core; seven-strand galvanised-steel impregnated with bitumastic compound; seven-strand hard-drawn copper conductor.

The specimens, which were taken from new lengths of conductor, were cleaned, the ends sealed off with celluloid and weighed before the test. They were then placed in chambers into which the spray was fed in the form of a fine mist. The sulphuric-acid spray was varied in composition at fortnightly intervals, and made to simulate atmospheres such as are encountered in city, industrial and other polluted areas, and the salt spray represented sea water.

The effects of both continuous and intermittent sprays were investigated; in the latter case the specimens were removed on alternate days and allowed to dry slowly, causing the solution to become concentrated and the corrosive effect to increase. The samples were weighed after the test and it was found that in all cases a loss in weight occurred with the action of the acid spray and a gain in weight with the action of the salt spray.

Microscopic Examination

Owing to the uncertainty of the adhesive properties of the products formed it was difficult to draw conclusions merely from the changes in weight. Considerable corrosion of the steel conductors occurred, but the copper conductors were comparatively unaffected. This was confirmed by microscopic examination of the unstranded conductors which also showed that the salt spray had less corrosive effect than the acid spray on the steel conductors, but that the reverse was true for the copper conductors. Microscopic examination also showed that bitumen offered little protection—much less than it is generally credited with; the steel conductors in all cases after the eight weeks' test had reached the end of their useful working life and it can be assumed that more rapid corrosion would probably take place with the conductors under tension.

Other disadvantages of a minor nature are associated with the use of steel conductors. In addition to the need to ensure that all binding wire, stirrups, clamps, etc., are of iron or steel so as to avoid electrolytic action, precautions must for the same reason be taken at tapping-off points where connections to copper lines are made. This, however, is probably counterbalanced by the increased liability of galvanised-steel fittings in contact with copper conductors to corrode. It should also be noted that if advantage is to be taken of the high tensile strength of steel

conductors, additional staying strength at angle and terminal positions must be provided.

No attempt has been made to quote actual costs, as these are subject to considerable fluctuation, and the balance has always been in favour of steel-conductor lines. There is little doubt that many hundreds of isolated consumers would still have been without supply had advantage not been taken of the low initial cost of steel conductors. Post-war development will call for supplies to be made available in an economic manner at many points at present not served, making it necessary to exploit the use of steel conductors as much as possible.

¹ J. S. Pickles, *Journal I.E.E.* Vol. 82, p. 333 (1938).

² E. C. Walton, *Journal I.E.E.* Vol. 66, p. 1065 (1928).

Staffing Supply Undertakings

Promotion and Recruitment

IN the March *Electrical Power Engineer* reference is made to the Electricity Commissioners' recent statement (see *Electrical Review*, Feb. 23rd, p. 276) that while the generating staff in the electricity supply industry has increased by about 24 per cent. since 1939 the distribution staff has fallen to about 54 per cent. of the 1939 figure. It is pointed out that although there has been an increase in the generating staff it has not kept pace with the increase in demand. Consequently when the expected expansion of the domestic demand sets in, undertakings will find it difficult to obtain the necessary staffs.

During the war the normal intake of men has ceased and the industry has lost many of its younger men who would otherwise have been fitting themselves for positions of greater responsibility. Those who return after the war will hardly be capable of filling the higher technical positions. Added to this there will be many retirements of older men who have held on during the war.

The filling of these gaps is a matter of major importance to which the closest attention should be given immediately. The *Electrical Power Engineer* suggests three possible solutions of the short-term and long-term aspects of the problem. First, a system of promotion should be introduced by which men in the smaller stations could be utilised in the larger ones. Many of these men are quite capable of filling higher positions and their transfer would be to their own advantage and to that of the industry. Secondly, ex-Service men might be given intensive courses of training for some of the positions in the industry. If they have had mechanical and electrical experience in the Services there should be no difficulty in bringing them up to the required standard of efficiency. Thirdly, as a long-term policy, there should be a scheme of training for young recruits to the industry as an alternative to the present haphazard and unsatisfactory recruitment methods. This is considered to be a matter which the industry's National Joint Board and National Joint Industrial Council should tackle without further delay.

COMMERCE and INDUSTRY

Scottish Hydro-Electric Contract. Improving Coal Output.

I.M.E.A. Meetings

IT has been decided to hold this year's annual meeting of the Incorporated Municipal Electrical Association at the Kingsway Hall, London, W.C.2, on June 14th. The annual meeting of the Scottish Centre is to be held in Glasgow on May 23rd.

Severn Barrage Scheme

Mr. Tom Smith, Parliamentary Secretary to the Ministry of Fuel and Power, stated last week that there was little likelihood of an early decision upon the Severn Barrage Scheme being arrived at. The recent report on the scheme was primarily of a technical character; there were economic and other aspects to be considered, particularly the probable future price of coal.

Rural Electricity Supply

In the House of Commons last week Mr. De La Bere asked the Minister of Fuel and Power whether, in connection with the installation of electricity in farms and buildings in the rural areas, he would consider convening a meeting of the electricity undertakings throughout the United Kingdom with a view to abolishing the high charges for installation and the long term guarantees which were at present demanded by many undertakings.

Mr. Tom Smith said that electricity undertakers were under no statutory obligation to afford supplies to individual premises situated more than 50 yards from a distributing line. This point was one of the matters which was being taken into account in the general reorganisation of the industry now under consideration by the Government.

Loch Sloy Contract

It is reported that a provisional contract of over £500,000 has been placed with the English Electric Co., Ltd., for the main water turbines and generators for the proposed power station at Loch Sloy, Dumbartonshire. The company is already engaged on the design of these machines and arrangements are being made with it for supply of materials and manufacture of component parts to be put into the hands of Scottish firms to the maximum extent.

Extra Payments at Fulham

In 1943 the Fulham Borough Council decided to remunerate the borough electrical engineer (Mr. W. C. Parker) and certain members of his staff for extra overtime services in connection with the power station extension by way of five equal yearly instalments of £750, totalling £3,750, in respect of the services of the engineer and similar instalments of £250, totalling £1,250, for the services of members of his staff.

The latter amount, approved for 1944, is apportioned as follows:—Mr. J. Y. Hutchinson (chief assistant engineer) £80; Mr. F. la T. Budgett (technical assistant) £50; Mr. P.

Scott (efficiency superintendent) £40; Mr. T. Gray (architectural assistant) £40; and Miss E. Lee (engineer's secretary) £40.

In view of the urgent need for more plant the Council has been asked to complete the extensions as soon as possible. It was originally intended that they should be finished in 1948 but it is now not improbable that they might be ready in 1946. In these circumstances the engineer and his staff will be required to work a greater amount of overtime in the shortened period and the Staff Committee has recommended, and the Council has concurred, that this case the annual payments should be correspondingly increased, although the total amounts originally specified will not be exceeded.

Rehabilitation of the Coal Industry

In the opinion of the Technical Advisory Committee on Coal-Mining, appointed last September by the Minister of Fuel and Power, the coal industry needs entire reconstruction on the most modern lines. The cost of this is uncertain but it would be heavy and would have to be spread over a number of years. The amalgamation of mines in the various coalfields is advocated with overall supervision by a central statutory authority.

The Committee shows how little improvement there has been in the output per man shift as compared with what has been achieved in other leading coal-producing countries and attributes this mainly to out-of-date haulage systems. It is shown that there is a need for general reconstruction at many mines—both of the underground and surface equipment. The attitude of many owners towards improvements is criticised and it is said that British mining engineers have often been handicapped by this and have not often enjoyed the technical independence of their counterparts on the Continent.

Brazilian Imports

A recent decree of the Brazilian Government institutes a new import licensing system. Among the articles subject to import licences (according to the *Board of Trade Journal*) are "machinery equipment, utensils and instruments in general, steam engine parts and accessories, locomotives, mining equipment, construction equipment, etc., pumps, turbines, lathes, machine tools, general industrial machinery and equipment, and printing machinery." Imports by the Government for the manufacture of war material and imports contracted for up to January 23rd last are exempt from the provisions of the ordinance.

Modifications have been made in the scale of "consumption taxes" placed upon imported and nationally-produced goods. The tax on the following goods when imported is 8 per cent. on the import price:—Certain machines and apparatus, including automobile accumulators and batteries, sound amplifiers, "radios and the like," electrical apparatus for domestic, medical, surgical and other purposes, heating

apparatus. X-ray apparatus, measuring apparatus, telephone apparatus, and radio and other valves. Manufactures of metal, including insulated wire, are subject to a 6 per cent. tax, but exceptions include uncovered wire of any type; transformers, dynamos and generators of energy; including boilers; and steam engines, internal combustion engines and electric motors. Imported electric lamps will pay a surcharge of 50 per cent.

Wages in the Supply Industry

The Industrial Court has rejected a claim that the present war bonus of 6d. an hour in the electricity supply industry should be increased to 8d. an hour. The court is not satisfied that any substantial change in conditions arising out of the war has taken place which would warrant an increase in the existing war bonus.

Employment of Overseas Agents

The Export Committee of the Gauge & Tool Makers' Association has prepared a specimen agreement for the employment of overseas agents. Copies are available from the secretary, Mr. Gilbert T. Beach, Standbrook House, Old Bond Street, W.1.

Belfast Battery Factories

Three new factories are to be established in Belfast under the auspices of the Ministry of Commerce. One of these is already in existence producing electric batteries for the Ministry of Supply. The second is on the point of completion and the third is intended for the production of dry cells. Production will be expanded after the war.

Mould-resisting Wires

In order to prove that wire covered with "Insu-Glass" complies with Ministry of Supply requirements as laid down in C.I.E.M.E. instruction T/HO/19/1, five unvarnished samples from 20 to 40 SWG have been submitted to tests under tropical conditions and at the end of 28 days no trace of mould growth could be detected. "Insu-Glass" is a registered trade mark of the Saxonia Electrical Wire Co., Ltd., for a type of covering that can be applied to insulated instrument wires, plain and enamelled h.c. copper conductors as well as all forms of resistance wires and strands.

Bowen Trust 1945 Prizes

Mr. W. Bowen has presented to the Scientific Instrument Manufacturers' Association a substantial capital sum, the income of which is to be devoted towards the encouragement and development of invention, design, research, processes and manufacturing technique in the scientific instrument manufacturing industry. The S.I.M.A. Council has drawn up a deed of trust under which the income will be devoted each year to prizes to be awarded to the employees of members submitting papers fulfilling the objects of the Trust.

For the current year the Council has decided to award five prizes to the value of £25 each for (a) a new invention; (b) an improvement of design; (c) an improvement in manufacturing technique; or (d) a new development or new process arising from research. Candidates are

asked to furnish a short description not exceeding 3,000 words with sketches or diagrams. The five prizes are offered for a paper on any one of the above subjects affecting or related to a scientific instrument covered by one of five sections, including industrial precision instruments, and laboratory, research and medical apparatus. All papers must be submitted to the secretaries, Messrs. Binder, Hamlyn & Co., River Plate House, 12-13, South Place, E.C.2, by not later than December 31st, 1945.

Mr. W. Bowen, M.I.E.E., is director of the Bowen Instrument Co. Ltd., Cables & Plastics, Ltd., and Bowen Research.

Russian Language Courses

Realising the need for competent people to handle our foreign trade relations in post-war years, the School of Slavonic and East European Studies (15, Gordon Square, W.C.1), which is a central activity of the University of London, decided a year ago to offer special facilities to chosen people, sent to them by commercial firms, for the study of Russian, Polish, Czechoslovak, Roumanian and Serbo-Croat. As things turned out only Russian was called for, and in October two groups were formed (chiefly of banking people) which worked two half days—a total of six hours per week, four on the language and two on history and economic institutions. The fees were paid by the firms sending them, and the results have been very satisfactory. Test examinations will be set for these groups in June.

We are told that the response from commercial and industrial firms was disappointing, partly no doubt because they did not know or did not realise what was at stake. The School plans to open fresh courses from next October and offers to furnish information to all interested parties. Special emphasis is laid on the acquiring of a good commercial vocabulary for trade agents, and a technical vocabulary for engineers. The groups are kept small, so that students get a full measure of individual tuition.

Wages in the Contracting Industry

There is to be no alteration in the cost of living (war) addition to the wages of operatives in the electrical contracting industry which amounts to 6d. per hour for adult labour, 3d. for men between 18 and 21, and 1½d. for those under 18. For convenience of reference we repeat the present rates of pay and war addition for journeymen electricians: these inclusive hourly rates cover all overtime actually worked.—Grade "A," 2s. 5½d.; Mersey District, 2s. 3½d.; Grade "B," 2s. 2½d.; and Grade "C," 2s. 1½d.

Double Day-shift Working

The Minister of Labour and National Service announces the appointment of a Committee "to inquire into the economic need for and the social consequences of the double day-shift system in manufacturing industry and the changes in the existing law that would be necessary to facilitate its wider adoption, and to make recommendations." The double day-shift system was practised in a variety of industries in this country before the war but not to a great extent. It affords a means of combining the running of plant for a longer period with relatively shorter hours for the individual

workers. The question whether the extension of the system should be encouraged is a matter of considerable importance from the point of view of the development of British industry after the war, and the Committee has been set up to examine the subject in its various aspects. The chairman is Professor J. L. Brierly, O.B.E., M.A., D.C.L. Communications should be addressed to the Secretary, Mr. D. C. Barnes, Ministry of Labour and National Service, 8, St. James's Square, S.W.1.

Farmers and Electricity

At the next meeting of the Farmers' Club (at the Royal Empire Society, Northumberland Avenue, W.C.2, at 2.30 p.m. on April 16th) Mr. H. W. Grimmit is to speak on "Present and Future Aspects of Electricity in Agriculture."

E.A.W. Conference

The annual conference of the Electrical Association for Women is to be held at the Institution of Electrical Engineers, London, on April 19th. An address is to be given by Lord Brabazon of Tara.

Plastics Federation Luncheon

Mr. Ernest Bevin, Minister of Labour and National Service, is to be the principal guest at the annual luncheon of the British Plastics Federation at the Savoy Hotel, London, W.C.2, on April 18th.

Changes of Name

The United S.I.E.M. Engineering Co., Ltd., has changed its name to Société Industrielle d'Electro-Metallurgie, Ltd.

Peto Scott Co., Ltd., has changed its name to Peto Radio, Ltd. To November 6th, 1944, 402 shares had been issued, of which Peto Scott Electrical Investment (Holdings), Ltd., held 362.

Trade Announcements

S. Green, radio and electrical engineers, 44 & 45, Tamworth Road, West Croydon, announce that their telephone number is now Croydon 7417-8.

The Banner Electric Co., Ltd., has moved to Burford House, Burford Street, Hoddesdon, Herts (telephone: Hoddesdon 2659).

E. H. Jones (Machine Tools), Ltd., have opened offices and showrooms at 34, Ardwick Green South, Manchester, 12 (telephone: Ardwick 4035).

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding makers of the following:—

"Con-cur" floodlighting fittings.

"Baby Boudoir" iron.

"Sunvic" 1½-volt batteries (not Sunvic Controls).

Trade Publications

British Thomson-Houston Co., Ltd., Rugby, Warwickshire.—Illustrated lists describing electronic control gear for resistance welding machine:—DL 5851-1 Edition D, summarises types available; No. 5851-3 Edition A is on thyatron timers for contactor gear; No. 5851-8 Edition A on ignitron controllers; and No. 5851-9 Edition A on ignitron-contactor gear. The pamphlet summarises the types of controller available and contains a glossary of technical terms. It is concerned with three of the five main methods of resistance welding (spot, projection and seam), the heat formulæ being fully explained and the several types of control valves described, including glass thyatrons, both glass and steel ignitrons, non-synchronous timers as well as synchronous controllers, with tabulated data on machine settings as a guide to modern practice in the welding of mild steel.

Clayflex, Ltd., Tiddington Road, Stratford-on-Avon.—Illustrated brochure giving dimensions and details of the construction and use of flexible bearings for couplings and anti-vibration mountings. These bearings consist of concentric sleeves with a pre-stretched rubber tube between them, which creates a frictional bond restricting relative movement between the two elements and so damps down oscillation. Illustrations of typical applications include the mounting of switchboard panels for protecting instruments against shock and the accommodation of misalignment of motor-driven shafts.

General Electric Co., Ltd., Kingsway, London, W.C.2.—With the object of helping to spread knowledge of flameproof and kindred apparatus, Mr. S. W. Richards contributed a series of informative articles to the "Osram Bulletin." These have been collected into a booklet entitled "Safety Electrical Equipment and its Use," reviewing the range of flameproof and intrinsically safe equipment available to industry to-day.

British Insulated Cables, Ltd., Prescott, Lancs.—A 48-page "Pocket Book for Wiremen" (M. 111/1) contains tabulated data on copper wire and strands, flexibles, carrying capacity of cables, fuse wires, amperage of motors, capacity of conduits and other similar information, recommended war emergency relaxations being shown in red. Extracts from the I.E.E. Regulations are included and some of the B.I. wiring systems are briefly explained.

Silentbloc, Ltd., Victoria Gardens, Notting Hill Gate, London, W.11.—An illustrated technical brochure of 31 pages entitled "A Study in Vibration." Although a large part of its contents has been published elsewhere and is drawn from the specialised field of aircraft engineering, that fact should not restrict the scope of the principles described. Indeed a better source of study could hardly have presented itself.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—Illustrated brochure (No. 220) containing technical details and dimensions of type-M circuit breakers of the ironclad oil-immersed non-drawout design for 660 and 3,300 V.

Applications for copies of these publications should be made on business letter-headings.

Earthing in Rural Areas

Experiments with Buried Conductors

WHEN the neutral of a medium-voltage overhead distribution system in rural areas is not connected to a water main, few faults to earth clear themselves by blowing fuses. With the development of rural water supply systems, provided permission is obtainable to earth the neutral to the water main, the problem of clearing earth faults will largely disappear, as the position will then be similar to that existing in urban areas, where a low-resistance earth connection is generally provided by the extensive cable system.

By **R. Mallet,**
B.A., A.M.I.E.E.

There is, however, at present a real difficulty, which is often aggravated by the presence of water mains to which the consumer earths his apparatus and to which the water supply authorities refuse to permit the undertaking to connect its neutral. News of the killing of livestock or even of the obtaining of a shock from apparently harmless pieces of apparatus, such as stay wires, spreads rapidly (usually in an exaggerated form) and it is noticeable that pedigree livestock seem to be peculiarly liable to injury!

A low-resistance connection between the neutral and the general body of earth is an essential preliminary in all cases, even though earth-leakage trips are used on all heavy current-consuming apparatus. Such a connection, though not necessarily solving the problem, does at least prevent dangerous rises in potential above earth of the sound phases during phase-to-earth faults and it also prevents dangerous conditions adjacent to the transformer. Pole-type substations are usually adjacent to buildings in pasture land where livestock congregate and make frequent contact with poles and stays. Dangerous voltage gradients or shock conditions in this vicinity are therefore particularly to be avoided.

Neutral Earthing Electrodes

There are two distinct schools of thought as regards the shape of earthing electrodes. The "vertical school" advocates the use of earth spikes or long rods driven vertically into the ground. The "horizontal school" advocates the use of conductors or tapes buried in trenches.

Buried earth spikes are generally inefficient and costly, as in order to obtain a low resistance, numbers of such spikes have to be dispersed over a considerable area and consequently connected by means of conductors buried in trenches.

Where the ground below the surface soil is suitable and the specific resistance of the ground decreases or remains constant for the

first 30 ft. or so below the surface, small diameter rods driven into the ground by electric or pneumatic hammers, form efficient and cheap low-resistance earth electrodes. However, in many areas, the ground is not suitable for this method or the necessary equipment is not available and the choice lies between earth spikes or buried conductors.

In parts of the area of the undertaking with which the writer is associated, 2 to 3 ft. of soil is found on top of solid chalk or sand and gravel. The chalk has a specific resistance of approximately 15,000 ohms per cu. cm. and the sand and gravel 50,000 ohms per cu. cm. Vertically driven rods obviously presented no solution and it was decided to experiment with buried conductors.

When the experiments were started the earthing electrodes consisted of double galvanized "Armco" iron spikes 6 ft. long and $\frac{3}{4}$ in. in diameter, buried vertically with their tops at least 2 ft. below the surface in order to reduce the surface potential gradients under fault conditions. Individual spikes gave resistance readings of from 13 to 300 ohms.

CALCULATED RESISTANCE OF ELECTRODES

Type of electrode	Resistance to general body of earth	Resistance per cent.
6 ft. long $\frac{3}{4}$ in. diam. spike	0.0052 ρ	100
15 yd. of 3/147 conductor at 2 ft. 3 in.	0.00117 ρ	22.5
40 yd. of 3/147 conductor at 1 ft. 6 in.	0.00055 ρ	10.5

ρ is the specific resistance of the soil in ohms per cu. cm. For comparison, the resistance of the earth spike is taken as 100 per cent.

For the buried conductor electrode, copper was chosen as most resistant to the action of chemicals in the soil. The conductor had to possess sufficient mechanical strength to reduce risk of accidental severing, without being large enough to produce dangerous potential gradients at the ground surface.

Strength was provided by using 3/147 (0.05 sq in.) hard-drawn copper conductor. Even under the most severe fault conditions with the conductor buried only 1 ft. 6 in. down, the maximum surface potential just above the electrode was only about 50 per cent. of that on the electrode.

Theoretical Considerations

Throughout the experiments it was found that theory and practice agreed closely, provided sufficient time was allowed for

excavated soil to settle down and become homogenous with the surrounding soil. The theoretical resistance of both earth spikes and conductors of given dimensions can be calculated, and in the table on the preceding

switch operating handle, thus reducing the likelihood of shock to the operator under fault conditions. The neutral of the transformer is connected to an insulated conductor run down the pole and underground to a point

10 ft. away from the pole or its associated stays. The insulated conductor is connected to 40 yd. of 3/147 copper conductor buried at a depth of 1 ft. 6 in. in a straight line. The direction and route of the trench is chosen so as to keep at least 10 ft. away from stays or fences.

A typical surface potential diagram for an earth electrode under the most severe conditions, is shown in Fig. 1. In this case, the phase wire was connected to a water-mains system some distance from the earthing electrode and the neutral assumed a potential of 226 V above the general body of earth. The specific resistance of the soil in the case shown, was 29,000 ohms per cu. cm., but the diagram will apply to soils of any specific resistance, provided the resistance of the fault is very small compared with the resistance of the electrode as in this case. An even wider generalisation can be obtained by expressing the surface volts as a percentage of the volts on the earth electrode, when a given diagram will apply to all similar

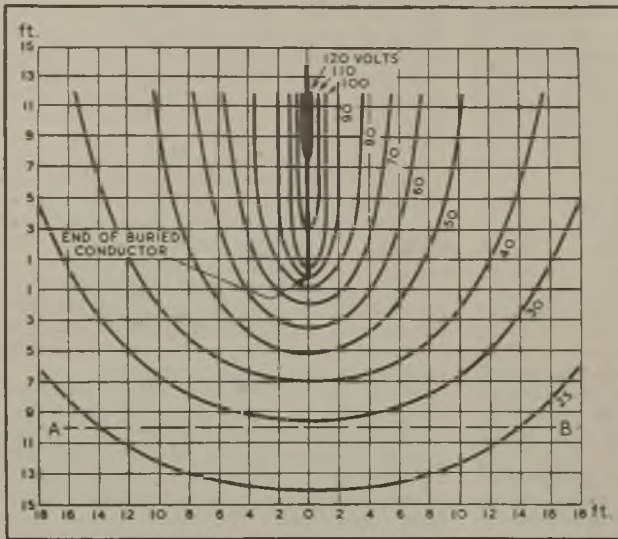


Fig. 1.—Surface potential diagram

page are given the figures arrived at for the original earth spike and for two specimens of the copper conductors.

The ability to obtain a low resistance by the use of buried conductors is abundantly clear on theoretical grounds, but the consequent surface potential gradients under fault conditions, can be obtained satisfactorily only by experiment. The resistance to earth and also the potential gradients under fault conditions, decrease as the depth at which the conductor is buried is increased. Under present-day conditions, with manual excavation, it is far cheaper to reduce both the surface potential gradients for a fault of given resistance and the resistance of the electrode to earth by extending the conductor—the depth at which it is buried being governed only by the need for protection against damage and accidental contact.

As a result of experiments, it was decided to standardise the following arrangements for pole-type substations from which no underground cables radiated and where, consequently, special excavation was required for the earthing conductor. All non-current-carrying metal-work on the pole is bonded and connected to an earthing spike buried immediately below the

electrodes in soils of any specific resistance and with faults of any resistance.

Provided the transformer and any stays or fences are kept on the opposite side of the line AB to that of the electrode, there is little danger of animals receiving fatal shocks.

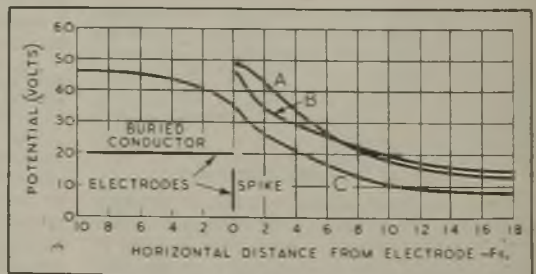


Fig. 2.—Surface potential gradients. Fault currents: 40 yd. 3/147 conductor, 50 A; 6 ft. long 1/2 in. dia. spike, 12.5 A. A. Earth spike. B. Buried copper conductor at right angles to line of electrode. C. Buried copper conductor along line of electrode

electrodes in soils of any specific resistance and with faults of any resistance.

Provided the transformer and any stays or fences are kept on the opposite side of the line AB to that of the electrode, there is little danger of animals receiving fatal shocks.

The area of severest potential gradients is kept out in open land and although in the worst place there is a potential difference of 50 V over a distance of 6 ft., this maximum is reached only immediately over the earthing electrode and is surrounded by an area of less severe potential differences which would deter animals from approaching it.

The efficiency of this type of electrode is better illustrated by Fig. 2, showing the surface potential gradients on the electrode for a fault of 3 ohms resistance to earth in soil of 3,000 ohms per cu. cm. specific resistance. For comparison, the same results are also shown with a single 6 ft. long $\frac{3}{4}$ in. diameter earth spike buried with its top 2 ft. below the surface.

When there is an underground cable running from a pole type substation, its sheath is of course bonded to the substation metalwork. In order to get the best earth for a given cost, the earthing conductor is laid in the same trench as the cable, the connection to the neutral, as before, being insulated for a minimum distance of 10 ft. from the pole. As approximately 50 per cent. of the resistance and consequently voltage drop, is within a few inches of the buried conductor, provided the conductor is laid 6 in. away from the

cable, there is no danger of heavy fault currents in the cable sheaths. When considerable lengths of cable are run from a substation, the neutral resistance can be reduced by increasing the length of buried conductor to give as low a resistance as is desired, the extra cost being only that of the buried conductor. The presence of the cable in the vicinity of the earthing conductor also reduces the resistance to earth by an amount that depends on the relative lengths of the conductor and cable.

With short lengths of underground cable, care has to be taken that the cable sheathing and consequently all metalwork connected to it, is not able to pick up a dangerous potential above earth from the earthing conductor.

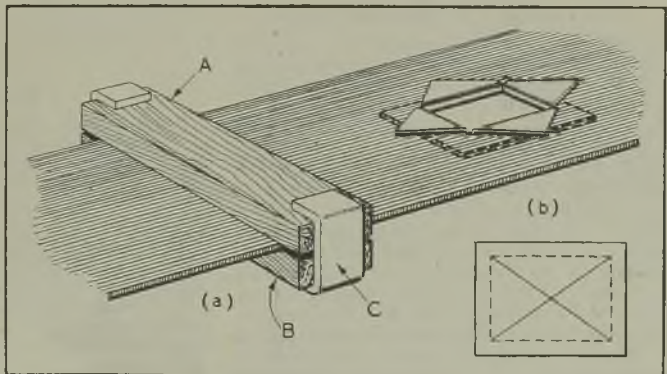
Experiments show that in the case of paper-insulated lead-covered double-steel tape-armoured cable laid solid in the ground 6 in. away from an earthing conductor, which does not exceed 30 per cent. of the total route length of cable, dangerous potential will not be caused. In the case of p.i.l.c. cable protected by "V" shaped tiles, the proportion can safely be increased to 50 per cent., owing to the decrease in contact surface between the cable and the ground.

Marine Installation Work

Method of Bending Supporting Trays

WIRING in ships, which is subjected to arduous conditions such as continued and sometimes severe vibrations and very bad atmospheric conditions, is usually of single lead-covered cable suspended from a sheet-iron plate or "tray" by means of brass clips. On the erection of this tray the efficiency of the wiring to a great degree depends. When sets are required in the tray they are commonly made round any convenient support, but this does not make for neatness. A suitable form for making sets is shown in the accompanying sketch. A and B are bars of wood and B is fitted at intervals to accommodate the up-turned edges of different widths of tray and C is one of a pair of clamps by which the tray is held firm. In use the tray is gripped firmly in this clamp (which is tightly secured) and given sufficient bend in that place. The clamp is then moved on and the tray bent again until a set of the required radius is obtained. Where the cable has to pass through the tray from underneath the

top, the holes must be bushed with thin sheet lead to prevent damage to the cable. These holes are usually set out with a chisel or hack-



(a) Bending device. (b) Sheet-lead bushing

saw blade fitted with a hack-saw handle. The inner oblong should be marked the same area as the hole in the tray. The lead should be cut through with a knife along the diagonal line. The four lead leaves are then bent up and pushed through the hole in the tray and bent over.—W. G. WARNER.

Standing-Cost Allocation

"Potential-Peak Responsibility" and "Consumption Responsibility"

A METHOD of allocating among the chief classes of consumers that part of the cost of electricity supply which is directly proportional to the maximum demand forms the subject of a report of the British Electrical and Allied Industries Research Association (K/T109) which has just been published at 9s. net. The treatment is on a purely cost basis and is not concerned with tariffs. The history of the subject is briefly dealt with and reference is made to a detailed survey of past methods published by the Association simultaneously (K/T106) at 13s. 6d.

The report states that the ordinary "peak-responsibility" method could be applied with some accuracy in the days when the peak resulted from the overlap of domestic lighting and industrial power (since its incidence and magnitude could be foretold), no demand-related cost being allocated to off-peak loads. At the other extreme, if the m.d. on the system were likely to be made at any moment the simple "demand" method could correctly be used, each component m.d. being measured whenever it happened to occur, and cost being allocated to it at a uniform rate per kW or kVA of system m.d. in the ratio of the collective diversity factor. In modern supply systems, however, the peak-responsibility method is invalidated by uncertainty as to when the peak will occur, while the demand method incorrectly assumes that every hour of the year is equally adverse.

Loads Capable of Producing Peaks

After reviewing a number of methods (including some based on considerations of "equity" and not on cost) the report proposes a method of allocation embodying two main principles, viz. "potential-peak responsibility" and "consumption responsibility." In the first case the criterion is whether an additional kW or kVA at any given point puts an undertaking to extra expense. Thus it differs from the simpler peak-responsibility method, which would allocate no demand-related cost to loads outside the single annual peak period. Yet these loads might produce a peak at another time in the future. Demand-related cost must, therefore, be allocated to all those loads which appear capable (under discernible trends) of producing a peak and thus causing demand-related expenses to the supply undertaking.

The principle of a potential-peak responsibility assumes that a peak is likely to occur during certain periods of the year and not in others, depending on the system or part of the system concerned. The second major principle, consumption responsibility,

acts as a weighting device, by which the allocation is to some extent made a function of the load factor in respect of the potential-peak periods. The ordinary demand method is characterised by an *average* diversity allowance, which cannot be true for all. The higher the component's load factor, the greater is the likelihood of its adding to the system peak and the lower its potential diversity.

In the E.R.A. method part of the demand-related cost is allocated at a uniform rate per kW or kVA of highest demand within the potential-peak period, while outside this time belt no allocation is made. The remainder of the demand-related cost is allocated as a kWh rate and spread over the consumption within the potential-peak periods. The division is not arbitrary, as there are some component loads whose costs are definitely known; for instance, a load of 100 per cent. load-factor monopolises a certain amount of plant and so incurs a known amount of demand-related cost. By making the equation give the right answer in this extreme case, the correct constants can be obtained for general application.

It is pointed out that a more scientific allocation would be the zoning of potential peak periods to correspond to different degrees of potentiality. In addition to describing the theory and practice of the E.R.A. method, the report indicates the data required and the way in which reasonable assumptions can be made from them, giving a detailed example.

Fatalities

Faulty Wiring Alleged.—An inquest was held on March 19th on the death of Mrs. Joyce Stephenson at Chester. It appeared that Mrs. Stephenson touched an electric iron while washing a floor and although the switch was in the off position she received a shock. An official of the Corporation Electricity Department said that a plug installed in 1929 had subsequently been changed. The method of wiring must have been faulty; the iron had fallen at some time and this had caused a live conductor inside the iron to make contact with the metal casing. A verdict of accidental death was returned.

Magnet Failures.—The *Western Mail* reports that the failure of the magnet of an overhead electric crane to hold a girder which was being moved at Brymbo Steelworks, near Wrexham, caused the death of Edward J. T. Morris, who was killed instantaneously when the girder fell on him. At the inquest an engineer said he was unable to explain why the amperage was insufficient to operate the magnet. The Coroner recorded a verdict of accidental death.

Process Heating

Comparison of Different Systems

ALTHOUGH there are still very real spheres of usefulness for the contact and convective methods in industrial heating, three other systems (radiant lamps, high frequency dielectric, inductive eddy current, none of which is fundamentally new) have been so developed during the war period as to demand serious recognition. An attempt to determine the proper field of application for each method in economically planned production is made in a paper prepared by MESSRS. L. J. C. CONNELL, O. W. HUMPHREYS and J. L. RYCROFT (G.E.C.) for the Installations Section of the Institution of Electrical Engineers.

The several systems of heating are first reviewed, their characteristics being tabulated for comparison. The physical laws and practical considerations by which they are governed and the rates of heating which may be obtained are indicated. Formulae are mostly in general terms to enable either British or metric units to be employed for facilitating heat-transfer comparisons with non-electric systems.

An endeavour is then made to classify, in terms of their technical requirements, the types of applications for which each heating process is best suited. Such selection needs the exercise of care, for suitability and speed of processing which is usually associated with reduction of floor space needed are not the only factors of importance; it is necessary to maintain a proper balance between technical and economic considerations.

Definition of Conditions Needed

The authors' tabulated classification serves primarily to present a broad qualitative view of the whole range of processes and methods available for industrial heating. Any attempt to interpret it with any degree of precision would necessarily be unsuccessful because of the wide range of conditions to be satisfied. When the latter are more closely defined, quantitative comparison becomes possible; knowledge of the temperature rise required and the processing time as well as the density, specific heat and thickness of the object to be treated, enables the mean rate of heating to be calculated graphically with the aid of a diagram provided in the paper.

For radiant heating (mainly, though not entirely with glass-bulb lamps) several types have been used in America with ratings up to 1,000 W each. British manufacturers have been restricted to one tungsten filament lamp of 250 W at 115 V normally series connected in pairs to 200 250 V mains. The

maximum emission occurs in the spectral region between 1 and 3 microns, so that gold reflectors have an initial overall efficiency from 2 to 5 per cent. greater than rhodium; and the latter are more durable in service while anodised aluminium may be an alternative when supplies become available. The maximum rate of electrical input of 860 W per sq. ft. (2,940 BThU per hour per sq. ft.) is about the limiting value with lamps of the present type mounted in flat reflector banks, though greater intensities may be obtained when concentrating reflectors can be employed. The maximum overall efficiency is of the order of 65 per cent.

Dielectric and Eddy Current Methods

Dielectric heating is generated at a uniform rate throughout a homogeneous material, but it does not necessarily follow that the rate of rise of temperature will be uniform. Power inputs of the order of 3 kW per sq. ft. (10,000 BThU per hour per sq. ft.) are quite feasible, for example, in heating thick stacks of wood veneers. For certain kinds of eddy current heating it is common practice to use inputs as large as 10 kW per sq. in. (5,000,000 BThU per hour per sq. ft.). The AC frequency range for dielectric and eddy current heating is usually between 50 kc/s and 200 Mc/s. Power outputs of 200 kW or more are obtainable at from 0.2 to 20 Mc/s and efficiencies are usually from 50 to 60 per cent.

Finally several specific applications are considered in some detail, indicating that processes of superficial similarity may nevertheless possess features, not at first apparent, which are of sufficient importance to warrant the use of different methods of heating. But the fact that the three developments mentioned undoubtedly have important roles to play in post-war manufacturing does not mean that the days of the convection oven, or of heated platens and rollers, are numbered.

Irish Power Engineers

UNDER the Trade Union Act passed in Eire in 1941 trade unions can only operate in that country by Government licence and by depositing a surety of £1,000. The effect of this upon the membership in Eire was discussed at a recent meeting of the Electrical Power Engineers' Association when it was stated that if nothing was done "the Association would gradually fade out in Eire altogether." It was decided that the Association should apply for the negotiating licence and deposit the necessary £1,000.

Forthcoming Events

Friday, April 6th.—*Manchester.*—Engineers' Club, 6.30 p.m. I.E.E. North-Western Students' Section. "Electrical Computing," by R. B. Quarmby.

Saturday, April 7th.—*London.*—Bonnington Hotel, W.C.2, 2.30 p.m. Institution of Factory Managers. S.E. London Branch meeting.

Leeds.—Y.M.C.A., Albion Place, 4 p.m. The Engineer Surveyors' Association. "Turbo-electric Drives in Mills" (illustrated), by F. R. Mason.

Bristol.—Merchant Venturers' Technical College, 3 p.m. I.E.E. Bristol Students' Section. Students' Lecture. "The Cathode-ray Tube and its Applications," by Dr. W. Wilson.

Monday, April 9th.—*Newcastle-on-Tyne.*—Royal Station Hotel, 6.15 p.m. I.E.E. North-Eastern Centre. Annual general meeting, 7 to 7.15 p.m. Reception by the President of the Institution, Sir Harry Railing.

Bristol.—University Physics Laboratory, Royal Fort, Tyndall Avenue, 5 p.m. I.E.E. Western Centre. "Survey of the Problems of Post-war Television," by B. J. Edwards.

Tuesday, April 10th.—*Glasgow.*—Royal Technical College, George Street, 6.15 p.m. I.E.E. Scottish Centre. Informal paper on "Plastics for the Engineer," by Dr. P. D. Ritchie and W. A. Kirkwood.

Wednesday, April 11th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Transmission Section. "Distribution of Tensile Load in relation to Temperature and Sag of Steel-cored Aluminium Conductors," by E. W. W. Double.

Birmingham.—James Watt Institute, 6.45 p.m. Electrodepositors' Technical Society. "The Plating Shop, Plant and Layout," by Dr. S. Wernick. (Date of meeting altered from April 3rd.)

Thursday, April 12th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Installations Section. "Factors Influencing the Design of Electric Lighting Installations for Building Interiors," by R. O. Ackerley.

Stafford.—At 6.30 p.m. I.E.E.E. South Midland Students' Section. "Fibrous Glass Insulation for Electrical Machines," by S. Steinbock.

Cardiff.—I.E.E. Cardiff Students' Section. Students' Lecture. "Electrical Engineering Research," by H. W. H. Warren.

Friday, April 13th.—*London.*—Connaught Rooms, 11 a.m. Institution of Chemical Engineers. Annual corporate meeting.

Newcastle-on-Tyne.—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. "CO₂ Measurement," by R. Lord.

Monday, April 16th.—*London.*—Royal Empire Society, 2.30 p.m. Farmers' Club. "Present and Future Aspects of Electricity in Agriculture," by H. W. Grimmitt.

London.—Institution of Electrical Engineers, 7 p.m. London Students' Section. "The Lumen Method of Illumination Calculation," by G. S. H. Mogford.

Tuesday, April 17th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Radio Section. Discussion on "Design of Broadcast and Television Receivers for the Post-War Market," to be opened by L. H. Bedford, O.B.E.

London.—Lighting Service Bureau, Savoy Hill, 6.15 p.m. Association of Supervising Electrical Engineers. "Electrical Installations for Post-War Buildings," by F. J. Sutton.

London.—Institution of Electrical Engineers, 2.30 p.m. British Society for International Bibliography. Annual general meeting and presidential address.

Luton.—Town Hall, 7.30 p.m. Luton Electrical Society. Annual general meeting and display of films of electrical interest.

Wednesday, April 18th.—*London.*—Royal Society of Arts, John Adam Street, Adelphi, 1.45 p.m. "The Work of the Department of Scientific and Industrial Research," by Sir Edward Appleton.

London.—Savoy Hotel, 1 p.m. British Plastics Federation Annual luncheon.

Thursday, April 19th.—*London.*—At Institution of Electrical Engineers. Annual conference of Electrical Association for Women.

Saturday, April 21st.—*London.*—Connaught Rooms, 1 for 1.30 p.m. Junior Institution of Engineers. Annual luncheon.

Thursday, April 26th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. Thirty-sixth Kelvin Lecture. "Electric Currents in the Atmosphere," by Sir Edward Appleton, K.C.B.

Durham Coal

A REPORT has been issued by the Ministry of Fuel and Power (Stationery Office, 1s.) on Durham Coalfield, which covers an area of 465 sq. miles. Reserves are conservatively estimated at 3,000 million tons plus what could be obtained from undersea working and from inferior seams. The characteristics of Durham coal, the Report states, vary over a wide range from soft bright coking coals with a volatile content of under 30 per cent. on a dry ash-free basis, to harder house and steam coals with a volatile content of about 40 per cent. In general, Durham steam coals, as marketed, contain in the largest sizes from 1 to 3 per cent. of moisture, 5 to 10 per cent. of ash and from 0.7 to 2.5 per cent. of sulphur according to the locality.

The calorific value, on the dry ash-free basis, is about 15,300 to 15,600 BThU per lb. and the ash fusion point often exceeds 1,450 deg. C. Reserves of high-quality coking coal (330 million tons) are in danger of being exhausted within fifty years. Some 737 million tons of the total are now left underground to provide support for over-ground structures and barriers against flooding, of which 467 million tons would become accessible if engineering and financial arrangements could be made for such support by pneumatic and hydraulic stowage.

Large reserves of coal now flooded in the south-west of the county should be drained and the recovered water used to supplement the insufficient public supplies. Few new sinkings will probably be made, but existing shafts will need to be deepened; transport, roadways and ventilation improved; and further mechanisation of production and cleaning of coal put in hand. The large amount of additional capital, it is recommended, should be provided by the Government on suitable terms. Research and the development of associated industries are also recommended.

ELECTRICITY SUPPLY

Grid Connection at Bedford. Stoke Newington Lighting.

Bedford.—NEW GRID CONNECTION.—On the recommendation of the Electricity Committee, the Council at its last meeting agreed to the execution of the remaining works relating to proposed new grid connection (establishment of main switchgear, transformers, switch house, cabling, etc.), and it was decided to apply to the Electricity Commissioners for sanction to borrow from internal resources the sum of £137,666.

Alderman W. E. Sowler, chairman of the Committee, pointed out that in the estimates prepared in 1943 by their consultants, the estimated expenditure corresponding to the proposals amounted to £130,450, plus £13,045 engineering costs, making a total of £143,495, as against the present estimate of £137,666. This reduction was partly due to the fact that their engineer was carrying out some of the work by direct labour, thus saving professional charges. In the consultant's report a further expenditure of £200,000 was estimated, covering a portion of the cost of low voltage distribution re-organisation, with engineer's costs of £20,000. This was gradually being carried out under the chief engineer as circumstances permitted by direct labour, with a saving to the Corporation of £20,000 professional charges. Already 15 per cent. of the work had been completed.

Alderman Sowler refuted a suggestion that they were turning a picturesque part of the river into a sort of factory site. The approximate area of the site, he said, was 15 acres, of which it was proposed to dedicate to the public a riverside frontage of over three acres.

Belfast.—DISTRIBUTION EXTENSIONS.—Application is to be made to the Ministry of Commerce for sanction to borrow £30,000 for distribution works.

Bexhill.—LOAN FOR APPARATUS.—The Electricity Committee has obtained sanction to borrow £1,000 for cookers and other electrical apparatus.

Supply to Farm.—An electricity supply is to be provided to Broadoak Farm at a cost of £160.

Burton-on-Trent.—ORDERS FOR POST-WAR EQUIPMENT.—In view of the Electricity Commissioners' suggestion that orders for essential equipment for immediate post-war needs should be placed now, the Electricity Committee recently recommended that works should be approved and equipment ordered at an estimated cost of £85,150. The recommendation was approved by the Council.

Coventry.—NEW PRIMARY SUBSTATION.—At its meeting last week the City Council authorised application for sanction to various items of expenditure submitted by the Electricity Committee, amounting in all to £512,196. The chief item was £100,110 for a new primary substation in the Whitley area.

Fleetwood.—ALL-ELECTRIC BUNGALOWS.—The Corporation has decided that the town's 100 prefabricated bungalows shall be equipped with electrical appliances throughout.

Hull.—"UNIT" CHARGE INCREASE.—As reported last week, the Electricity Committee is making formal application for consent to an

adjustment of the "unit" charge in all tariffs where coal clauses are not operating. The proposal is to make ½d. the minimum in place of ¼d. It is stated that a large number of small consumers will not be affected.

Liverpool.—PLANS FOR DEVELOPMENT.—The preparations of the Electricity Department for post-war development are reviewed in an article in the *Liverpool Daily Post*. An extension scheme costing about £350,000 which the Electricity Committee has just approved provides for two large new distributing centres to serve roughly the Speke industrial estate and the district of Knotty Ash. It also provides for the laying of many miles of 33-kV cables underground.

London.—SUPPLY TO TEMPORARY HOUSES.—The Stoke Newington Borough Council has received letters from the London County Council asking for details of existing and proposed mains, services and voltages for the supply of electricity to a number of sites upon which temporary houses are to be built. The L.C.C. requires an estimate of the cost of the actual services and extension of mains on private property and public highways and asks whether the Borough Council proposes to ask for the payment of the whole cost or for a contribution towards it.

The Stoke Newington Electricity Committee says that this matter has been under consideration by the Electrical Development Association with a view to the formation of a uniform scheme among local authorities and it is suggested that the L.C.C. should be asked to meet the entire cost of providing all electricity services and mains for these temporary houses. The Committee recommends a reply to the L.C.C. on these lines.

Street Lighting.—The Stoke Newington Highways and Sewers Committee last week presented a report to the Council on street lighting in the borough showing the progress made since 1903. At the present time there are about 400 gas street lamps and 300 electric (including temporary gas conversions). It is said that the Council is faced with two problems—the provision of a reasonable standard of lighting in the near future and the "more permanent bringing up to date of the system." The Committee says that it is impossible to commence the preparation of any scheme until, as a matter of policy, it is decided whether gas or electricity shall be used in future. It has therefore recommended that the future lighting of the streets of the borough by electricity be approved in principle and that the Committee shall prepare a detailed scheme for the installation of up-to-date lighting throughout the borough.

Bethnal Green Recovery.—With many consumers returning to the borough there was a general improvement in the operations of the Bethnal Green Electricity Department last year. Mr. E. E. Jolly, the electrical engineer and manager, in his report for 1943-44, records an increase in sales to all classes of consumers and the total consumption of 17.7 million kWh

compared with 16.3 million in the preceding year but was still well below the figure for the last pre-war year (21.1 million kWh).

A small increase in charges in force for eight months of the year, together with the improved sales, converted the estimated deficit of £14,418 on the year (following one of £15,973 in 1942-43) into a net surplus of £1,353. The total income from the sale of electricity was £125,613 (against £108,269) and the average price received per kWh sold rose from 1.592d. to 1.702d. Although there was a further rise in bulk supply cost the overall average per kWh sold fell from 0.839d. to 0.824d. due to improved efficiency of use, the load factor having risen from 35.35 to 35.84 per cent.

The engineer records that a total sum of £24,510 has been written off since the outbreak of war in respect of property destroyed or abandoned. During the period under review, the meter department suffered very severe air-raid damage through an incendiary bomb attack, but far more serious destruction was averted by the prompt action of the staff.

Reviewing the activities of the mains section, Mr. Jolly states that work was started during the year on the new rising main distribution system intended for post-war application in blocks of flats. Numerous tests were carried out on welding installations to ascertain representative operating characteristics so that a suitable tariff could be formulated.

The installation section's maintenance calls were appreciably more numerous than in the previous year on account of extensive malicious damage to air-raid shelter installations. Contract wiring work carried out included an installation at the London Chest Hospital.

North-East Coast.—PURCHASE OPTION TIME EXTENDED.—The Electricity Commissioners have made the South Shields Rural Electricity (Extension of Time) Order, 1945. This extends by a year the period of 42 years within six months of the expiration of which the South Shields, Sunderland and Jarrow Corporations and the Boldon, Felling and Hebburn Urban District Councils may exercise their rights of purchase of the parts of the undertaking of the North-Eastern Electric Supply Co., Ltd., authorised by the South Shields Rural Electric Lighting Order, 1903, which are within their respective areas.

Oswestry.—FURTHER CONCESSION.—For the third year in succession the Electricity Department, of which Mr. H. Breckell is engineer and manager, is to give a special rebate to consumers taking supply on the general tariffs for lighting, heating, cooking and small power purposes. The rebate this year will be calculated at 25 per cent. of the March quarter's account.

Portland.—SHORTAGE OF APPARATUS.—For some time it has not been possible to meet the demand from consumers wishing to hire apparatus and a waiting list has been compiled. At the last meeting of the Electricity Committee the question of whether apparatus on hire should be recovered on change of tenancy was discussed. It was agreed that incoming tenants should be allowed to take over the apparatus.

Southampton.—IMPROVED FINANCIAL POSITION.—Badly hit in the early years of the war, the Electricity Department is now regaining its financial stability. A steady growth

in sales has resulted in a considerable increase in revenue and the past year's working has been the most successful since the outbreak of war. Total income to March 31st, 1945, is expected to be £668,290, exceeding the estimate of twelve months ago by £80,360. Instead of the deficiency of £13,010 which was foreshadowed the final figures are now likely to show a surplus of £27,410. For the coming financial year it is estimated that the total income will amount to £703,280 with a net surplus of £13,040. The Mayor (Councillor J. C. Dyas) has congratulated the borough electrical engineer (Mr. W. G. Turner) and his staff on the excellent results achieved.

Southport.—CHANGE-OVER.—Authority has been given to the borough electrical engineer to proceed with the necessary work in connection with the change-over from DC to AC in the Birkdale area of supply. Application is to be made to the Electricity Commissioners for authority to spend £9,505 out of surplus revenue on the work.

Stockton-on-Tees.—DISMANTLING SHELTER INSTALLATIONS.—The question of dismantling electrical equipment in 200 air-raid shelters is being considered by the Town Council. The electrical engineer suggested that the internal wiring should be removed and that the underground cables from which the supplies were taken should be made good. The total cost would be about £800. The Civil Defence authorities, it is stated, would not agree to this expenditure, and it was proposed that only the meters should be taken from the shelters and the cables left in position. The Council has drawn the attention of the Civil Defence authorities to the danger of carrying out this plan. The matter is still under consideration.

West Hartlepool.—SUBSTATION SITES.—At the request of the Electricity Committee the borough electrical engineer is to report on sites for the erection of further substations.

Workington.—TARIFFS AND DEVELOPMENT.—In a report on post-war prospects Mr. C. W. Emanuel, engineer and manager of the Electricity Department, says that the undertaking's domestic tariff is one of the lowest in the country and should encourage householders to use electricity for all purposes. He is not quite satisfied, however, with the present rateable value method of assessing the fixed charge and feels that some form of variable block tariff would be preferable.

All new houses should be designed to make housework easier by electrical equipment and the minimum number of plugs should be three in living rooms and three in the kitchen with additional connections for cooker, wash-boiler and water heater. All plugs should be interchangeable.

Every effort should be made to encourage the use of electric vehicles for urban delivery work. He points out that the Department's first electric vehicle purchased in 1935 is still in use and has proved to be most satisfactory for urban delivery work.

In order to save cartage of fuel and attendance it would be possible to equip the swimming baths with an electrically operated storage heating system, the demand of which would fall mainly during off-peak load. Storage heating could also be applied to the heating of cinemas, schools, theatres, etc.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Northmet Power Co.—Mr. G. W. Spencer Hawes deputised for the chairman, Lord Ashfield, who was indisposed, at the annual general meeting on March 27th. Giving details of progress made he said that the number of consumers had increased from 263,750 at the end of 1938 to 338,245. Electricity supplied had risen from 706.1 million kWh in 1938 to 1,054.7 million kWh in 1944. In the same period the gross revenue rose from £3,342,000 to £5,113,000, while expenses increased from £2,428,000 to £4,268,000. During the five years the company spent £965,000 in developing and extending the transmission and distribution systems and, with the total capital expenditure of the Station Company, the aggregate capital expenditure exceeded £18,500,000. The financial position of the company was strong.

The North Metropolitan Power Station Co., Ltd.—Permission to deal has been granted in respect of the £1,500,000 $\frac{3}{4}$ per cent. second mortgage debenture stock, 1970.

The Lancashire Electric Light & Power Co., Ltd.—Sir Joseph Nall, the chairman, stated at the annual general meeting on March 27th that in 1944 they had sold 1,401 million kWh, including surplus sold to the C.E.B. This compared with 862 million kWh sold in 1939. The gross operating revenue in 1944 amounted to £3,301,000, compared with £1,576,000 in 1939, while gross operating expenditure was £2,516,000 (£916,000). In the five years of the war the company had paid £1,272,445 in national taxation in addition to £441,264 for local rates. Due to restrictions capital expenditure on mains and plant had averaged a little over £101,000 per annum, compared with £486,000 per annum in the previous five years. The maximum demand on the undertaking reached a record of 217,000 kW during 1944. They had been directed by the Central Board to extend the Kearsley station by a further 104,000 kW and orders for this plant had been placed at a cost of £3,500,000, which was about double the pre-war price. Considerable extensions to the distribution network were contemplated as and when labour and materials could be made available.

The Bournemouth & Poole Electricity Supply Co., Ltd.—Referring to the annual general meeting on March 27th to the local authorities' option to purchase the undertaking, Sir Robert Renwick, the chairman, said that a purchase now would disclose an increase in the value of assets of between 50 and 65 per cent. and it would be remembered that the terms of purchase were the market value of the assets at the time of purchase. The very large sum required for the purchase would be new money of an unproductive nature at the very time when the country would want vast capital sums expended in a productive way if we were to have implemented Government programmes of full employment and social security. The payment

of an enhanced purchase price due to wartime circumstances was not likely to lead to a reduction of prices to consumers, but on the contrary to an increase. The undertaking was already involved in a new capital venture costing £4,000,000 to provide a new generating station and £1,500,000 for transmission and development. If the Government authorities permitted this purchase to take place they were likely to do so only on the condition that there was also purchased the very large rural area held by the company and the areas of the subsidiary companies adjoining. The wide experience of generation and transmission of the County Company group was at the disposal of the Bournemouth Company at the moment, but this experience was not purchaseable by the corporations.

The Clyde Valley Electrical Power Co.—Presiding at the annual general meeting on March 27th Mr. Robert Robertson, the chairman, said that the company's generating stations had been extended and the capacity of the plant had been increased by 120,000 kW since 1938; of this 90,000 kW had been installed since the beginning of the war. They had now 257,500 kW of steam generating plant, with 15,500 kW of hydro-electric plant belonging to the associated company, the Lanarkshire Hydro-Electric Power Co. The hydro-electric plant had operated at the very high average annual load factor of 57 per cent., and since the beginning of 1939 had saved over 300,000 tons of coal. The maximum demand of consumers in December, 1938, was 143,260 kW. Last December it was 234,410 kW, the annual consumption increasing from 464 million to 980 million kWh. Charges for electricity supplied to domestic consumers had not been increased since the beginning of the war, despite heavy increases in operating costs.

The British Aluminium Co., Ltd.—Mr. R. W. Cooper, presiding at the annual meeting on March 27th, said that the urgent internal increase in the production of aluminium since the beginning of the war had been accomplished as far as possible by completing their Lochaber scheme, increasing output at Kinlochleven by the utilisation of transmitted power, and by erecting and managing a plant on behalf of the Government where power was obtained from a steam station. They were also associated with two further developments for the production of the metal by the use of transmitted power. With the exception of the Lochaber hydro-electric extension, all these additional producing units had to be closed down last year on account of the coal situation, and there appeared to be little likelihood of their being restarted.

To meet the additional production of aluminium their latest chemical factory at Newport, Mon., was materially enlarged and minor extensions were carried out at their Burntisland and Larne alumina works. Their rolling mills at Milton and Warrington were largely extended and a new factory was put down to provide for the heat treatment of high

strength alloys. In addition they had designed and erected an entirely new rolling mill which was the largest of its kind in the country and contained the most up-to-date plant. After the war they had no doubt of the ultimate absorption of the world's output and the utilisation of the increased fabricating facilities.

Associated Electrical Industries, Ltd., reports that after providing for taxation and £235,857 (£235,295) for depreciation, the net profit for 1944 was £467,543, against £459,971 for 1943. Special reserve account again receives £150,000 and the ordinary dividend is maintained at 10 per cent., leaving £320,454 (£301,309) to be carried forward. The consolidated balance sheet, which includes subsidiaries, shows that total assets have increased from £32,161,884 to £33,563,547.

The Midland Electric Manufacturing Co., Ltd., records a trading profit for 1944, after taxation, amounting to £46,462 (£44,385). Interest and fees bring the total to £48,623 (£46,594). Directors' fees take £200 (same), leaving a net profit of £48,423 (£46,394). After paying preference dividends £2,813 (£2,812) and again placing £20,000 to general reserve, the ordinary dividend is maintained at 10 per cent., with a bonus of 15 per cent. (same) and £35,820 (£28,960) is carried forward.

The Cambridge Instrument Co., Ltd., records a profit for 1944 (after providing for taxation) of £45,574, as compared with £49,049 in the previous year. The pensions fund receives £1,000 and directors' fees take £850. A dividend of 15 per cent., tax free, is again paid but the bonus is reduced from 6d. to 3d. tax free. The carry-forward is increased to £11,400 to £11,539.

Brown Bros., Ltd.—Mr. J. Albert-Thomson, chairman and managing director, said at the annual general meeting on March 26th that the removal of certain restrictions on trading with overseas markets had improved the prospects of the export side of their business. There were great potential markets both at home and abroad for their goods and they faced the future with confidence and optimism, tinged with apprehension lest business should be stultified or stifled by the retention of bureaucratic controls long after their usefulness had ended.

The India Rubber Gutta Percha & Telegraph Works Co., Ltd.—Sir Walrond Sinclair, the chairman, stated at the annual general meeting on March 28th that notwithstanding the difficulties which faced the rubber manufacturing industry as a whole and the company's own special problems, he looked forward with the greatest confidence to its successfully taking its proper place in post-war reconstruction and development.

Hoover, Ltd.—Reviewing the company's contribution to the war effort, Mr. C. B. Colston, chairman and joint managing director, stated at the recent annual general meeting that the company's major effort had been in the manufacture of small rotary transformers, of which during the war they had made approximately 750,000. In addition they had manufactured huge numbers of plugs and sockets, complete wiring installations for aircraft, fractional-HP motors, blowers, engine-speed indicators, engine starters and other electrical and non-electrical

equipment. They were operating eight factories and in addition had organised ten outworking units employing 1,758 women. The range of peacetime products would be wider than before the war and they were negotiating with the Government for a new factory in Scotland. Their associated companies in France, Belgium and Switzerland had kept their heads above water and were anxious to start trading with them again.

The Coventry Gauge & Tool Co., Ltd., reports a net profit for the year ended August 31st last of £27,753 (£24,021). A dividend of 7½ per cent. with a bonus of 7½ per cent., both tax free (same) is to be paid, leaving £94,041 (£85,098) to be carried forward.

Presiding at the annual general meeting on March 28th, Mr. H. H. Harley said that owing to the general nature of their business they would be able to turn over quickly to peacetime production. They were in process of making certain important arrangements to foster future export trade.

The British Oxygen Co., Ltd., proposes to issue a million cumulative second preference shares of £1 each at par. The new shares, which will carry a cumulative dividend of 4 per cent., are to be provisionally allotted to ordinary shareholders on the register at March 16th in the proportion of one new preference share for every complete £3 10s. ordinary stock or fraction.

The Telephone & General Trust, Ltd., is to pay a final dividend of 5 per cent. (same) on the ordinary stock, again making 8 per cent., and also a dividend of 8 per cent. (same) on the "A" ordinary shares. The profits for 1944 amounted to £120,463 (£115,469), and £77,175 (£73,708) is carried forward.

The Globe Telegraph & Trust Co., Ltd., announces a quarterly interim ordinary dividend of 1 per cent.

A. C. Cossor, Ltd., are again to pay an interim dividend of 3 per cent.

The Renold & Coventry Chain Co., Ltd., is maintaining its interim dividend at 3 per cent.

The Shropshire, Worcestershire and Staffordshire Electric Power Co. is paying a final dividend of 3 per cent. (same) on its "B" ordinary shares, again making 5½ per cent.; and 4 per cent. on the "A" ordinary, making 8 per cent. (same).

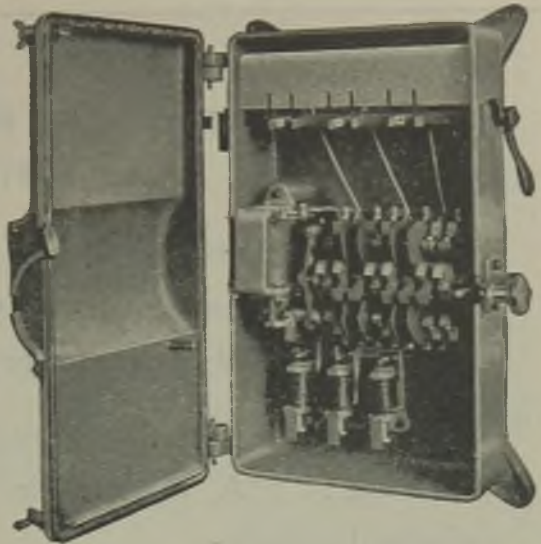
The Wessex Electricity Co. is again paying a final dividend of 3 per cent., making 5 per cent. (same).

The South Wales Electric Power Co. proposes to pay a final dividend of 4 per cent. (3½ per cent.), making 6 per cent. (5½ per cent.) for the year.

The Electric Supply Cpn., Ltd., is paying a final dividend of 6½ per cent. (same), again making 10 per cent. for the year.

The North Somerset Electric Supply Co., Ltd., is maintaining its dividend at 7 per cent. The net profit for 1944 was £62,880 (£62,234).

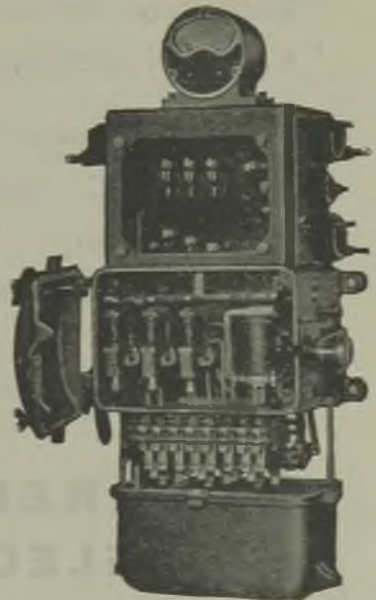
The Oakham Gas & Electricity Co., Ltd., reports a combined profit for 1944 of £4,021, of which the electricity undertaking provided £3,248. A dividend of 3 per cent. is to be paid on the original ordinary shares and 2·4 per cent.



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LONDON AND BRANCHES

and 2.1 per cent. respectively on the 8 per cent. and 7 per cent. new ordinary shares. The carry-forward is £433.

The American Telephone & Telegraph Co., in a preliminary report for 1944, records an operating revenue of \$230,192,000 (\$209,575,761) and a net income of \$163,138,000 (\$168,530,764). Dividends take \$171,924,000 (\$168,478,336), leaving a deficit of \$8,786,000 as compared with a surplus of \$52,428.

New Companies

Birmingham Electric Furnaces, Ltd.—Private company. Registered March 20th. Capital, £100. Objects: To carry on by itself or through subsidiaries the business of designers and manufacturers of and dealers in electric and other furnaces and heating appliances, for melting, smelting, annealing, heat treatment, or other purposes, etc. So long as Birlec, Ltd., or any nominee or subsidiary thereof holds three-fourths of the issued shares, that company shall be the sole director and manager. Delegate director: D. O. Evans, Pigeonsford, Blangranog, Llandyssul, Cardigan, vice-president of the International Nickel Co. of Canada, Ltd. Registered office: Grosvenor House, Park Lane, W. 1.

S. W. C. Wanstall, Ltd.—Private company. Registered March 24th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in electrical, radio and mechanical apparatus and accessories, etc. Directors: S. W. C. Wanstall and Mrs. M. L. Wanstall, both of 204, High Road, Loughton, Essex. Registered office: 204, High Road, Loughton.

Loughton Radio & Electrical Co., Ltd.—Private company. Registered March 24th. Capital, £1,500. Other particulars as for S. W. C. Wanstall, Ltd. (above).

H. Russell & Co. (Walsall), Ltd.—Private company. Registered March 22nd. Capital, £3,000. Objects: To acquire the business of a manufacturer of ship, train and general electric lighting fittings carried on by H. Russell, sen., at 143, Bridgeman Street, Walsall, as H. Russell & Co. Directors: H. Russell, sen., 17, Persehouse Street, Walsall, and two others. Registered office: 143, Bridgeman Street, Walsall.

W. Hampton (Stafford), Ltd.—Private company. Registered March 8th. Capital, £2,000. Objects: To acquire the business of an electrician, electrical engineer, etc., formerly carried on by the late William Hampton at 1a, Bridge Street, Stafford. Permanent directors: W. G. Harrison, Mill Bank, Stafford, and H. M. Gardner, 3, Bridge Street, Stafford.

Electro-Lifts, Ltd.—Private company. Registered March 12th. Capital, £1,000. Objects: To carry on the business of mechanical and electrical engineers, etc. Subscribers: R. C. Yablon, 17, Bridge Street, Bradford, and Mary Stanworth, 8, Poplar Drive, Sandbeds, Bingley. F. W. Margeson is one of the first directors. Registered office: 17, Bridge Street, Bradford.

Modern Telephones (Overseas), Ltd.—Private company. Registered March 21st. Capital, £1,000. Objects: To carry on the business of manufacturers and exporters of telephone equipment, etc. Directors: E. Ivens, The

Pines, Northcote Road, Horsley, Surrey; and T. W. Torrance, 8, Grange Avenue, Leagrave, Luton (both directors of Modern Telephone Co., Ltd.). Registered office: 139, Tottenham Court Road, W. 1.

United Electronics, Ltd.—Private company. Registered March 20th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, wireless and television apparatus, electric batteries and accessories, etc. Subscribers: D. Sefton, 49, Clifton Avenue, S. W. 19, and Joan Scott-Smith, 59, Southampton Street, Reading. Secretary: Miss Joan Scott-Smith.

Heating and Sanitation, Ltd.—Private company. Registered March 13th. Capital, £1,000. Objects: To carry on the business of electrical engineers, manufacturers of and dealers in automobiles, cycles, aircraft, vehicles, etc. Directors: J. O. Frogley, 20, Fairfield Drive, Dorking, and F. Marchant, Haddon, Pett Road, Guestring, Sussex. Secretary: J. O. Frogley. Registered office: 640, Finchley Road, N. W. 11.

Companies Struck off the Register

The following companies have been struck off the Register: Electro-Metallic Recovery Co., Ltd.; Northern Electric (London), Ltd.; Ismay Zeros, Ltd.; Radiometers, Ltd.; and Radio Winton & Television, Ltd.

Companies' Returns Increases of Capital

Cuttriss Radio & Electrical, Ltd.—The nominal capital has been increased by the addition of £1,800 in £1 ordinary shares beyond the registered capital of £200.

Electrical & General Accessories (Leicester), Ltd.—The nominal capital has been increased by the addition of £18,000 in £1 shares beyond the registered capital of £2,000.

Rylands Electrical Co., Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 shares beyond the registered capital of £1,000.

Mortgages and Charges

British Unit Heater Co., Ltd.—Mortgage on properties, etc., at Colnbrook, Middx., dated March 6th, 1945, to secure £7,000 with premium of one per cent. on repayment. Holders: Friends Provident and Century Life Office.

Liquidations

Cuba Submarine Telegraph Co., Ltd.—Winding up voluntarily. Liquidator, Sir Alan Rae Smith, 5, London Wall Buildings, E. C. 2.

Bankruptcies

D. A. M. Trew, trading as "Trew Electrical Service," 59, Primrose Hill Street, Coventry, electrical dealer.—Application for discharge to be heard on April 16th at the County Hall, Coventry.

H. J. C. Luckeuck, radio dealer, trading as Herbert Luckeuck, jun., at 328, Welford Road, Leicester.—Order made for discharge as from August 8th next.

STOCKS AND SHARES

TUESDAY EVENING.

EASTER made comparatively little difference to the Stock Exchange markets this year. Before the holiday, business fell away to some extent, though not in so marked a manner as it does ordinarily. On the return to business to-day, most of the markets continued the firmness which characterised them on the eve of the breaking-up. The early end of the war in Europe is awaited with such confidence that business in stocks and shares goes on almost as though peace had been declared, though what will happen when the long expected announcement is made even the oldest and most experienced members of the Stock Exchange express their inability to foresee.

Cable and Wireless

One of the features of the last days of March in the Stock Exchange was a rise of 2 points, to 90½, in the price of Cable & Wireless ordinary. This followed upon a previous rise of 3½ points, as recorded in last week's issue. The ordinary stock is the subject of a mild speculation at the present time, rumour toying with the idea that after the war Cable & Wireless may be constituted into an official board. If the combine were to become a quasi-official undertaking, it would raise, of course, the status of the stocks. What degree of truth there may be in the suggestion it is impossible to say, but judged by the character of the buying that has lifted the stock so materially during the past month, it would seem as though some foundation may exist for the optimistic views now current. Curiously enough, the preferred stock has gone back by 4½ points, to 113½. This has led to the supposition that some of the preferred stockholders are exchanging into the ordinary.

Reports and Dividends

The majority of company reports and dividends in respect of the year ended 1944 make a favourable showing. It is not every case, however, where the figures for last year are in excess of those in the previous twelve months. In fact, some of them show a decrease, though dividends are generally maintained without the financial stability of the company being in any way impaired. From the experience of last year, it would appear that the labour shortage had become more acute, and that, at the same time, costs showed an advance. In view of the conservative policy pursued by most of the leading industrial companies at the present time, a moderate reduction in profits need cause neither anxiety nor surprise, and that this is generally recognised, share quotations bear obvious witness by their stability. The Scottish Power Company, as an example,

puts aside the larger sum of £245,000 for depreciation, renewals and reserves for its subsidiaries, with the result that the net amount left for the Scottish Power Company is £307,600, a reduction of £25,000 as compared with 1943.

The Chairmen's Speeches

At all the meetings of shareholders held recently by the electricity supply companies, the chairmen have dwelt upon the imperative need for the companies to operate independently, without the official control which, according to the speakers, would inevitably lay a check upon electrical development and progress. Bureaucrats, once they have obtained a hold, are usually loth to release it, but in view of the seriousness of the post-war situation from the point of view of national well-being, it might be supposed that the utility companies would be permitted to expand in their own way.

Price Fluctuations

Midland Counties Electric ordinary have risen 1s. 6d. to 43s. 6d., persistent demand finding a shortage of supply. Bournemouth & Poole are 1s. up at 65s., on the good report and figures. Gains of 6d. lifted British Power & Light to 34s. and West Gloucestershire to 26s. The manufacturing and equipment group is unusually quiet. There is little change of consequence. De la Rue are 2s. 6d. higher at 11½. Vactrics followed last week's rise of 3s. 9d. with an advance of 2s. 9d., making the price 23s. 9d. Telegraph Constructions are a florin higher at 62s. Callender's at 118s., Burco 15s. 6d., Laurence Scott 14s., have secured small improvements. The radio market is irregular, E.M.I. being a few pence lower at 34s., while Cossors are 6d. harder at 33s. Associated Electrical Industries at 56s. 9d. are 6d. down and General Electrics drooped to 97s. 6d.

Consolidated Signal

Discrepancy between the prices of Westinghouse Brake and Consolidated Signal shares has prevailed for many weeks past, but it becomes more noticeable now that the Consolidated Signal Company has raised its dividend to 28 per cent. The Consolidated Signal owns 391,112 Westinghouse Brake shares, and derives its profit entirely from the dividends received from these.

Consolidated Signal shares can be bought at 6½, giving a return at that price of £4 0s. 6d. per cent. on the money. Westinghouse Brake shares stand at 79s. middle. Last year's dividend was 14 per cent., which gives a return, at 79s., of £3 10s. 9d. per cent. The expense of making an exchange from one into the other might be considered too considerable to justify a swap, but for new money that is going into the companies.

Choosing an Export Agent

Need for Adequate and Efficient Organisation

ALTHOUGH it is obviously impossible to give advice on the choice of an agent who would best serve the interests of every manufacturer desirous of securing export trade, the following notes may give some guidance to those contemplating entering the export market for the first time.

From appropriate trade and technical journals the manufacturer can obtain some interesting facts of the activities of overseas agents handling related lines to those of his own. He will probably find also that mention is made of the activities of large buyers, such as chain stores, from which he can glean much information of the products they are seeking. From the London offices of various publishers he will no doubt be able to secure specimen copies of trade journals, newspapers and periodicals circulating in the markets in which he is principally interested, and these will serve to guide him on the style of display should he be contemplating Press advertising in those countries. From the advertisements he can obtain the names and addresses of reputable agents for good, established British products appealing to the same trades as those in which he is most interested. A careful study of all these advertisements and publications will assist the manufacturer very considerably.

Agents' Organisations

If he so desires, he can invite applications for his agency and possibly sort out, from the many replies he will probably receive, a suitable agent. He must use sound judgment in his choice because he will perhaps be inundated with letters from individuals who promise to work wonders if only the manufacturer will grant them the sole selling rights immediately. Something more tangible than just promises is required and the manufacturer must ensure that the agent of his choice can provide an essential selling and distributive organisation adequate and efficient enough to handle his goods satisfactorily, and to meet the demands which the manufacturer hopes to create.

In the larger overseas countries he must ensure that the agent will carry stocks in suitably dispersed areas to serve the needs of all prospective users. It is obvious that if the agent transacts his business from only one principal town he cannot be expected adequately and conveniently to serve his own sub-agents and the industries spread over the whole country.

It must be realised, however, that efficient agents do exist who specialise in the selling

By "Sala" and distribution of manufacturers' products within a specified area and that two or three such agencies can be arranged to cover the whole country. In such an event it would be very advisable for the manufacturer to come to a very definite arrangement that the sole selling rights granted to each agent cover only the specified areas which they serve. In actual practice this might not work out very satisfactorily and friction might later be created over boundary problems. A very close understanding and guarantee would be necessary between the agents themselves, but the arrangement is quite workable if the various differences which might arise are smoothly ironed out between the agents.

From his experience in the home market the manufacturer must have a good idea of which channels of distribution best serve his purpose. He will find that certain overseas agents specialise in serving one section of the industry, or are specialists in a particular range of products. For example, in the electrical industry he might find that one agent specialises in the sale of small accessories whilst another concentrates more on the sale of heavy electrical machinery.

Competitive Items

Any other agencies which the agent holds for related products will assist the manufacturer in his choice. No hard and fast rule can be adopted. The manufacturer might assume that an agent whose qualifications are otherwise satisfactory, but who already handles more expensive items than his own, would not have the same enthusiasm for the smaller, inexpensive lines. The efficiency and adequacy of the agent's selling and distributive organisation is the main thing that should sway the manufacturer's choice. No doubt it would not be difficult for the manufacturer of small, inexpensive items to prove to the agent that the volume of business he can secure on those small items of perpetual requirement can bring him in a larger profit than concentration on the sale of more expensive items that have only a limited demand which, when satisfied, is not repeated to anything like the degree of the smaller items. He will obviously avoid coming to terms with an agent who might be also holding the agency of one of the manufacturer's competitors, although any reputable agent would decline the offer of an agency were he already acting for a competitor.

And now for the pitfalls to be avoided in export trade. Unless a genuine understanding exists that the agent will stock the manufacturer's goods at convenient distribution

centres and will put his full effort into assisting the manufacturer to develop his market, the question of immediately granting sole selling rights to that agent will be treated cautiously by the manufacturer.

Of all the problems of distribution which face the manufacturer that of granting the sole selling rights of his product for a fixed period is the most difficult. Without any previous experience of the agent, he feels that he is blindly committing himself for that fixed period of time, which in fact he is. The agent might be a complete failure and all the manufacturer's efforts and expenditure to create a market for his product will be of no avail if the agent's part in assisting the sales and meeting the demands created is not carried out adequately and efficiently.

Whilst it may conflict strongly with the opinions of the agents themselves, some reasonable trial period should exist during which the manufacturer agrees to confine all sales of his product to that country through the agent who he is contemplating appointing. During that trial period the agent will be referred to not as the agent, but as the main stockist or distributor. It may seem hard on the agent to have to work to such a one-sided arrangement, with a possibility that after he has put in so much work on the manufacturer's behalf he may be dismissed as unsuitable at the end of the trial period. He must appreciate the manufacturer's point of view, however, and if he does that he will realise that the arrangement is not so one-

sided as it may seem. The manufacturer cannot even start to introduce his product unless he can tell his prospective customers where supplies are available in their country. Without adequate advertising to introduce and popularise his product the manufacturer will make little headway in creating a demand. With adequate advertising that demand will no doubt be created.

It is up to the agent, therefore, to prove during the trial period that he is capable of holding the sole selling rights of the manufacturer's product. After all, whatever he puts into the job of assisting the manufacturer during that trial period he will profit by in the commission he receives on the sales that have been made. The arrangement, admittedly, has its disadvantages in that the agent is not encouraged to appoint the necessary local agents and stockists who are all a part of his full scheme of adequate distribution.

Finally, whether an agent has been officially appointed or is on trial, the manufacturer must realise that the agreed commission on all sales to, or intended for, the country in which the agent represents the manufacturer shall be paid to the agent. Attractive pieces of business may come the manufacturer's way in the form of orders from English export houses or possibly direct from the agent's country. A suitable arrangement beforehand with the agent as to how such business shall be handled will save endless friction.

NEW BOOKS

Engineering Research. By R. A. Collacott. 24 pp. Crosby Lockwood & Sons, Ltd., 20, Tudor Street, E.C.4. 1s. 6d.

As an introduction to research in engineering, this little book should prove helpful to the student or junior engineer in indicating the significance of the subject in relation to his own studies (which should, the author considers, include research) and to the electrical industry as a whole. Dealing mainly with applied research, the text furnishes numerous examples of its practical utility and points out the scope for it in even small firms. For readers seeking further information than can be compressed into the brief space at the author's disposal references are given to various sources.—C.O.B.

Greek Science. By Benjamin Farrington. 143 pp. Penguin Books, Harmondsworth, Middlesex.

The intellectual attainments of ancient Greece are generally regarded as reaching their zenith in the era of Socrates, Plato and Aristotle, but in many ways, the author of this book contends, the scientific outlook of this period was not so close to our own as was that of the less sophisticated century before—*i.e.*, just after 600 B.C. The earlier investigators, such as Thales, regarded science as a technique for the control of natural environment—an approach that

accorded with the Baconian view that "in nature practical results are not only the means to improve well being but the guarantee of truth." On the other hand, in the fourth and fifth centuries B.C., owing to the institution of slavery, the philosopher became concerned with abstract thought divorced from its practical applications, which was held to be a matter for slave craftsmen, resulting in relative sterility in technical development. While the influence of this dichotomy on the evolution of science provides an important theme of the work, its main aim is to promote a better knowledge of the technical history of classical antiquity.—C.O.B.

Books Received

An Introduction to Electronics. By Ralph G. Hudson. (97 pp. 72 illustrations and index.) The Macmillan Co., 60, Fifth Avenue, New York, U.S.A. Price \$3.

Journal of the Electrodepositors' Technical Society. (60 pp. with illustrations and index.) Eleven papers and proceedings. Northampton Polytechnic Institute, St. John Street, Clerkenwell, London, E.C.1. Price 21s. bound.

Electric Traction for Cranes. By Richard A. West, B.Sc., Hons. (Eng.), A.M.I.E.E. (Igranic Electric Co.) Pp. 86; illus. Sir Isaac Pitman & Sons, 39, Parker Street, W.C.2. Price 15s.

Notes from France

From our Paris Correspondent

Power Projects.—The Ministry of Reconstruction aims at complete electrification in France and this is said to be causing some disagreement with the construction companies. The Ministry wants to see the smallest cottage equipped with electricity not only for lighting but also for cooking and heating and has drawn up plans for the installations including the power which will be necessary. The Syndicate of Power Producers is in agreement with the idea but considers that the amount of power projected is excessive. I understand that the talks are proceeding and that agreement will be reached sooner or later.

Reconstruction work is only in its first stages and most of the work done is of a temporary nature in order to supply sufficient electricity for lighting. Production is being maintained at between five and six million kWh per day, although reconstruction work in the Mareges has been responsible for a slight falling off.

It has been estimated that French water power is capable of producing about 30 milliard kWh per year. The Government is now studying numerous projects which will, in a few years' time, exploit that potential to the full. New methods of bringing power from the Alps, the Pyrenees and the Massif Central are being studied, and it is expected that the present projects, now under consideration, will increase production by about 10 milliard kWh per year.

Damage to the Kembs barrage as a result of German destruction has now been assessed, and it is serious. On the south side of the barrage two sluice gates were blown up and there has been a serious drop in the water level. It is expected that the work of repair will take anything from six months to one year.

Nationalisation Proposals.—There is a good deal of uneasiness among electricity producers regarding the growing demand for nationalisation. Monsieur Roger Durand, of the Energie Industrielle, told the *Electrical Review* correspondent that during the occupation producers were asked by the Germans to undertake a programme for linking French with German lines for the purpose of supplying the Reich with power. The producers steadfastly refused to do this. He also said that the Germans asked that all copper lines should be dismantled so that the copper might be sent to Germany. Producers were compelled to dismantle some lines but the Germans received only a fraction of what they asked for.

During the occupation two barrages in the Massif Central were proceeded with in spite of pressure to stop construction. This kept thousands of men employed and so saved them from being sent to Germany. It is stated that the electrical industries managed to keep more of their personnel than any other industry.

Monsieur Durand admitted that there was room for considerable reorganisation among distributors and agreed that there would have to be serious rationalisation and combining of distributors to meet the demands of the country. He did not believe, however, that nationalisation would help very much; the enormous reconstruction plans, now nearing completion, could best be carried out by private enterprise.

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.

AKT.-GES. Brown, Boveri & Cie.—“Mercury current collector, particularly for unipolar dynamo-electric machines.” 6638/43. May 16th, 1942. (567984.)

Aron Electricity Meter, Ltd., and E. J. Riordan.—“Prepayment mechanism for electricity and other meters.” 10361. June 26th, 1943. (568100.)

A. Bailey and Castle Fuse & Engineering Co., Ltd.—“Electric cable terminals specially applicable for wireless apparatus.” 9619. June 16th, 1943. (567993.)

K. Brenkert.—“Electrode feeding mechanism.” 14696. October 20th, 1942. (568036.)

British Thomson-Houston Co., Ltd.—“Pressure relief devices.” 12701/43. August 11th, 1942. (568055.) “Electric lampholders.” 11149/43. July 11th, 1942. (568103.)

Chloride Electrical Storage Co., Ltd. (E. Graf).—“Electric accumulator or storage battery cells.” 15067. September 14th, 1943. (568033.)

J. A. Crabtree & Co., Ltd., H. F. McLoughlin, B. G. Harrison and J. F. Duffield.—“Plugs of electric couplings.” 8745. June 1st, 1943. (568097.)

W. C. Fairweather (Singer Manufacturing Co.).—“Controller for electric motors.” 13584. August 20th, 1943. (568024.)

E. Fawssett.—“Apparatus for measuring or indicating distances between opposed surfaces or opposed parts of a continuous surface.” 6739. April 28th, 1943. (568069.)

Ferranti, Ltd., and N. Newton.—“Control of automatic voltage regulators operating in parallel.” 11137. July 9th, 1943. (567995.)

General Electric Co., Ltd., and W. Schiff.—“Protective devices for metal vapour electric discharge converters.” 14368. November 7th, 1941. (568008.)

J. E. Leech.—“Telephones.” 13576. August 20th, 1943. (568058.)

Marconi's Wireless Telegraph Co., Ltd.—“Measurement of losses in radio-frequency circuits and components thereof.” 16006/43. September 30th, 1942. (568116.)

Mullard Radio Valve Co., Ltd., and K. E. Latimer.—“Attenuators for electric signalling systems.” 13949. August 26th, 1943. (568107.)

Murphy Radio, Ltd., G. B. Baker and J. H. Balean.—“Aids for deaf persons.” 13804. August 24th, 1943. (568027.)

Omes, Ltd., and C. Rogati.—“Electric heating apparatus for billets and the like.” 1458. September 6th, 1943. (568110.)

Patentverwertungs-Patelhold & Elektro-Holding Akt.-Ges.—“Arrangement for automatically influencing the tuning of oscillation circuits.” 11290/43. July 10th, 1942. (568053.)

G. R. Shepherd (Westinghouse Electric International Co.).—“Insulating material.” 7489. May 11th, 1943. (568071.)

Walsall Conduits, Ltd., and E. Gough.—“Electric tumbler switches.” 13575. August 20th, 1943. (568106.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

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

Australia.—May 28th. Mackay City Council, N.S.W. 2,500-kW turbo-alternator. Contract 42/45. Plans and spec. (10s. 6d.) from A. E. Axon, consulting engineer, Bank of Australasia Chambers, Brisbane.

Cleethorpes.—April 23rd. Electricity Department. Switchgear, transformers and cable. (March 23rd.)

Littleborough.—April 10th. Electricity Department. 500-kVA transformer. (March 23rd.)

Manchester.—April 7th. Electricity Committee. Service cut-outs and cables. (March 16th.)

Middlesbrough.—April 20th. Tees-side Rail-less Traction Board. Two 300-kW mercury-arc rectifiers, etc. (March 9th.)

Orders Placed

Glasgow.—Corporation Electricity Committee. Accepted. 6,000-kVA transformer (£4,865).—Bruce Peebles.

Corporation Transport Committee. Accepted. Trolley wire (£3,940).—Thomas Bolton & Sons and I.C.I. Metals. Bow collector plates.—North British Steel Foundry. Cable.—Scottish Cables (special offer).

London.—FULHAM.—Electricity Committee. Accepted. Low-pressure pipework.—Stewarts & Lloyds. Turbo-alternator and condenser.—Metropolitan-Vickers Electrical Co.

METROPOLITAN WATER BOARD.—Accepted. Electric pumps for Ferry Lane pumping station (£4,382).—Harland Engineering Co. Air compressor (£104).—Hamworthy Engineering Co.

Newcastle-on-Tyne.—City Council. Accepted. Installation of electric heating appliances in the isolation block at the City Hospital for Infectious Diseases (£200).—R. H. Patterson.

Oldham.—Electricity Committee. Accepted. Two 1,000-kVA and two 750-kVA transformers.—Metropolitan-Vickers. Extension of "Mulsifyre" equipment at Chadderton generating station.—Mather & Platt.

Portsmouth.—City Council. Accepted. Power station extensions: Supply and erection of 15,000-kVA transformer (£10,380).—British Electric Transformer Co. 400-V board for turbine auxiliaries (£2,024).—English Electric Co. Coal cranes (£31,000).—Babcock & Wilcox. Chlorination plant (£3,500).—Wallace & Tiernan. "Mulsifyre" system (£9,047).—Mather & Platt.

Stockton-on-Tees.—Corporation. Accepted. Four 300-kVA transformers for kiosks in Fairfield Road, Junction Road and Fussick Bridge together with one transformer for emergency.—Crompton Parkinson.

West Hartlepool.—Corporation. Accepted. Equipment for the Regal, Clarendon and Rift House substations.—A. Reyrolle and 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.—New out-patients' department for Royal Infirmary (post-war scheme); medical superintendent.

Angus.—School, Forfar; county architect, County Buildings, Forfar.

Burton-on-Trent.—Additions to Clarence Street Schools (£2,498); G. Moncur, borough engineer, Town Hall.

Chorlton-upon-Medlock.—Ice cream factory, rear York Street, for Duncan & Foster, Ltd.; F. Hill, consulting engineer, 11, Tenterden Street, Bury.

Croydon.—Extensions to Croydon General Hospital (£20,000); secretary.

Goole.—Central library, Carlisle Street (£5,000); J. H. Castle, borough surveyor.

Greenock.—Private patients' unit, out-patients' examination and waiting-room, children's ward and additional staff accommodation (£30,000) for Ear, Nose and Throat Hospital (post-war); R. Greer, chairman.

Lanarkshire.—New bath moulding shop for Jackson Elphick & Co., Ltd. (£5,800); H. B. Kerr, contractor, Blantyre.

Manchester.—Conversion of premises, Mins-hull Street, into juvenile court and probation offices; G. Noel Hill, city architect.

Middleton.—Grammar school, Alkington; borough surveyor.

Ossett.—Warehouse reconstruction, Highfield Mills; W. Walker & Sons, Ltd.

Paisley.—Machine shop and other offices for Thos. White & Sons, Ltd., Laighpark; manager.

Rotherham.—Extensions to Technical College (£40,000); V. Turner, borough engineer, Town Hall.

Rutland.—Additions at the Castle, Oakham; E. J. Williams, architect, 13, New Street, Leicester.

Stockport.—Extensions, Stepping Hill Hospital; H. S. Fairhurst & Son, architects, Chancery Chambers, Manchester, 2.

Stretford.—Factory buildings; Relf and Son, Ltd., timber importers, Shaw.

Sunderland.—Additions to the works: National Galvanisers, Ltd.

Totnes.—Joinery works; Staverton Builders, Ltd.

Warrington.—Works extensions; T. Whittle & Co., Ltd., belt manufacturers, Rose and Crown Street.

Windsor.—Conversion of Lawrence House, Alma Road, into 20 flats (electrical work); G. G. Cullingham, acting borough engineer, 16, Alma Road, Windsor.



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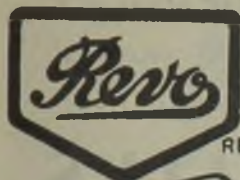
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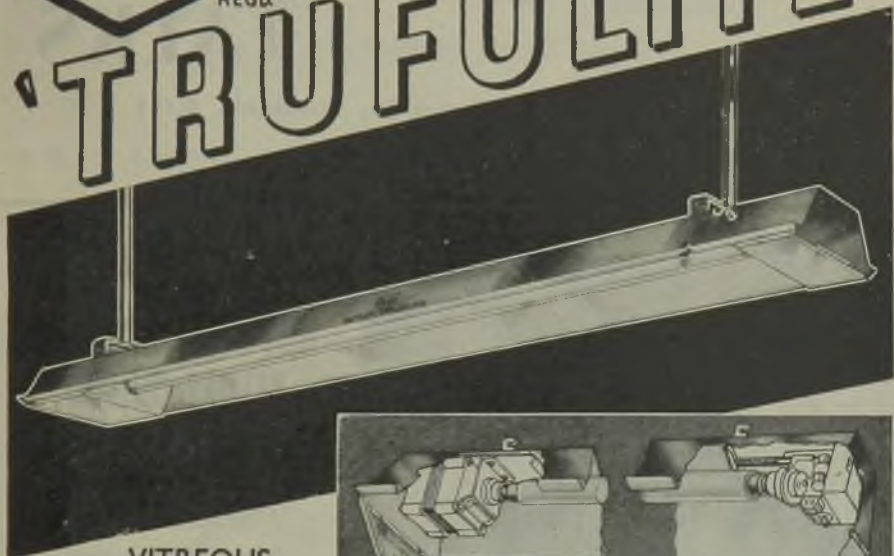
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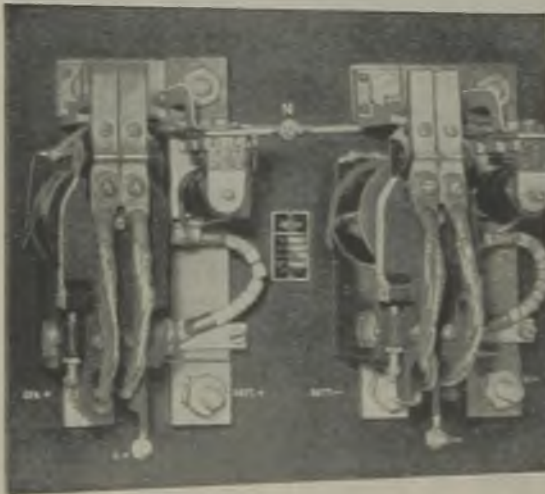
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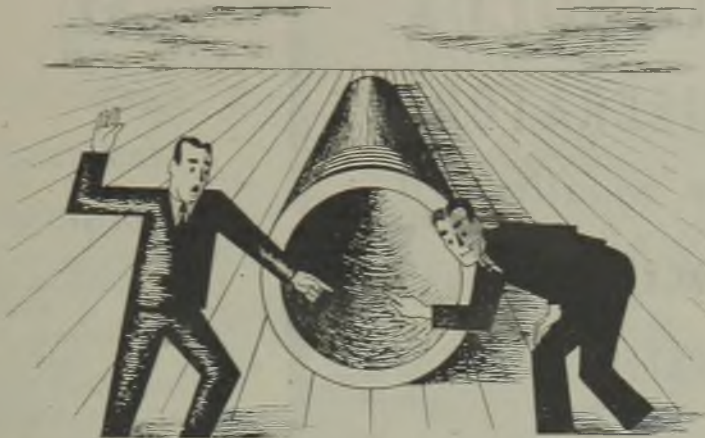
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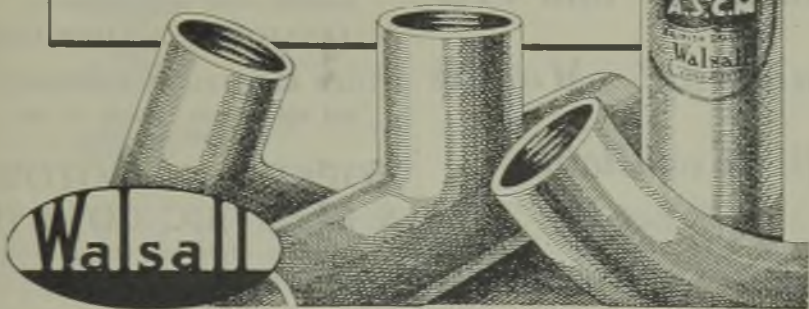
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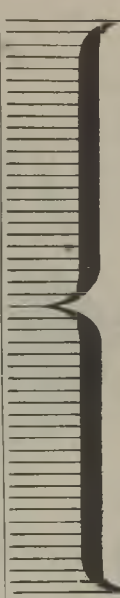
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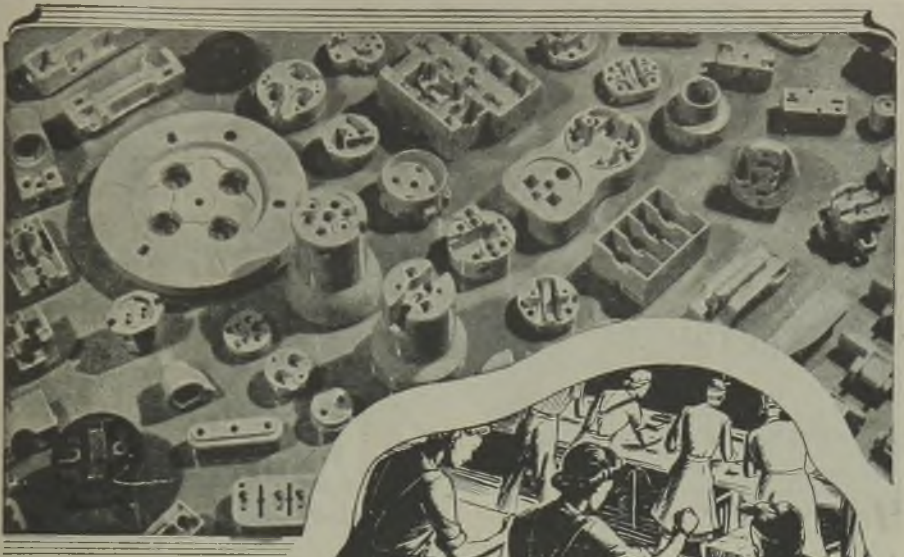
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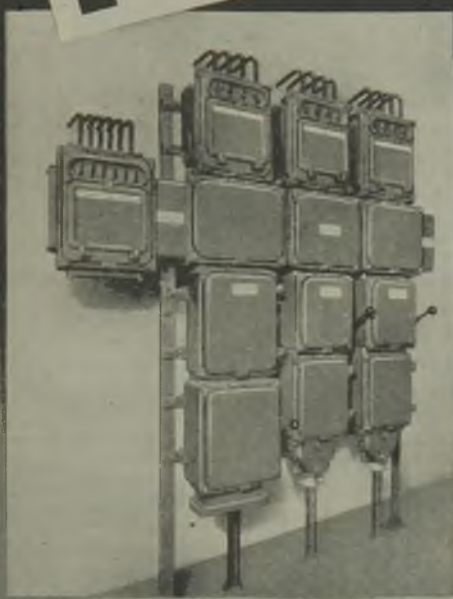
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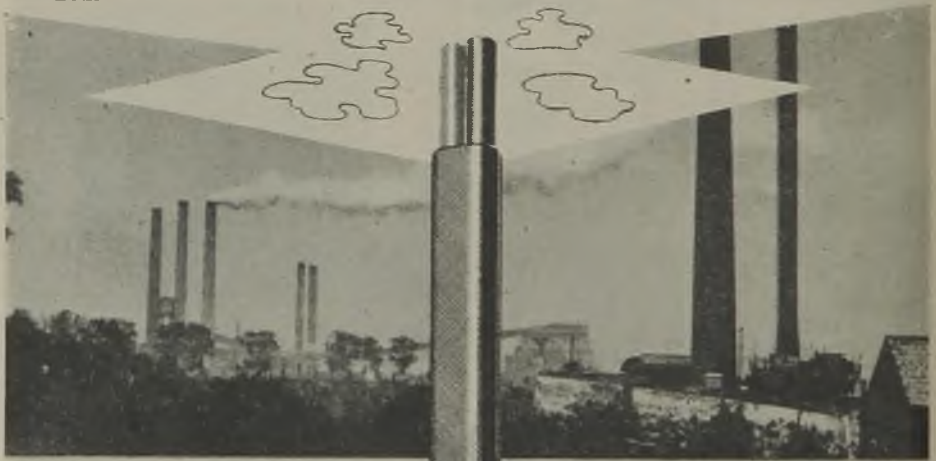
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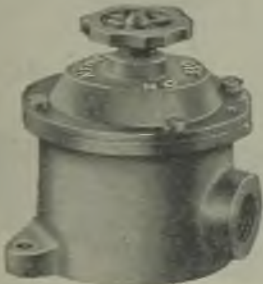
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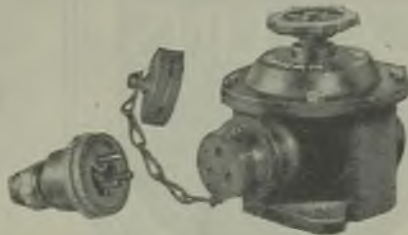


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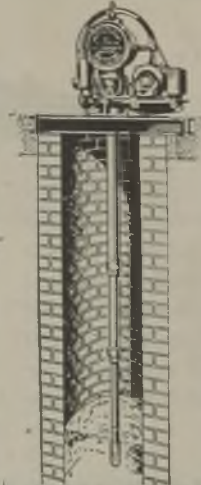
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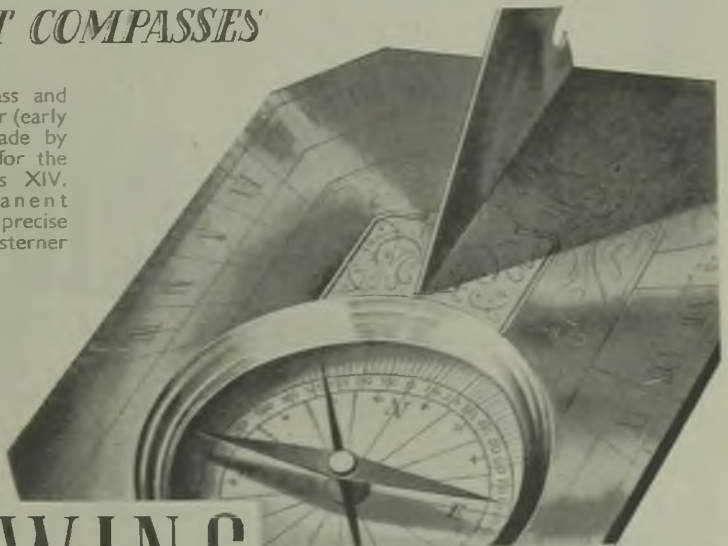


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The old phrase "a gem of the purest water" is particularly applicable to Knowles Electrolytic Plant for the production of hydrogen and oxygen.

Where purity is of prime importance, as in hydrogen for processes involving catalysis, in the hydrogenation of synthetic foodstuffs, etc., the Knowles electrolytic cell produces direct and without further purification, hydrogen which is 99.95% pure, with oxygen 99.8% pure.

The Knowles plant is unique in its simplicity, making it possible to operate with a minimum of labour which need not be skilled. Special devices make the equipment safe under all conditions, maintenance is reduced to negligible proportions, and the plant has exceptionally long life.

Equipment for plants of any size can be supplied.

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ELECTROLYTIC PLANT FOR HYDROGEN & OXYGEN



THE INTERNATIONAL ELECTROLYTIC PLANT CO. LTD.

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HART STORAGE BATTERIES

FOR ELECTRIC LIGHTING AND POWER INSTALLATIONS



HART ACCUMULATOR CO. LTD.

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WITH 'LOX-ALL' ELECTRIC LAMP LOCKS



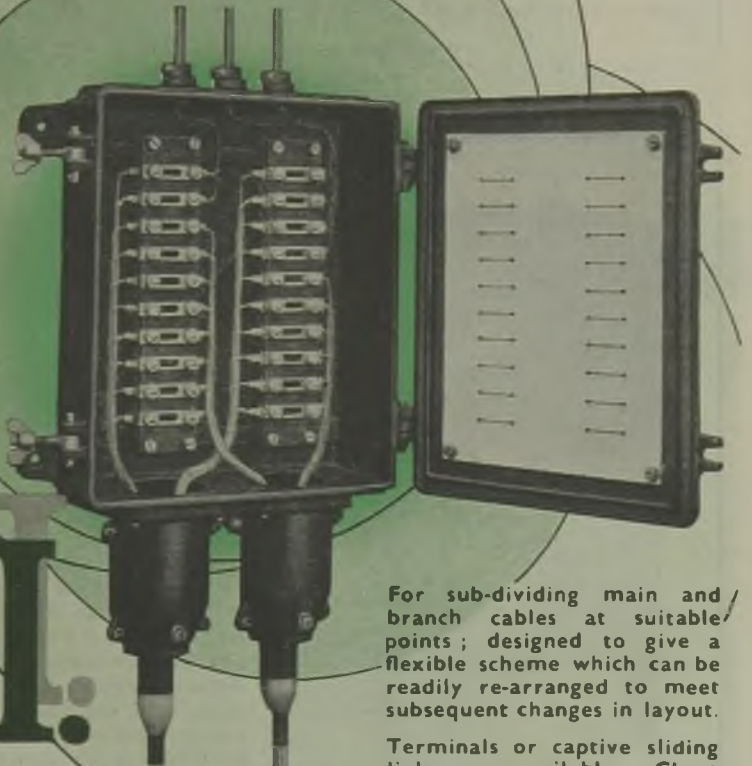
No unauthorised person can remove electric light bulbs when once they are fitted with Lox-All Locks, which prevent theft and reduce breakages... they can be used with all bayonet-type lamp holders and the first cost is the last cost.

Lox-All Locks are extensively used by Government Departments, Municipalities, Public Utility Companies and Industry generally.

Sales Representative: PERCY PHILLIPSON, 169, Piccadilly, London, W.1. Telephone: Regent 1900
 Manufactured and Marketed by CELESTION LTD. London Road, Kingston-on-Thames, Kingston 5656.

THESE BOXES

are being used extensively
for telephone systems
in industrial and allied
applications.



B.I.

DISTRIBUTION and
TERMINAL BOXES
for telephone systems

For sub-dividing main and branch cables at suitable points; designed to give a flexible scheme which can be readily re-arranged to meet subsequent changes in layout.

Terminals or captive sliding links are available. Chart boards are fitted to the inside of the lids, for recording the connections made.

A range of boxes for conductors up to 40 lb. per mile can be supplied with a maximum of 320 terminals or 160 links.

BRITISH INSULATED CABLES LTD.,

Head Office, PRESCOT, LANC'S Tel. No. PRESCOT 6571

WRITE FOR LITERATURE

Burco

begins its post-war programme with the new model

"600"

which sets a new standard in Electric Boiler design and efficiency

Constructed in galvanised steel, excellently finished.

Full opening of the hinged lid gives complete access to boiler, eliminating potential dirt traps. Top casting is aluminium.



Foot press switches on boiler — or three-heat rotary switch on boiler or wall-mounting according to type

Serviceability with Modernity

Particulars from:

BURCO LTD.
ROSE GROVE, BURNLEY



These approved and certified Conduits and Fittings are consistently reliable under the most arduous conditions of service. You can specify none better.

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WALSALL TUBE WORKS
PLECK ROAD, WALSALL. PHONE WAL. 2123

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Switch-over

Tomorrow morning has notoriously proved too late for preparing tomorrow's affairs — they depend for success on today. Which is no doubt why you are making it your business to get a working knowledge of all the new features that may change the character and enlarge the possibilities of post-war British industry. Take into account the wartime development of aluminium alloys, which will play so important a part in peacetime industry. How, and how much, aluminium can be made to help your affairs, we shall be glad to tell you — at once, if you like.

We can give you

FACTS about Aluminium

NORTHERN ALUMINIUM CO. LTD.
BANBURY, OXON Makers of NORAL products



This illustration shows W. & G. Lamp-holders, one of many types of lampholders supplied with and without porcelain interiors.

A wide and comprehensive range of electrical accessories is available to consumers for National Service.

WARD & GOLDSTONE LTD. PENDLETON, MANCHESTER. 6.
ESTABLISHED OVER HALF A CENTURY



**“ M E N D
 AND
 MAKE-DO ”**

There are hundreds of thousands of Venner Time Switches which have been lying idle and possibly unattended during all these war years.

We are now able to undertake their overhaul and repair to enable them to resume a life of usefulness for many years to come.

V E N N E R
 KINGSTON BY-PASS ROAD • NEW MALDEN • SURREY
T I M E S W I T C H E S L T D .



Coal, Air and Water Covered Wire

Not so silly as it may sound to some of the less technical of us. The coils above are wound with Nylon covered wire. Nylon is "built up" from a dibasic acid and a diamine. Both are derived from phenol or benzol, the latter also from ammonia. Phenol and benzol are by-products of coal; ammonia is made by causing hydrogen from water to unite with nitrogen from the air. Hence coal, air and water produce a wire with a covering 100 times more resistant to abrasion than that of other wire in common use. V. & E. Coils include those of every conceivable type and size within the smaller categories. Write us. If we cannot supply you now, our advice may be useful for after the war.



**COILS for
ALL SMALLER
REQUIREMENTS**

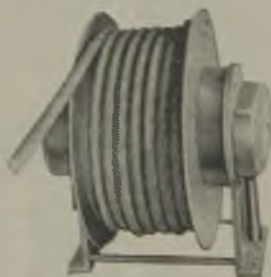
also TRANSFORMERS AND CHOKES

V. & E. FRIEDLAND Ltd. Lowerhouse Mills, Bollington, CHESHIRE

WRITE FOR
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POLES LTD TYBURN RD ERDINGTON,
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**CABLE
DRUMS**

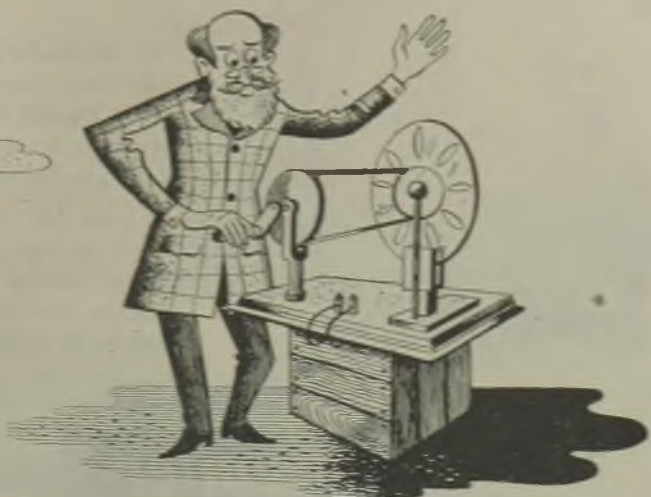
All sizes and types of self-winding drums supplied for electrical cable or pressure hose.

Our experience is at your disposal.

Quotations promptly upon receipt of particulars of your requirements.

The NEWAY ENGINEERING CO. LTD.
BROOK ST., NOTTINGHAM

Telegrams: "Newbeck, Nottm." Phone: 41045 6 Nottm.



To Wimshurst's problem (strange but true!)
 Three words provide a full solution,
 One simple sequence gives the clue:
 Volt, Re-volt, Revolution.

James Wimshurst, in his day, was a man of some consequence. It is but the irony of fate that his name should survive only in association with the Wimshurst Machine, the fruit of his leisure hours. This was an ingenious contrivance for inducing electricity at high voltage; the machine is now just of academic interest, but its part in the evolution of such modern marvels as X-rays and Television has assured its place in the annals of science.

To-day, the experimenter has everything made easy for him. He has at his command materials perfectly adapted to his needs. In DISTRENE (Regd.), for example, he has an ally whose value can only be appreciated in actual use. Here is an insulating material which has revolutionised high-frequency electrical design.

BX DISTRENE (Regd.)

COMPRESSION STRENGTH	tons per sq. in.
STATIC GRAVITY	1.06
WATER ABSORPTION	%
COEFFICIENT OF LINEAR EXPANSION	0.001
SURFACE RESISTIVITY (24 hours in water)	3×10^8 megohms
DIELECTRIC CONSTANT 60-10 ⁶ CYCLES	2.60-2.70
POWER FACTOR UP TO 100 MEGACYCLES	0.002-0.003

DISTRENE is made in sheets, rods and tubes, and in powder-form for injection moulding.

BX PLASTICS LTD., LARKSWOOD WORKS, LONDON, E. 4

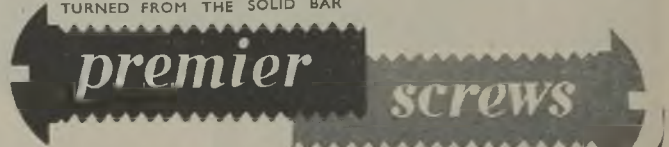


"By the way, Smithson, I want all the small steel screws for this contract to be Premier make, as it is most important we use turned from the bar screws exclusively.

"I know the Premier people carry stocks, so there should not be any delay in getting the sizes you require quickly. Will you ask Jones to send Premier an order, right away?"

WHITWORTH AND B.A. THREADS
TURNED FROM THE SOLID BAR

London Office :
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VICTORIA STATION
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The PREMIER SCREW & REPETITION CO. LTD., WOODGATE, LEICESTER. Tel. 5695-6



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In applying the rubber tape under tension (after first removing the red protective interleaving cloth) each layer fuses to the other to form one piece of SOLID yet flexible rubber.

A single layer withstands more than 5,000 volts.

From all Electrical Wholesalers & Factors
Manufactured by **ROTUNDA LIMITED**
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MOTORS
1/10 to
5,000 H.P.
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TRANS-
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**REWINDING
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PRICE LIST ON APPLICATION

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ECONOMICAL
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DOOR-TO-DOOR
DELIVERY



Plymouth Co-operative Society find it pays to use these electric hand trucks for door-to-door deliveries in a hilly city. They have a fleet of over 80, all driven by Britannia Batteries.

Hundreds of electric 'Prams,' propelled by Britannia Batteries, are delivering milk, bread and other goods, quickly and very economically in level and hilly districts alike, all over the country.

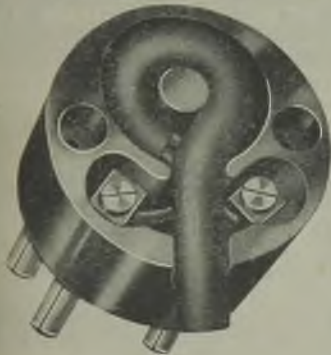
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LEAD ACID

VEHICLE BATTERIES

BRITANNIA BATTERIES LIMITED, REDDITCH, WORCS.

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B.S.I.



PAT. PEN.

PLASTIC PLUGS

EASY TO WIRE

SECURE GRIP ON CABLE SHEATH
OF ANY DIAMETER

NO CABLE CLAMPS & SCREWS

EXTRA SAFETY IN USE
EARTH WIRE LAST TO BECOME DE-
TACHED IF CABLE IS WRENCHED OUT

SELF-ALIGNING CURRENT PINS

(Single or double pole fused pins not self-aligning)

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M.S.M. are specialist manufacturers of tilting type mercury switches suitable for instrument work, domestic and industrial apparatus and power control gear.

THE MERCURY SWITCH MANUFACTURING CO. LTD.
WEST DRAYTON, MIDDLESEX

Air-kon

FLOW INDICATORS

The oil or water spins a chromium plated ring under a glass dome. If the flow stops, the ring stops.

WALKER, CROSWELL & CO LTD
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DURAWIRES

Durawire your Electrical Work and be Sure

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DURAWIRES & DURACABLES ARE NOT A WAR EMERGENCY SUBSTITUTE

They are not a substitute at all in the sense in which this irritating word is generally used. **DURAWIRES AND DURACABLES** have their own OUTSTANDING PROPERTIES and will play their part in building the New World as they are helping to win the war.

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BOBATON & WIRE LTD.
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BAKELITE AND **ERINOID**

MOULDINGS AND TURNINGS

TO ANY SPECIFICATION

FREDERICK W. EVANS LTD.

PLASTIC WORKS

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Diecastings by **Predico Ltd.**

SPECIALISTS IN PRESSURE DIECASTING OF SMALL ACCURATE COMPONENTS IN ZINC AND TIN ALLOYS

23 PRINCESS MAY ROAD, LONDON, N.16

YOUR Generators
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Motors, etc.



Need bearings that are not only initially concentric, but in which this quality is maintained because they are also wearless.

HOFFMANN BALL & ROLLER BEARINGS

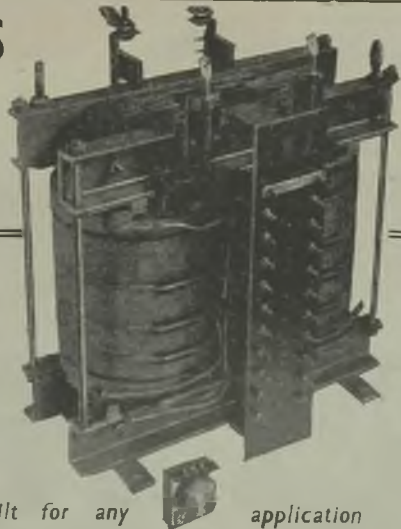
fill this need so perfectly that you can use the smallest possible air gap without risk of fouling. You will notice the smooth running evidenced by the even-toned hum which is a delight to the engineer.



THE HOFFMANN
MFG. CO. LTD.,
CHELMSFORD
E S S E X

TRANSFORMERS

AIR-COOLED
AND
OIL IMMERSED
0-50 kVA



Also

**SWITCHBOARDS and GENERAL
POWER EQUIPMENT
MANUFACTURED and SUPPLIED**

Special units designed and built for any application

THE NELSON ENGINEERING CO. LTD.

NETHERFIELD WORKS, NELSON, LANCS.

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Die Castings
 BASIC METALS -
 ALUMINIUM, ZINC, TIN AND LEAD



★ *Write for Treatise on Die Castings*
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 FOUNDED 1896

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Control Equipment
 FOR EVERY TYPE OF
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DEWHURST & PARTNER Ltd
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**INDUSTRIAL
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 RESISTANCE UNITS**



ST MARY STREET KNIGHTON LANE
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For Anything in **MICA**

**MICANITE
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Natural in all Grades and Qualities, Stove Micas, Plates, Washers, Commutator Segments, Condenser Films, etc.

Moulding, Commutator, Flexible, Heat-resisting Qualities, Commutator Rings, Spools, Tubes, etc.

Mouldings of any shape or form, Tubes, Plates, Washers, Sheets in all thicknesses, etc.

SEND TO THE MANUFACTURERS
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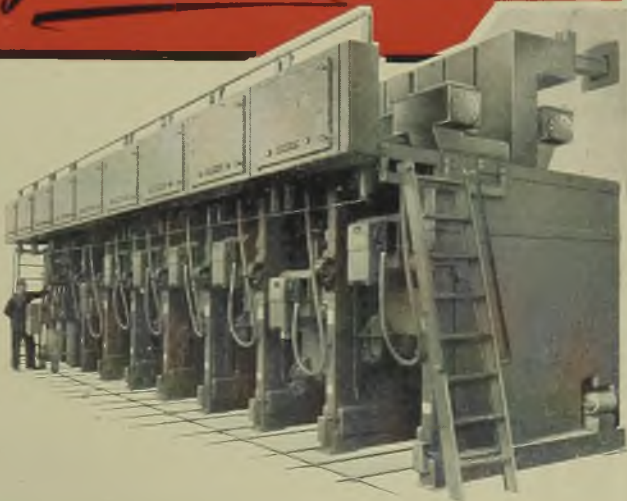
DOLPHIN ENGINEERING CO. LTD.
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FAST TIME by a RECORD 'BREAKER'



Modern Switchgear for Major Installations

VTRP 13/3
SWITCHGEAR
for
33kV
SERVICE



Manufactured by SWITCHGEAR SPECIALISTS—

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phone DROYLSDEN 1301 (8 lines)
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LONDON Temple Bar 8711/2
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SenTerCel
RECTIFIERS

WHEN we were the only manufacturers of Selenium Rectifiers in this country there was no need to give a special name to our product.

The many advantages of the "Standard" Selenium Rectifier over other types has inevitably introduced competition, and we have therefore adopted the name of "SenTerCel" as our trade mark, so that our customers may know that rectifiers bearing this name will have the high standard of performance to which they have become accustomed.

The name "SenTerCel" combines the idea of centre-contact construction, which is an exclusive feature of our rectifiers, with the S.T.C. registered trade mark which is known all over the world as the symbol of the highest quality in tele-communication equipment.

Standard Telephones and Cables Limited

NEW SOUTHGATE · LONDON · N·11

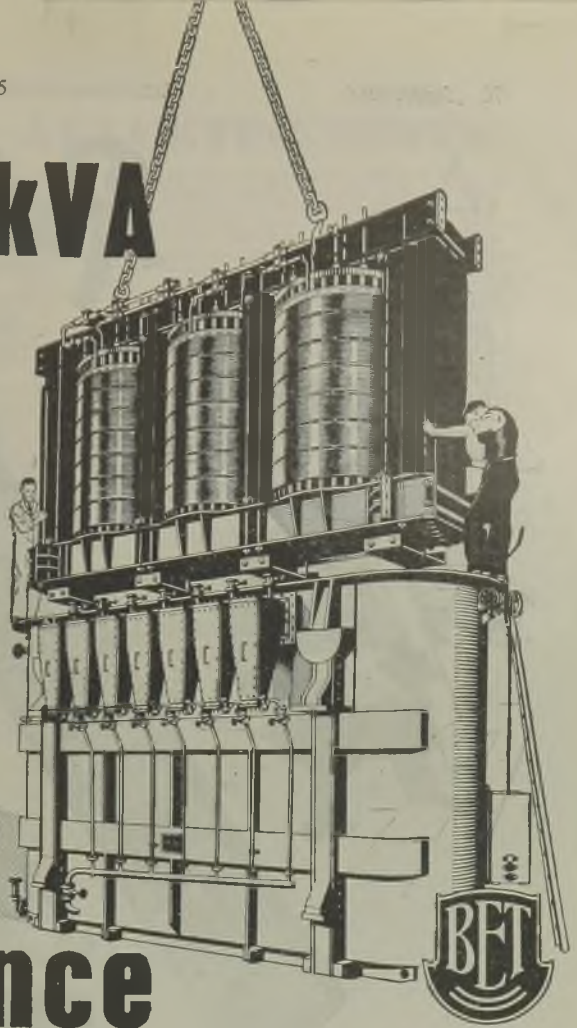
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62,500 kVA

of

B.E.T.

Experience



This B.E.T. 62,500 kVA Transformer is going into its tank to give years of service. Its duty will be a responsible one but it goes out with the confidence of its makers. B.E.T. have specialised

in transformers for 47 years. There is nothing in transformer construction for which B.E.T. experience does not provide an answer. This experience is at your service.

The
British Electric Transformer
Company Limited

In association with CROMPTON PARKINSON LIMITED

ELECTRA HOUSE, VICTORIA EMBANKMENT, LONDON, W.C.2

Reliability



G.E.C. STEEL-CONDUIT

Plain, Screwed, Welded and Solid Drawn.
Finishes:—Black Enamelled, Galvanised and Sherardised.

CONDUIT FITTINGS

Malleable Iron and Pressed Steel for all requirements.

Stocks available at all G.E.C. Branches

CLASSIFIED ADVERTISEMENTS

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

THE CHARGE for advertisements in this section is 2/- per line (approx. 8 words) per insertion, minimum 2 lines 4/-, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number there is an additional charge of 6d. for postage of replies. **SITUATIONS WANTED.**—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

Original testimonials should not be sent with applications for employment.

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.

SITUATIONS VACANT

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

METROPOLITAN BOROUGH OF HACKNEY

Appointment of Shift Charge Engineer
(Electricity Department)

APPLICATIONS are invited for the above appointment, on the permanent establishment, at the Millfields Generating Station. Salary will be in accordance with N.J.B. Schedule, Class H, Grade 8, plus 23%.

Applicants must have had a sound technical education and practical training and also have been in charge of a shift in a station containing high pressure and temperature equipment.

The appointment will be subject to one month's notice on either side, to the provisions of the Council's Superannuation Acts, and the selected candidate will be required to pass a medical examination.

Forms of application may be obtained from the undersigned upon receipt of a stamped addressed foolscap envelope, and must be returned endorsed "Shift Charge Engineer," and reach me not later than first post, Friday, 13th April, 1945.

Canvassing, directly or indirectly, is prohibited and will be deemed a disqualification.

DUDLEY SORRELL,
Town Clerk.

Town Hall,
Hackney, E.8.
22nd March, 1945. 1718

COUNTY BOROUGH OF IPSWICH EDUCATION COMMITTEE

School of Technology

Principal: T. S. Harker, B.Sc., M.I.Mar.E., A.M.I.Mech.E.

APPLICATIONS are invited for the post of LECTURER in ELECTRICAL ENGINEERING subjects, duties to commence in September next. Candidates should have had good industrial experience, and preference will be given to those who are corporate members of the Institution of Electrical Engineers. Previous teaching experience would be a recommendation.

Salary in accordance with the Burnham Scale for Technical Colleges, with such appropriate additional allowances, depending upon the qualifications of the successful candidate, as may be allowed under the new salary scale.

Forms of application and further particulars may be obtained from the undersigned, to whom applications should be returned so as to be received not later than 20th April, 1945.

J. T. HILL,
Chief Education Officer.

Education Department,
17 Tower Street, Ipswich. 1719

VACANCY FOR AN ASSISTANT SECRETARY

THE NATIONAL EXECUTIVE COUNCIL of the Electrical Power Engineers' Association invites applications for the appointment of Assistant Secretary on the Official Staff for the North-Western Area (location Manchester).

Supply Industry, preferably on the technical side.

The duties will comprise the conduct of negotiations on behalf of members, propaganda work, etc. Salary scale (basic) £350 rising to £500, plus an addition based on the operation of Clause 33 of the National Joint Board of Employers and Members of Staff for the Electricity Supply Industry Agreement; present commencing salary, £411.

The successful applicant will be required to pass a medical examination and to contribute to the Association's Staff Pension Scheme.

Applications in writing, giving full particulars, including age, and endorsed "Assistant Secretary, Dept. A." should be addressed to:

The General Secretary,
Electrical Power Engineers' Association,
102, St. George's Square,
London, S.W.1.

and should be received not later than Friday, April 20th, 1945. 1732

CITY OF LONDON ELECTRIC LIGHTING CO. LTD.

A vacancy occurs for a Shift Charge Engineer at Bank-side Power Station. The successful candidate must be suitably qualified and sufficiently experienced in power station practice to take sole charge of the operation of all plant in the Station.

Salary will be in accordance with the N.J.B. scale, Grade 8, Class H.

Applications, together with details of experience, should be forwarded to the Station Superintendent, 64, Bank-side, S.E.1. 1721

THE UNIVERSITY OF SHEFFIELD

Lecturer in Electrical Engineering

THE Council invite applications for appointment as Lecturer in Electrical Engineering. Qualifications in light-current engineering, particularly electronics, will be a recommendation. Salary £570 per annum, with wartime marriage and children allowance. Further particulars may be obtained from the undersigned, with whom applications should be lodged by April 30th.

A. W. CHAPMAN, Registrar.
1894

ASSISTANT Boiler Attendants required for a large power station in the West Midland area. Should have had experience with high pressure boiler units up to 200,000 lbs. per hour evaporation and large chain grate stokers. Wages 2s. 1d. per hour for 48-hour week. Shift duties. Apply in first place to—Establishment Officer, Edmundsons Electricity Corporation Ltd., 30, Gillingham Street, London, S.W.1. 1735

ELECTRICAL wholesalers require Trade Counter Assistant. Must be conversant with all types of electrical material for installation purposes.—London Electrical Co., 92, Blackfriars Road, S.E.1. 24

INDOOR Sales Staff Assistant required for new developments in thermoplastics. Engineering qualifications an advantage. Good correspondent with initiative and enterprise in dealing with both established and new lines. Reply, stating full particulars of experience and salary required, to—Box 1727, c/o The Electrical Review.

MIDLAND Contractor requires Manager. Must be first-class engineer, capable of handling lighting, power, overhead installation, and conversant with contractor's office routine. Commencing salary £600 per annum.—Box 1729, c/o The Electrical Review.

NON-Association electric cable makers require first-class Representative for Midlands territory, preferably resident in the Midlands. Must be fully conversant with selling cables and be able to prove results.—Box 1700, c/o The Electrical Review.

PRODUCTION Control Manager required by Midland firm of electrical instrument manufacturers, to be responsible for purchasing stores, stock control, scheduling and progressing. Accountancy knowledge useful but not essential. Salary £600-£650 per annum according to qualifications. Applications in writing (no interviews), stating date of birth, full details of qualifications and experience (including a list in chronological order of posts held) and quoting reference number 130M, should be addressed to the Ministry of Labour and National Service, Appointments Office, Commerce Chambers, Upper Parliament Street, Nottingham. 1724

PROGRESSIVE Company in the London area, intending to specialise in Electrical Measuring Instrument Manufacture as soon as the present restriction on employment is removed, invite applications for the post of Design Research Engineer. Applicants must have wide theoretical and practical experience in development of electrical and electronic apparatus. Excellent opportunity for really first-class man. Write, giving details of experience, salary required, etc., to—Box 1670, c/o The Electrical Review.

SALES Engineer required by electrical instrument manufacturers for the London area. Write, stating experience, age, salary required and when available, to—Box 1714, c/o The Electrical Review.

SALES Representative or Agent required for reputable manufacturers of conduit fittings, lighting fittings and electrical accessories, for Midlands and South-West England areas, wholesale trade only. State experience, age, full particulars of any qualifications, and remuneration desired.—Box 1686, c/o The Electrical Review.

TECHNICAL Lighting Assistant required in London by large lamp manufacturers, to prepare lighting schemes for war applications, factories, public lighting, etc. Electrical and lighting experience and technical correspondent essential. Permanent position with post-war prospects for young man free of National Service obligations. Write, stating age, qualifications, experience and salary required, to—Box 1631, c/o The Electrical Review.

APPOINTMENTS FILLED

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

SITUATIONS WANTED

ASSISTANT Managerial post with elect. contractor or Technical Sales Engineer with manufacturer. Age 27, stud. I.E.E., Senior National Elect. Eng., D.O. and testing experience, 4 years organising naval construction in stallation, 100-150 men.—Box 6903, c/o The Electrical Review.

DEMONSTRATOR holding E.A.W. diploma, with 20 years' experience in the industry, would like position where initiative and business capacity useful. Interested in selling domestic appliances. Would travel abroad.—Box 6905, c/o The Electrical Review.

DESIGNER Draughtsman, with over ten years' experience in the design and manufacture of domestic electrical appliances, including thorough knowledge of design as applied to mass production, desires to change position to firm interested in the development and utilisation of domestic electrical products in the post-war period.—Box 6878, c/o The Electrical Review.

DRAUGHTSMAN/Designer (28) in responsible D.O. position, seeks change with post-war prospects, preferably in S.W. England.—Box 6906, c/o The Electrical Review.

ELECTRIC Heating, Sales Engineer (50), experienced in space and water heating and cooking, installations and equipment design, wishes to represent manufacturer in London and Southern Counties. Contacts amongst Govt. depts., supply authorities and trade.—Box 6877, c/o The Electrical Review.

ELECTRICIAN, fully exp. all branches installation work, used to estimating, costing and control labour, seeks position in supervisory capacity.—BM/L.E.K., London, W.C.1. 6913

LAMP Works Executive (40), wide technical and administrative experience of modern manufacturing practice, including production and personnel management, seeks change, not necessarily lamp manufacture.—Box 6884, c/o The Electrical Review.

OVERSEAS post as Technical Sales Engineer with electrical, electronic or lighting equipmt. firm. Age 27, stud. I.E.E., Senior National Elect. Eng., D.O. and testing experience, at present supervising naval installation construction.—Box 6902, c/o The Electrical Review.

PLASTIC Moulding (Compression) Foreman seeks similar position, 18 years' practical experience, ex. refs., go anywhere, free now.—Box 6895, c/o The Electrical Review.

STORES Supervisor seeks position with concern manufacturing light engineering and electrical equipment. Fully experienced in modern stock control methods and stores routine, buying, etc.—Box 6879, c/o The Electrical Review.

STUD. I.E.T. seeks supervisory post, 22 yrs' exp. elec. installations and maint.—Box 6901, c/o The Electrical Review.

SUBMERSIBLE Motor-driven Pumps. Chartered Electrical and Mechanical Engineer, skilled in design and manufacture, wishes contact first-class pump manufacturing concern interested in same. Box 6882, c/o The Electrical Review.

SUPPLY Authorities, Qualified Electrical Engineer, S.A.I.E.E. (38), free from Government Service next few months, would appreciate enquiries in any of the following capacities: Generation, distribution, consumers' engineer, sales or development. Sound technical and executive background.—Box 6870, c/o The Electrical Review.

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COMPANY MEETING

BRITISH THOMSON-HOUSTON COMPANY

Efficiency of Plant Maintained

THE Fiftieth Ordinary General Meeting of the British Thomson-Houston Co. Ltd. was held on Friday, 23rd March, at Crown House, Aldwych, London, W.C.

Mr. Henry N. Sporborg, the chairman, who presided, in the course of his speech said:

In June of last year we lost the services of Mr. P. S. Turner, who died after bravely enduring several months of severe illness. I have already expressed to his family our deep appreciation of his services and our sincere sympathy in their loss.

In December last Mr. D. Abel Smith found it necessary to resign his seat on the Board. Mr. Abel Smith did much valuable work for the company during his membership of the Board, and I have expressed to him our sincere regret at its termination. During the year the Board has been strengthened by the election of three new members: Mr. E. H. Ball, Mr. E. S. Little and Mr. W. W. Vinsen.

Profit and Dividend

The profit for the year, after deducting all expenses and charges other than interest on debentures and loans and after providing for taxation, was £596,527, as compared with £580,362 for the previous year.

It has been decided to transfer to the general reserve account £150,000, thereby raising it to £1,300,000. The dividend on the 7% Preference shares, less income tax, amounting to £52,500, has been paid, and your directors recommend the payment of a dividend on the Ordinary shares at the rate of 7% for the year, less income tax, £70,000, leaving £255,704 to be carried forward to the new account, as compared with £248,368 brought in.

Our manufacturing plants have been maintained during the year in as high a state of repair and productivity as possible under the existing conditions.

Our capital expenditure on manufacturing equipment and buildings during the past year has again been curtailed by the prevailing conditions, but we have fully maintained our established practice by writing off to depreciation of our Plant Account the sum of £228,975. We have also extensive plans for replacement and extension of plant at our various factories to meet the coming demand, when conditions permit.

Our work covers such a wide range of products that it is not possible for me to refer to any one section of it without appearing to neglect others of equal importance, but I can refer to the satisfaction that was felt throughout the organisation at the honour that was done us when His Majesty the King conferred distinctions upon Mr. G. S. C. Lucas, O.B.E., and Mr. T. H. Kinman, M.B.E. Both of these gentlemen hold responsible positions in our research organisation.

Export Trade Prospects

With regard to the future, there is ample evidence of the demand for the products of the company, and there can be no question of the potential capacity of the electrical industry to meet this demand and contribute substantially toward the national need for increased exports.

Overseas purchasers, however, have made it clear that, both as regards technical performance and price, our products must be competitive with those offered by foreign manufacturers, and it remains to be seen whether under existing conditions this test can be met.

As regards technical performance, I think it is recognised that our products can compete in efficiency with those obtainable in any foreign country; but in regard to price our position is less favourable. This is not due to any excessive charge on capital account or to unreasonable demands for profit, but results entirely from the cost of raw materials used in the manufacture of our products and the rate of productivity of our labour.

Over many years there has been steady improvement in the technical efficiency of the apparatus manufactured by our industry for use in power stations. This has resulted in a substantial increase in the amount of electricity produced per ton of coal consumed. Unfortunately, the price of coal has increased to such an extent that the entire economic benefit of this improvement has been nullified.

It is, I think, important to realise that the national plans for the improvement of social conditions, standard of living and educational facilities are all dependent upon our ability to secure the great increase in exports necessary to maintain the policy of full employment. A fundamental condition for accomplishing this is our ability to secure the raw materials required for our industries at prices which will enable our manufactured products to be competitive.

The report of the directors, together with the company's accounts to December 31st, 1944, were approved and adopted. The retiring directors were re-elected and the auditors re-appointed.

1726

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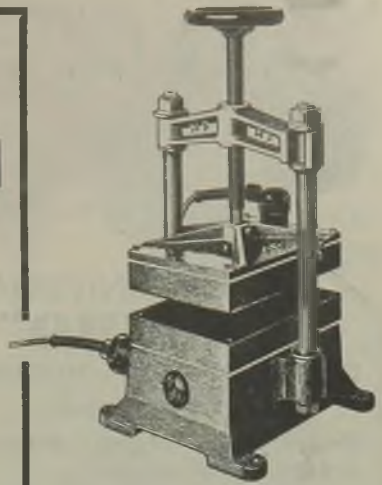
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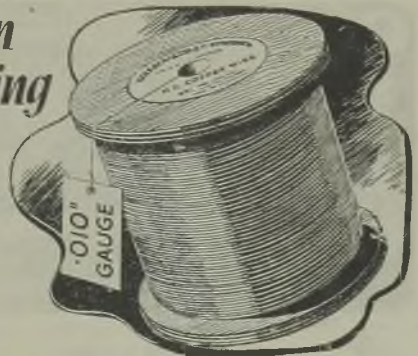
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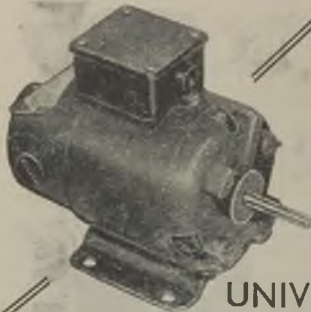


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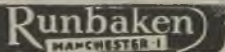
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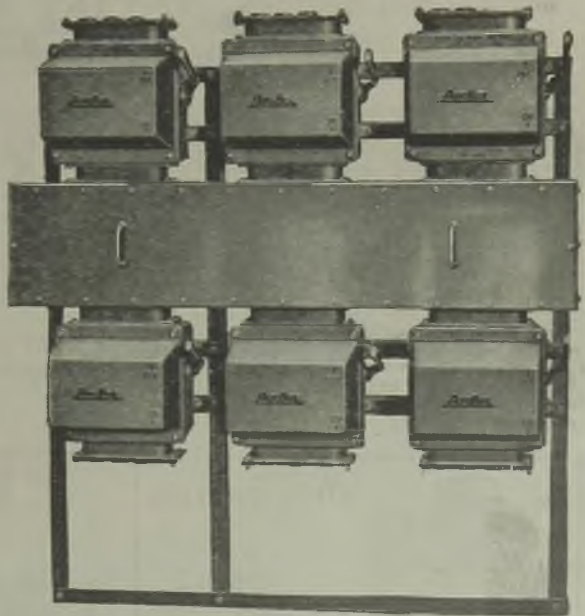
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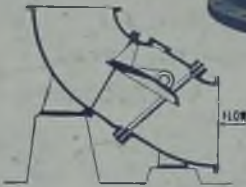
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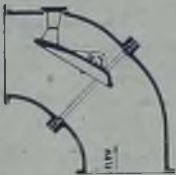


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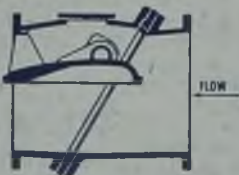
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