

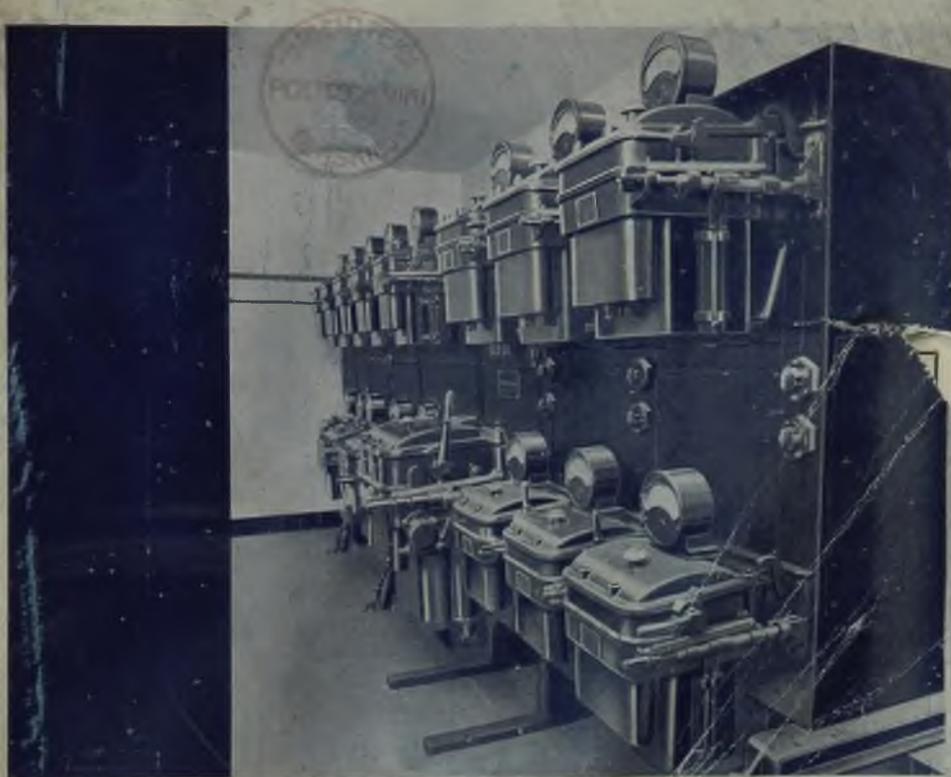
ELECTRICAL REVIEW

FOUNDED
1872

Vol. CXXXVII. No. 3553

DECEMBER 28, 1945

9d. WEEKLY



CRAMPED QUARTERS . . . A PHOTOGRAPHER'S DILEMMA . . .

In taking this photograph in so limited a space the photographer had an awkward problem. But he evidently solved it.

Long before, Ellison engineers had solved the problem of fitting switchboards into limited spaces by introducing switchboards with circuit breakers mounted in tiers. Indeed, where space is strictly limited an Ellison multi-tier switchboard is often the

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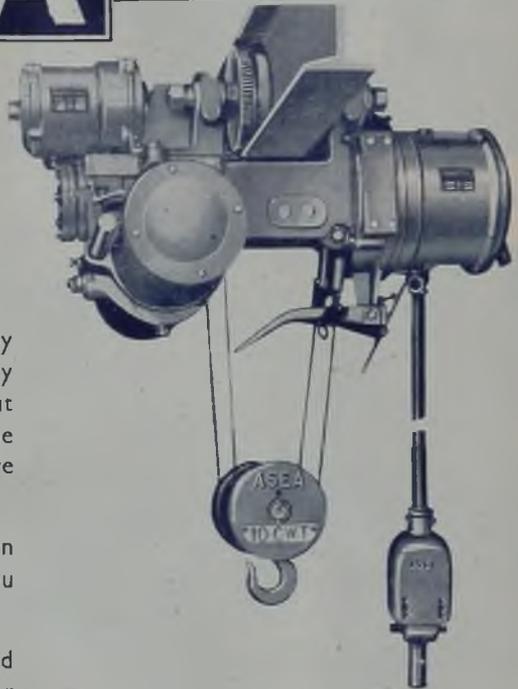
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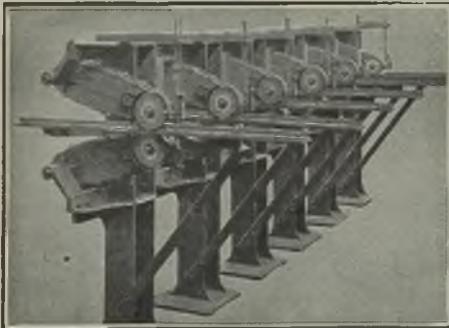
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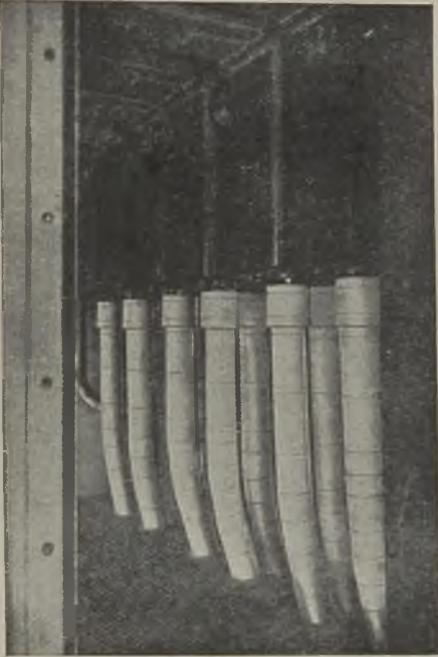


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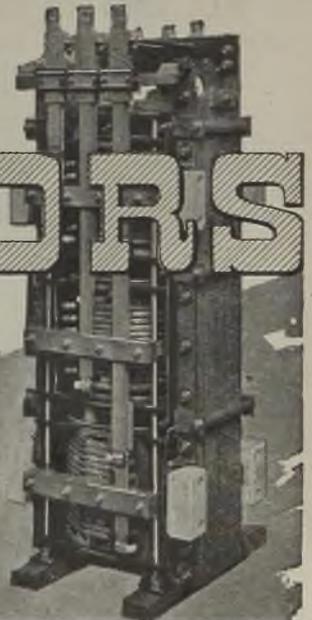
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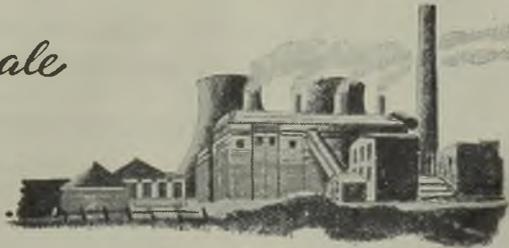
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C. 39

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FA & FB

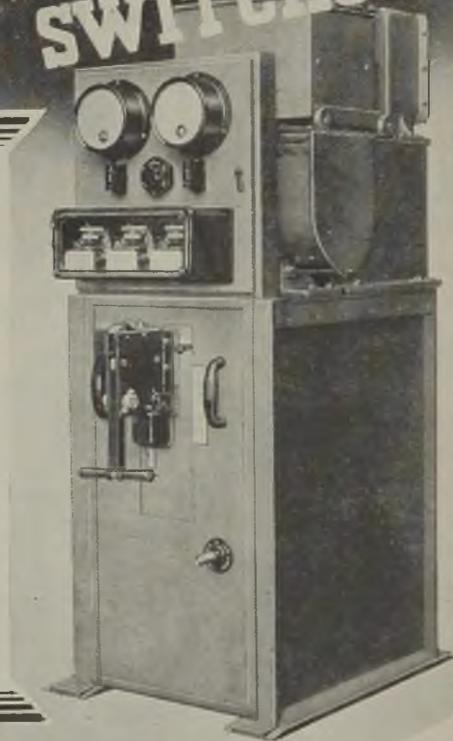
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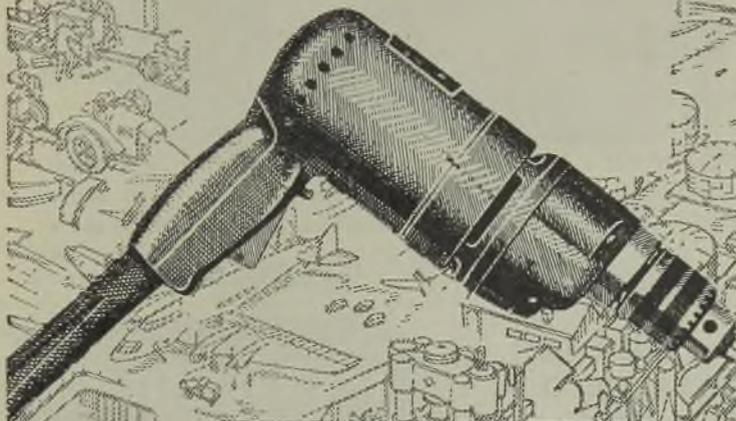
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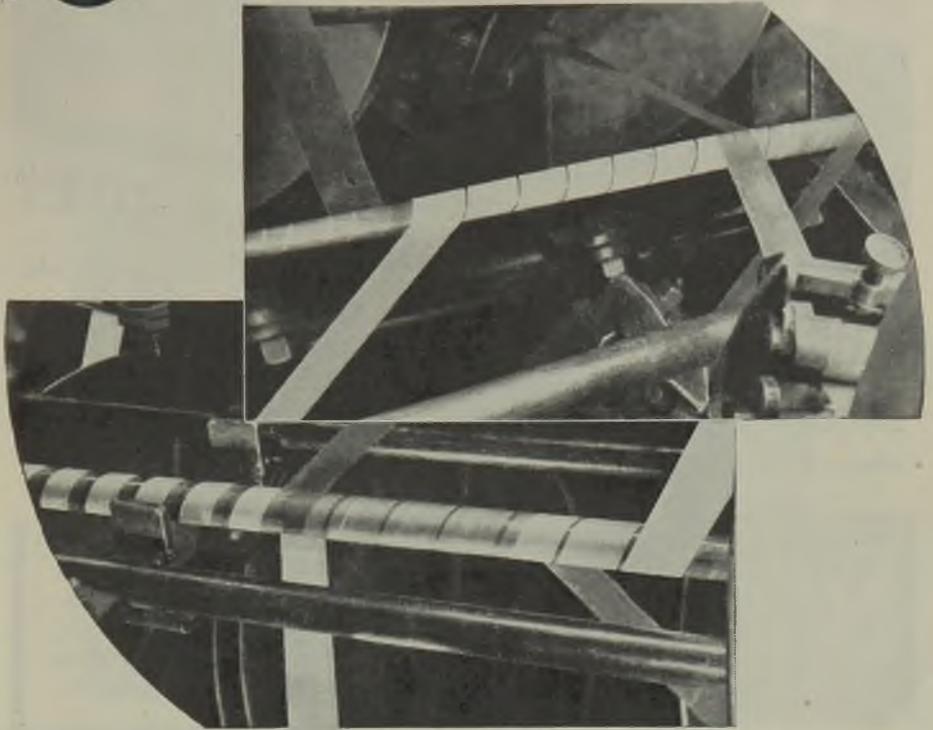
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"SANDWICH" TYPE CABLES

BRITISH PATENT No. 364710
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FOR INDOOR POWER DISTRIBUTION

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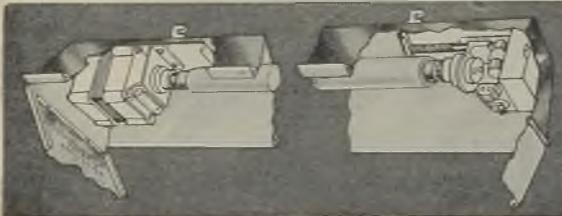


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Note how compactly the control gear is **BUILT-IN** the ends of the reflector, concealed by hinged covers and instantly accessible.



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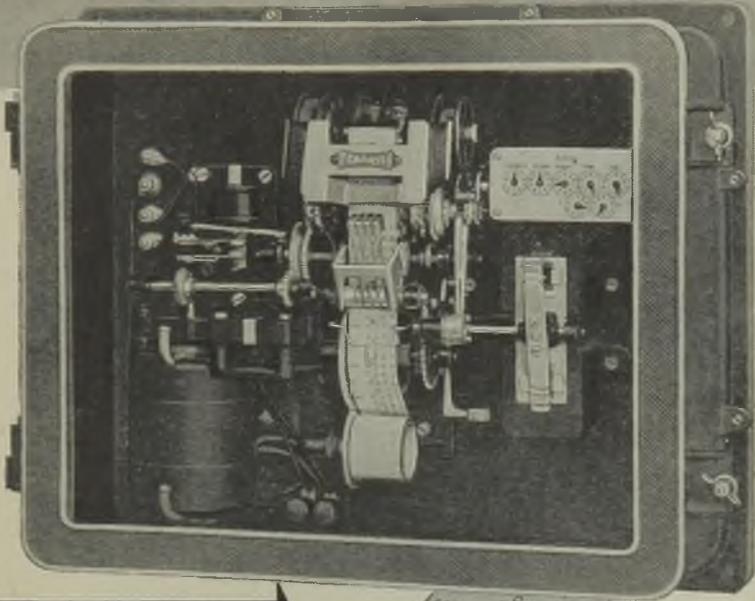
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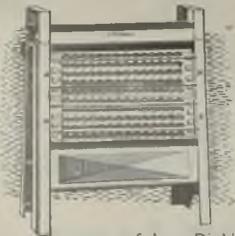
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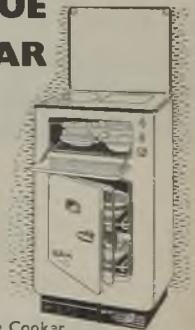
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Streamline Cooker

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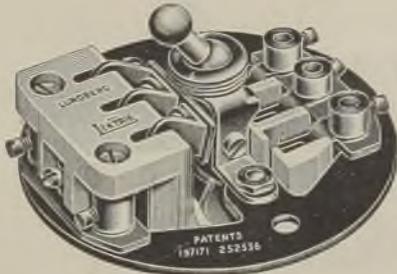
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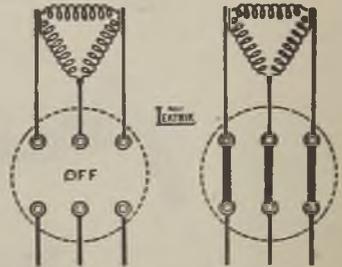
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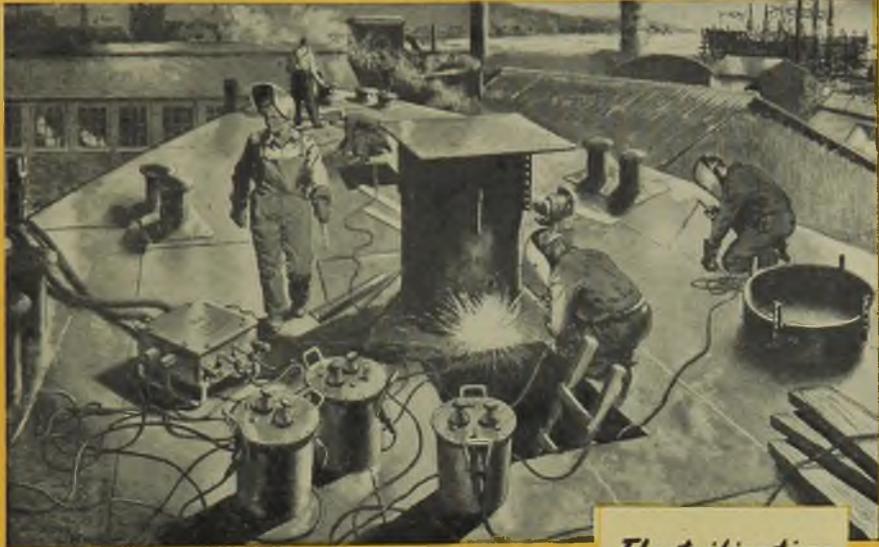
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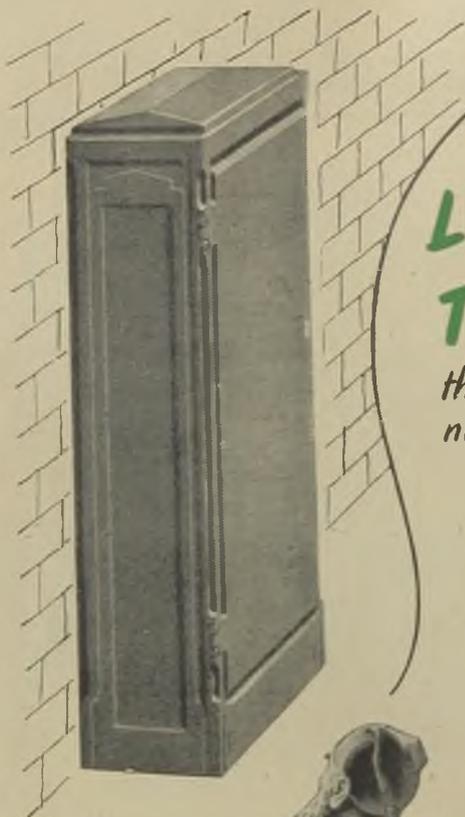
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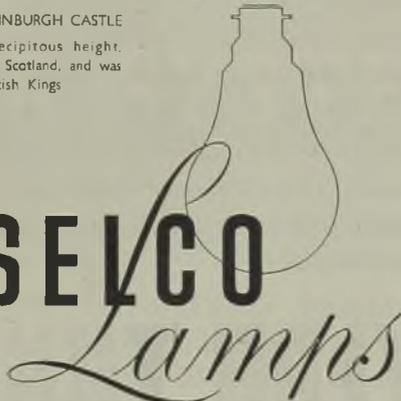
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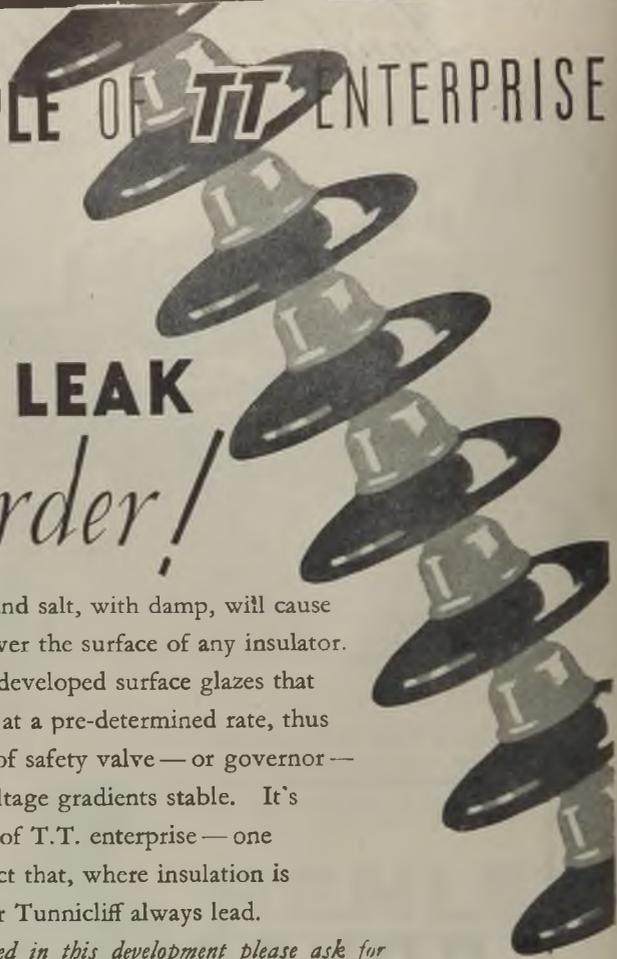
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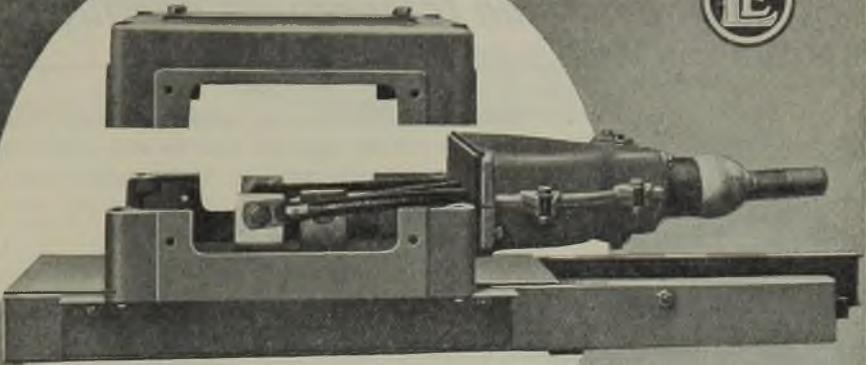
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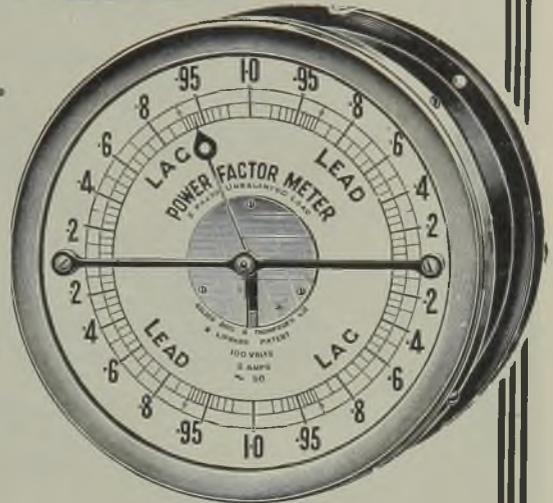
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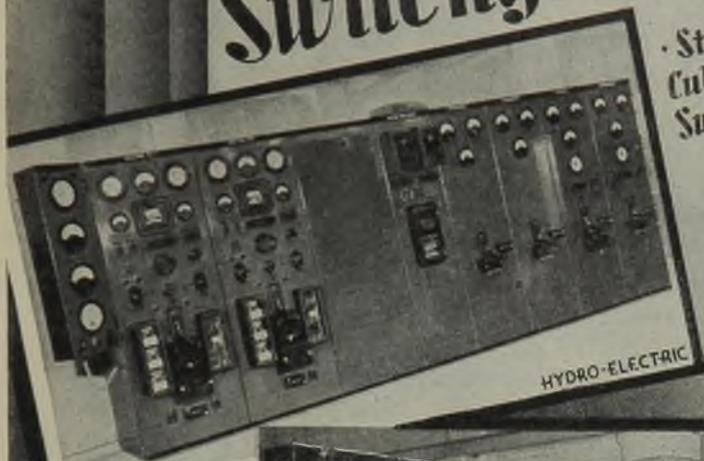
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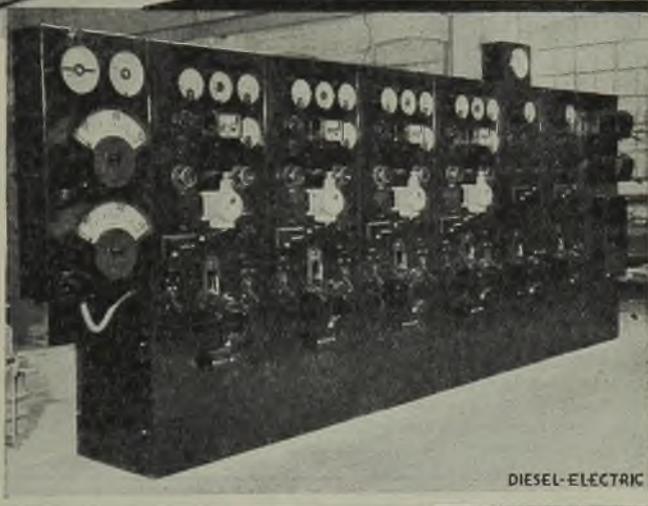
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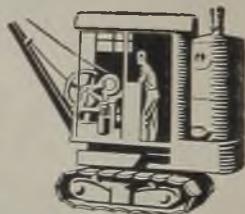
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Turn up these Bulletins:

FUEL ECONOMY BY SAVING ELECTRICITY (Bulletin No. 13)

A rapid survey of the possibilities. Brief, practical pointers that take you straight to sources of substantial economy in electricity consumption.

THE INDUSTRIAL USE OF COMPRESSED AIR (Bulletin No. 29)

Compressed air is a very convenient medium of power transmission. But it can also be a great waster of power unless carefully supervised and maintained. This Bulletin tells you what to look for and how to put it right.

FUEL ECONOMY AT COLLIERIES (Bulletin No. 32)

The colliery official will find this Bulletin a real boon. It is a guide to the economical operation of colliery compressed air plant, but it also contains a brief summary of hints on steam boilers, prime movers, fans, pumps and so on.

SMALL VERTICAL BOILERS, STEAM CRANES AND SHUNTING ENGINES (Bulletin No. 37)

These power units are often neglected. How fuel losses can be reduced and operation improved is explained in a very practical way.

UNTIL YOU HAVE looked into the possibilities of every recommendation in these Bulletins you ought not to decide that your power is being used efficiently. If you haven't all the Bulletins ready at hand, please ask for the copies you need from the Regional Office of the Ministry of Fuel and Power.



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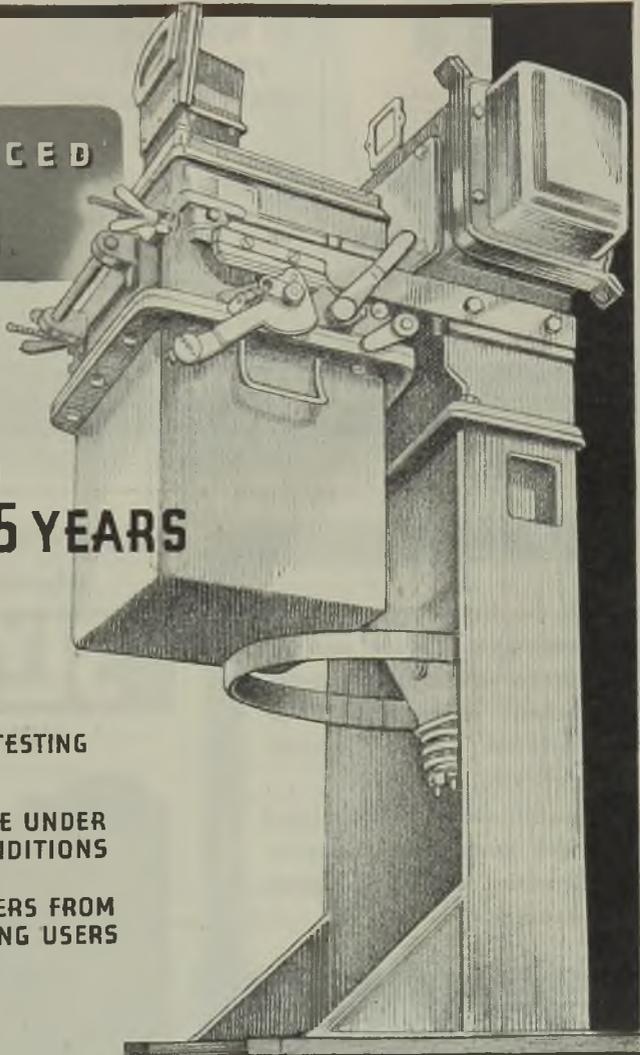
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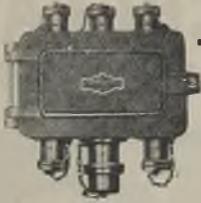
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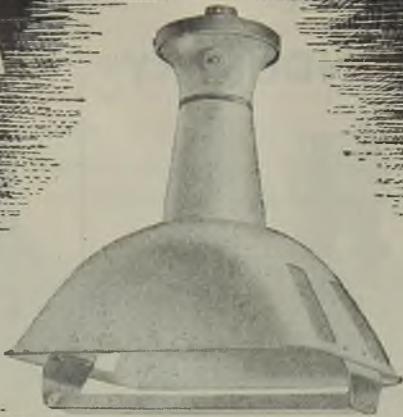
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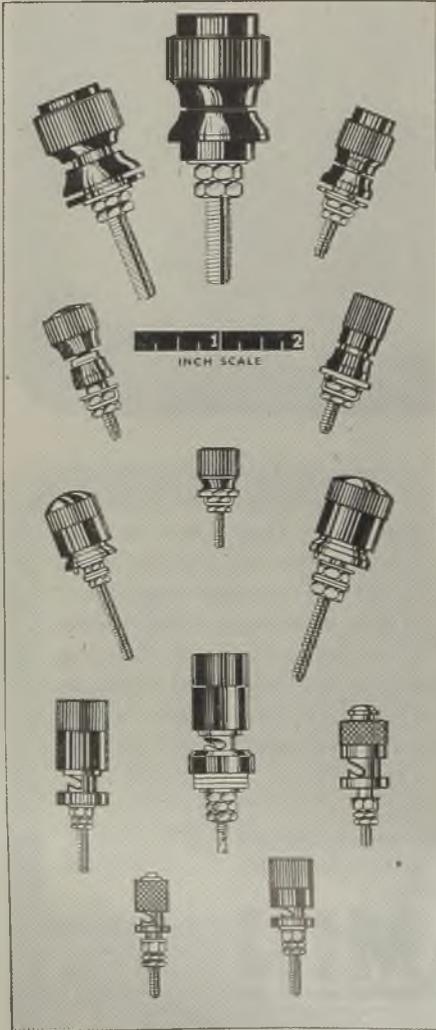
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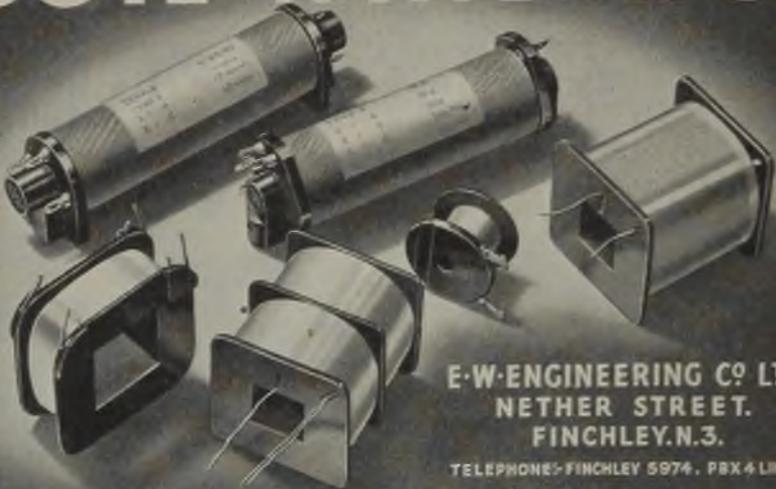
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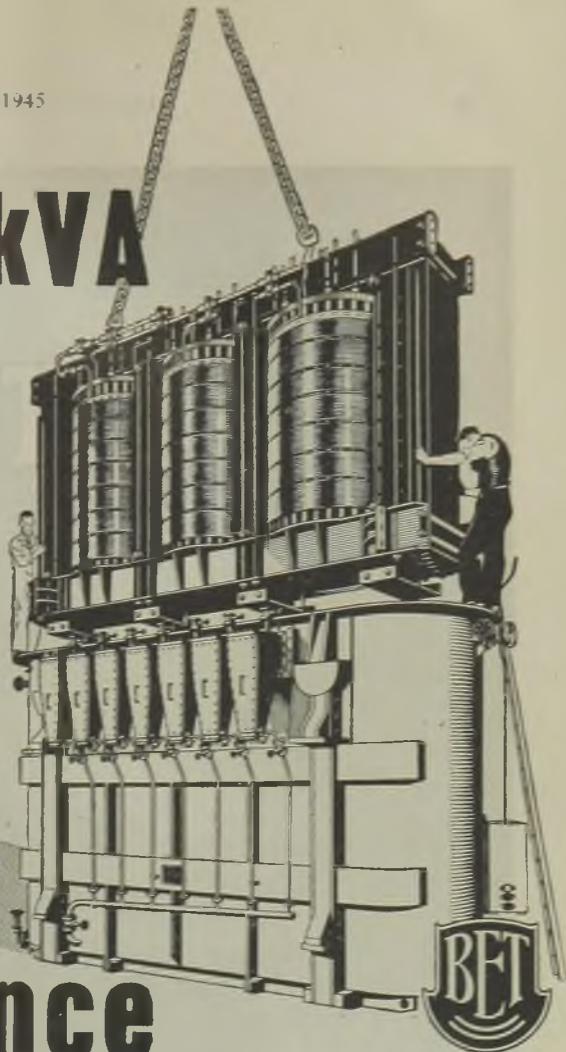
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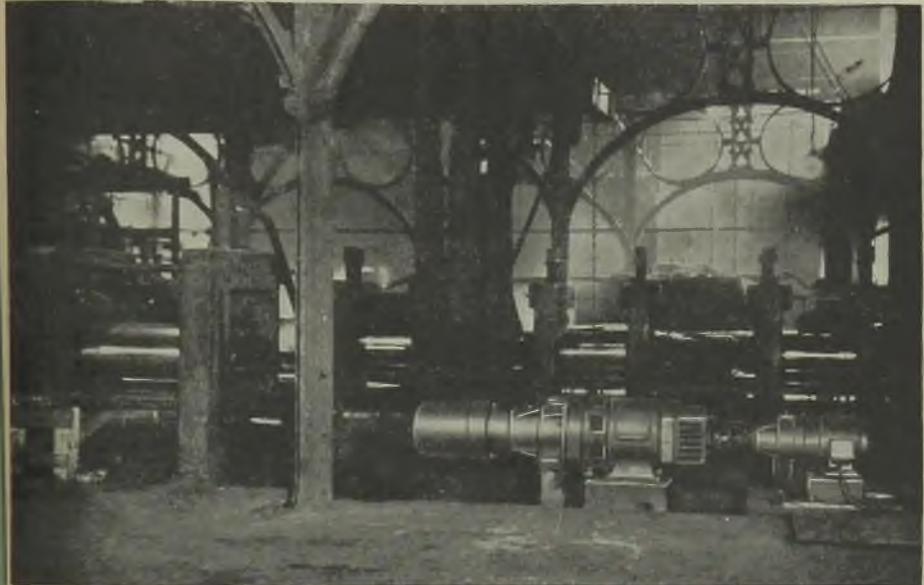
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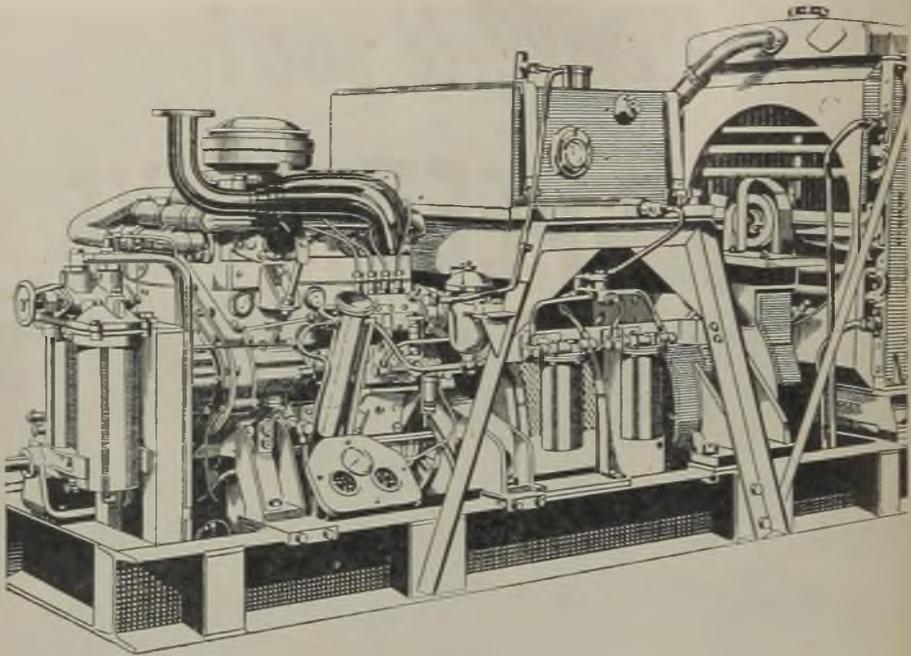
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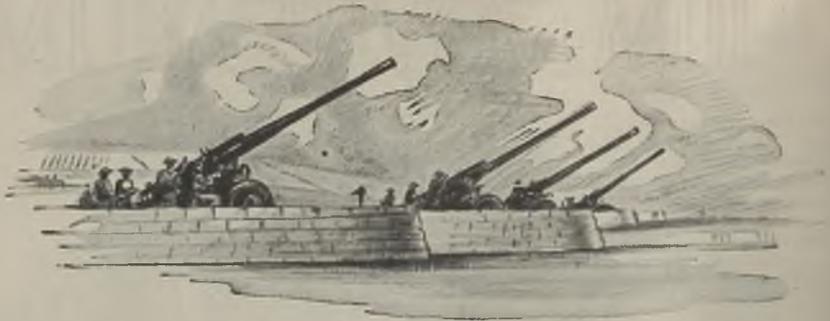


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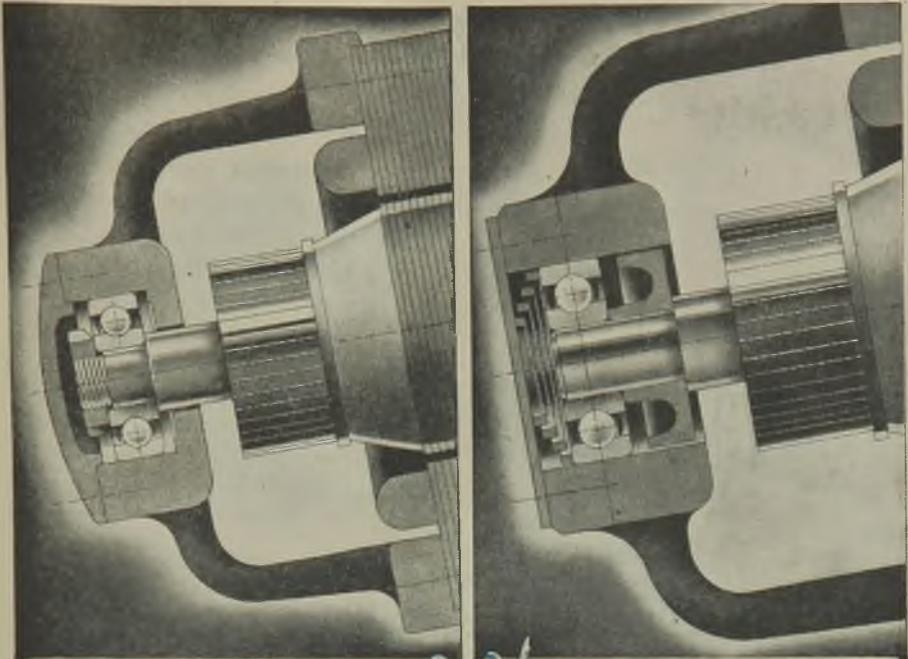
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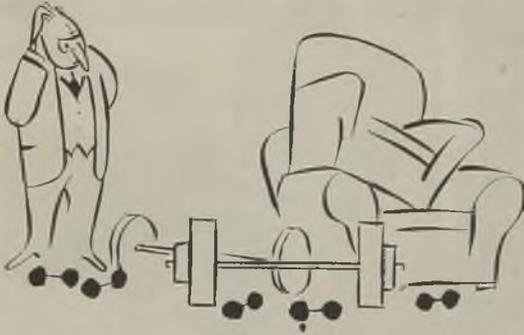
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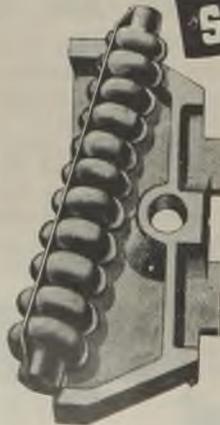
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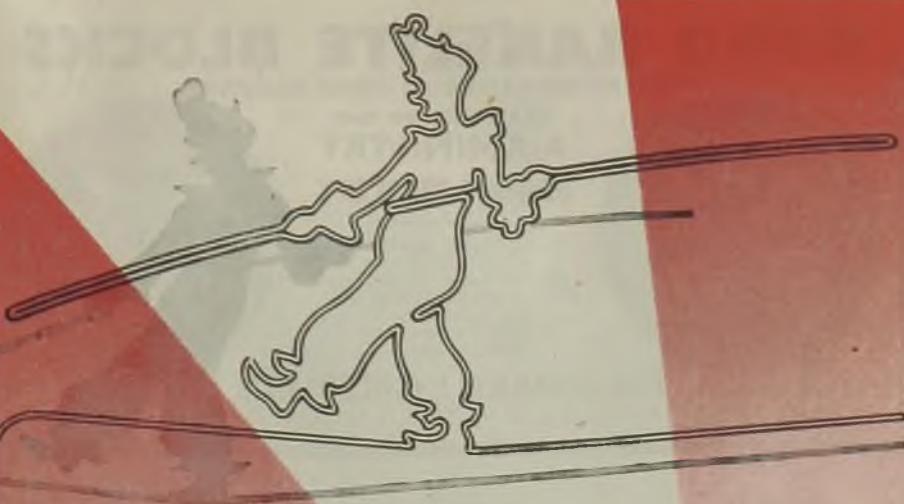


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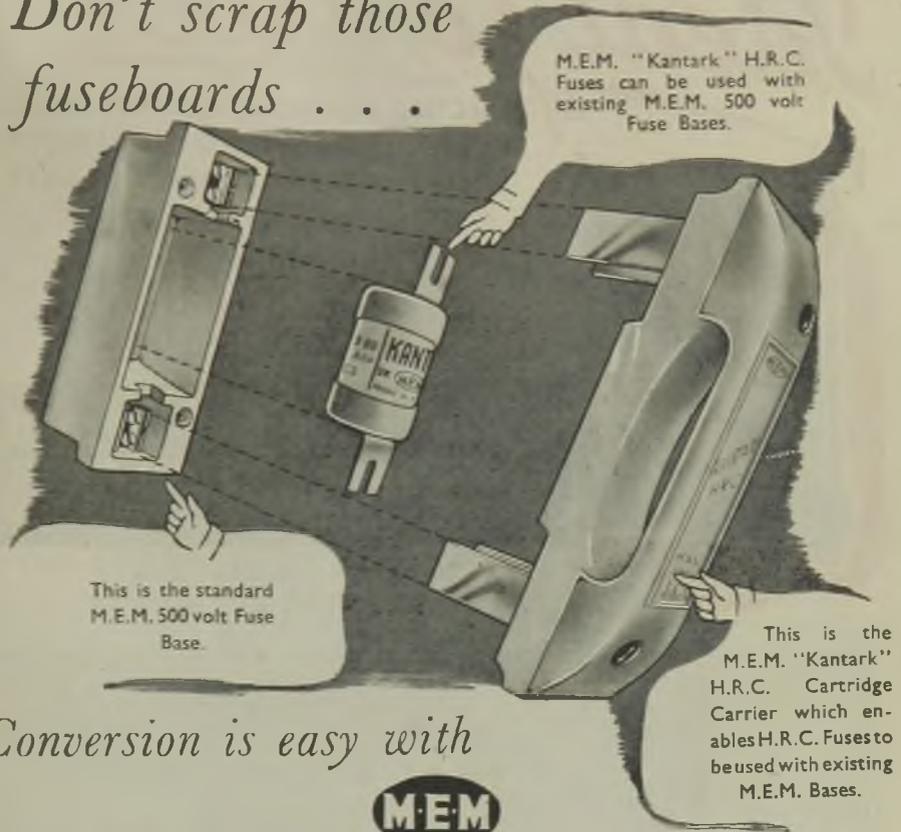
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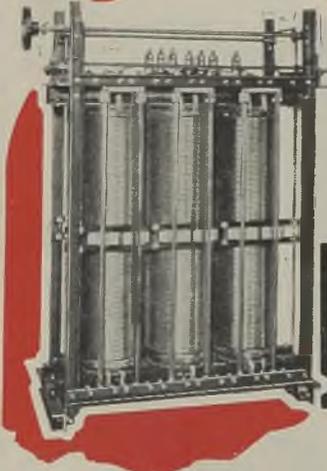
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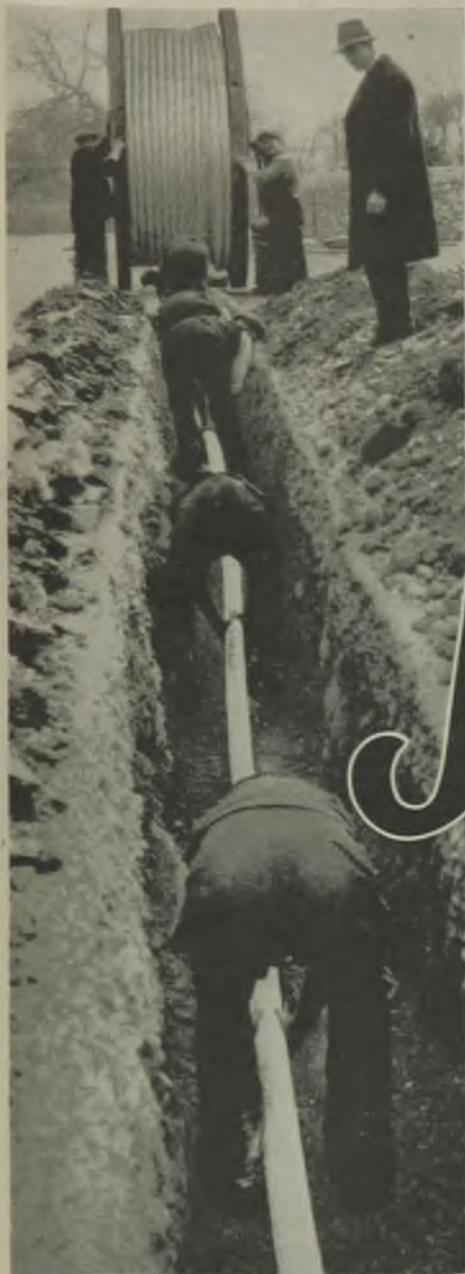


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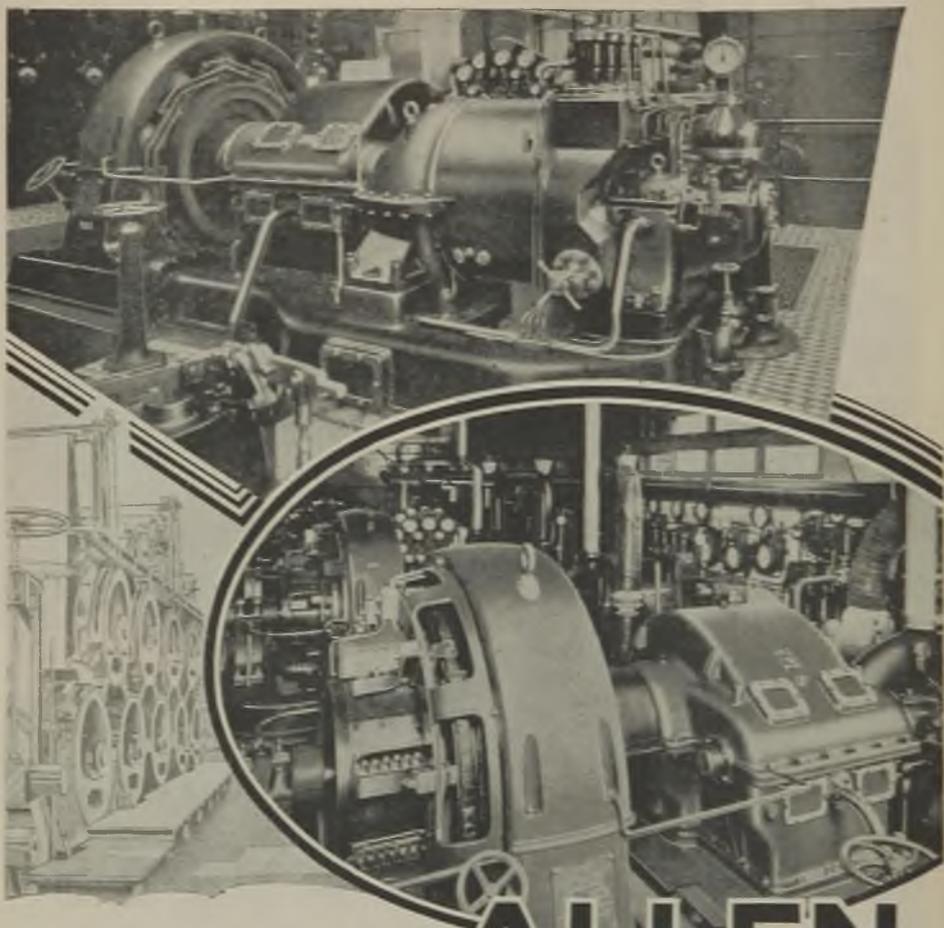
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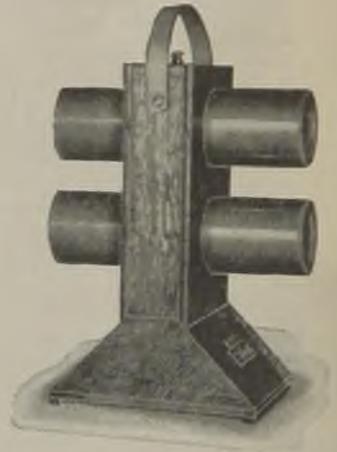
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Technical Books

Engineers' Needs and Resources

PRICMARILY concerned with the application of knowledge to practical ends by methods varying with circumstances and owing much to innate ability and experience, the engineering outlook is not normally disposed towards reading for its own sake. Students, who form the bulk of readers, not unnaturally tend to regard books as an aid to passing examinations, with a view to securing passports to higher-grade employment or, more thoughtfully, as a store-house of knowledge accumulated by earlier workers that is placed at their disposal.

Most technical books published have an academic cast. Many of these cover well-trodden ground and any improvements over their predecessors are not so marked as to shake the preference of older readers for established works (brought up to date) which they know well enough for ready checking of formulæ or for refreshing their memories quickly on some point.

Too Few "Practical" Authors

That too small a proportion of authors is drawn from among those engaged on the more practical aspects of industry was one of numerous sound criticisms of present conditions that was raised during the discussion of the address given by Mr. C. W. Marshall to the Association of Supervising Electrical Engineers last week. It is significant that the lecturer's own choice included a number of veterans, especially on non-electrical subjects (other than chemistry). He did well also to draw attention to the great value of certain

B.S.I. and E.R.A. publications. For those specialising in electrical installation and maintenance there are in addition the text-books named by the Association as likely to be helpful (they may be referred to during the examination) in qualifying for the Swann Diploma, while on broader lines the list issued by the Institution of Electrical Engineers in connection with its examination should be studied.

Current Developments

All too scarce are books dealing with new developments and processes. Although particular aspects of these are described in the technical press and in manufacturers' brochures and, usually after a lapse of time, form the subjects of papers read before various institutions, the co-ordination of such scattered data in a proper relationship calls for presentation in book form. Difficulties are great. Those actually engaged on work of this nature may not be able to devote time to literary effort in the requisite detail. They may look forward to early progress that would perhaps make initial work obsolete or they may wish to avoid premature disclosure of results. This need to keep in constant touch with technical developments everywhere is sufficient justification for the value ascribed by the lecturer to an ability to read foreign literature in the original.

Few books containing clear diagrams are available to those, including foremen and craftsmen, who find themselves off the beaten track and, in a dilemma, are more concerned with the "how" than with the "why." Although intensive read-

ing that keeps wide of the risk of the crystallisation of ideas is a utilitarian necessity, many will agree with Mr. Marshall's view that need having been satisfied one can thereafter profitably indulge one's bent over more extensive fields of technical literature, including biography. To do so often brings its own reward in promoting a clearer outlook on everyday affairs.

Cost of Poor Fuel implies more than that fewer heat units are obtainable for the same cost per

ton. It also entails increased capital and operating charges. This is illustrated by the new boilers for Battersea "B" station (particulars of which appear this week) in which design has been very considerably influenced by the need to secure a high order of availability. Provision is being made to pulverise part of the fuel when this is unsuitable for mechanical stokers and plant is being installed especially to compensate for the increased consumption of steam for soot blowing as a result of greater fouling of the heating surfaces.

Electricity Output Trend EXCEPT for January and April the electricity output of authorised undertakings this year has been consistently below the corresponding figures for 1944. This was to be expected as the war load came to an end and was foreshadowed in the reports of undertakings for 1944-45, many of which revealed a reduced power demand offset by greater domestic consumption. The Commissioners' returns for November show that the decline in that month was 3.7 per cent., which compares with 4.6 per cent. in October and 7.3 per cent. in September. It is too early yet to judge whether this indicates a balancing of peace-time industry against the loss of the war load.

Clean Air SUPPORTING Mr. Herbert Morrison's plea to local authorities at the official opening of Waterloo Bridge that they should carry on the scientific campaign against atmospheric pollution comes the Report of the Department of Scientific and Industrial Research on investigations at Leicester, some particulars of which are given in this issue. As a result of the experience there gained, reliable informa-

tion can now be obtained more expeditiously in other towns where surveys are being made. The Report bears out the contention advanced by electrical engineers that coal burned under controlled conditions at power stations with a few tall chimneys adds little to general atmospheric impurities which, it has been estimated, cost the community £40 million a year in material damage alone. These impurities are preponderantly due to emanations from myriads of dispersed domestic chimneys.

The D.O.T. FROM its inception the Department of Overseas Trade has been under the joint control of the Board of Trade and the Foreign Office, an arrangement that has not always proved satisfactory. Last week Mr. Attlee announced the Government's intention to leave the Department entirely in the hands of the Board of Trade. This, at all events, will relieve the D.O.T. of the task of endeavouring to serve two masters and on the whole the Board is the more appropriate of the two parents to take sole charge. One thing is not quite clear, however. That is the position of the commercial representatives, who are a part of the diplomatic service. Presumably their reports, a valuable feature of the D.O.T.'s work, will be presented to the Foreign Office which will either publish them itself or hand them over to the Board of Trade for publication. It is to be hoped that no delay will result.

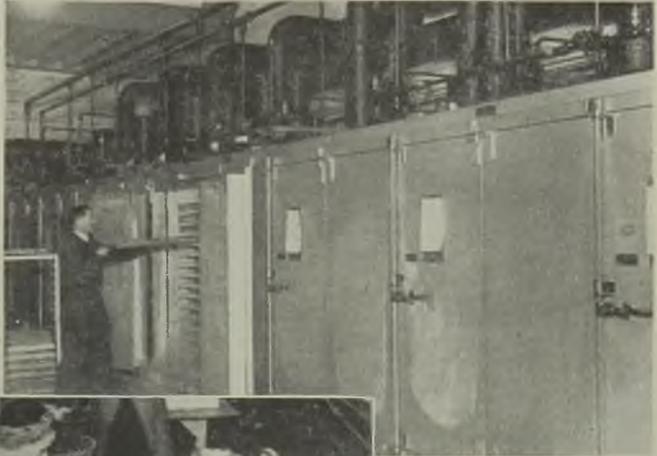
Mineral Insulation FOR situations requiring the use of fire-proof and fire-resisting cables, powdered magnesium-oxide insulation has established its case and merits the special consideration given it in the I.E.E. Regulations. So much was evident from the discussion of the paper presented by Messrs. F. W. Tomlinson and H. M. Wright before the I.E.E. Installations Section. When terminal accessories have been developed to the same standard as the cable itself, the scope of the system ought to be considerably widened. Compactness and ease of installation should make a metal-sheathed system having a reasonable amount of flexibility especially suitable for housing schemes, for which cable lengths could be prepared in quantity beforehand. This should bring about a desirable reduction in cost.

Herring Freezing

Refrigeration Plant for Storing Surplus Fish

TO permit surplus herrings in glut periods to be kept in good condition until required in seasons of scarcity, Mac Fisheries, Ltd. (which is associated with Lever Bros. & Unilever, Ltd.), is setting up, in conjunction with the Herring Industry Board, a number of depots in which the fish can be rapidly frozen and then kept in a refrigerated store. One of these depots has already been opened at Fraserburgh, and a second at Great Yarmouth has just been put into commission. Through the courtesy of the owners we were recently given an opportunity of inspecting the plant at the Yarmouth establishment.

The herrings arrive from the nearby fish-wharf by lorry in "swills," large baskets holding one-third of a cran (five crans = one ton), and are tipped into a trough and washed. They are then scooped out in wire baskets which are weighed to hold 7 lb.



Left: Preparing and packing the herrings into trays before freezing. Above: Loading trays into the frosters



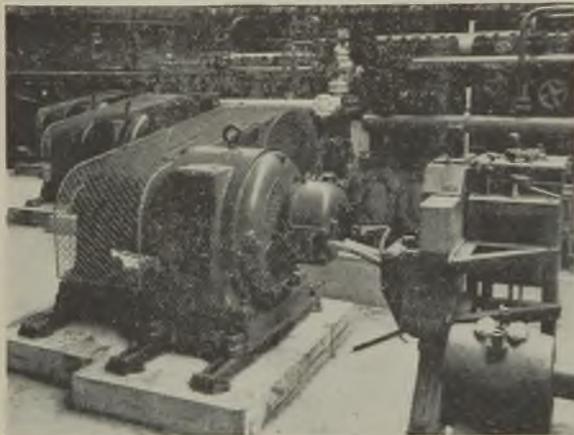
(roughly twenty-three fish). Packers lay the fish neatly in flat aluminium trays containing four 7-lb. divisions, each being separately wrapped in waxed paper. The trays are loaded on to rack trolleys, holding thirty trays, and wheeled to the frosters, of which there are eight, each holding forty-five trays (90 stone).

Inside the frosters the trays are placed on shelves formed of aluminium plates with steel tubing through which liquid ammonia is passed. Hydraulic pressure is applied to ensure that the trays are in close contact with the shelves, the temperature of which is maintained at minus 27 to 40

deg. F. After approximately two hours in the froster the trays are removed and taken to the knocking-out table where the now solid 7-lb. slabs of frozen fish are stored in cardboard cartons each holding six slabs (42 lb.). When stuck down the cartons are taken by means of a roller conveyor to a

ammonia is circulated through the froster pipes by means of centrifugal pumps driven by 1-HP 420-RPM motors, all pipework being insulated with a covering of cork 5 in. thick.

The refrigeration plant for the cold room is automatic; thermostats maintain the temperature at the required figure and all necessary safety devices are incorporated. In this case a twin compression unit is employed driven by a 40-HP, 1,440-RPM Crompton Parkinson motor, the automatic control gear having been supplied by the Watford Electric & Manufacturing Co., Ltd. Since no spare



Some of the compressor plant for the frosters

cold store capable of holding 400 tons, the temperature there being maintained at minus 10 deg. F. In this cold store the fish can be kept in perfect condition until the out-of-season period begins. From store the herrings will go (in refrigerated vans) for sale as "fresh" fish or (if required) for kippering. Working from 8.30 a.m. to 5.30 p.m. it is possible to deal with 120 crans (20 tons) of fish a day.

To operate the frosters four J. & E. Hall mono-block ammonia compressors are provided, each driven by means of V-belts

Compressor and automatic control gear for the cold store

by a 120-HP 970-RPM 400-V Crompton Parkinson motor, manually operated by means of an Erskine Heap starter. In very hot weather all four compressors may be required to maintain the temperature at the desired figure, but normally one or two are sufficient. A check on temperature is obtained by means of thermo-couple recorders. The

plant is installed, the installation is normally run at well below the stipulated temperature of the cold room, minus 10 deg. F. instead of minus 1 deg. F., this giving a 12-hour reserve, in case of a failure.

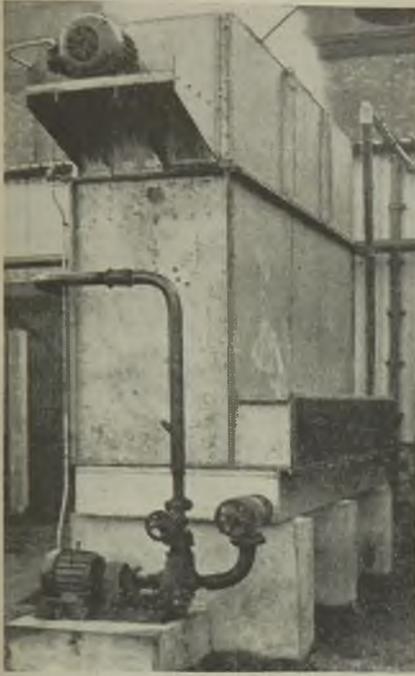
Each of the five compressors installed is provided with a condenser erected outside the main building. The ammonia gas (in coils) at approximately 210 deg. F. is cooled to a liquid at 60 deg. F., by means of cold water (supplied by a Gwynne's centri-



fugal pump driven by a 2-HP 930-RPM Crompton Parkinson "Klosd" motor and supplemented by a forced-draught fan (also operated by a 2-HP "Klosd" motor) which

draws air in at the bottom of the condenser.

The hydraulic gear for the froster shelf plates comprises two centrifugal pumps compressing the operating liquid to 200 lb. per



Ammonia condensers

sq. in., the apparatus starting up and stopping automatically when the pressure falls below a 150 lb. per sq. in. or rises above 250 lb. per sq. in. Higgs 3-HP motors running at 1,100 RPM are employed to operate this gear. The whole of the metal-clad switch-and fuse-gear installed throughout the works is of the English Electric Company's construction.

As may be imagined, the hands of the washers, packers and plant operators are liable to get very cold, particularly in the winter, so to supplement the tubular heaters and bowl fires which provide the general heating, a number of gilled hand-warmers are provided round the walls.

We thank Mr. R. F. Houston, manager of the works, Mr. N. C. Goult, supervisor, and also Mr. R. H. Johnstone, Ministry of Food Herring Control Officer, for the assistance which they afforded us in the preparation of this article.

St. Pancras Plans

Purchase and Sale of Domestic Appliances

APPROVAL has been given by the Finance and General Purposes Committee of the St. Pancras Borough Council to a scheme submitted by the Electricity and Public Lighting Committee for the inauguration of cash sales of apparatus to consumers at the showrooms. Reporting on the subject the Electricity Committee quoted the relevant passages from Section 48 of the Electricity (Supply) Act, 1926, relating to the sale of fittings and apparatus and asked for the Council's authority to undertake direct sales from the showrooms. In view of the present shortage of supplies it was proposed that sales should be restricted to the retail market but that the question of sales to contractors should be reviewed in six months. The Finance Committee estimates expenditure during the current half-year at £5,000.

Consumers' Freedom of Choice

Dealing with the purchase of electrical appliances the Contracts and Stores Committee has reported that well-known makers were asked to submit tenders for cookers and water heaters and these have been analysed. Acceptance of a tender implies the purchase of only such apparatus as may be required and the Council does not commit itself to purchase any specified quantity. Successful tenderers will be given facilities for displaying and demonstrating models in the electricity showrooms and the Council will place no restrictions upon the free choice of the consumers. As it is extremely difficult to obtain apparatus except in small quantities the Committee considers that all the tenderers should be placed on the Council's list of firms from whom cookers and water heaters will be purchased as and when required.

The cooker manufacturers thus listed are the Revo Electric Co., Ltd., the General Electric Co., Ltd., the Jackson Electric Stove Co., Ltd., Belling & Co., Ltd., and Moffats, Ltd. The water-heater makers are Johnson & Phillips, Ltd., Heatrac, Ltd., the General Electric Co., Ltd., Drake & Gorham Wholesale, Ltd., Aidas Electric, Ltd., Hotric, Ltd., Berry's Electric, Ltd., and Ferranti, Ltd.

It is recommended by the Finance and General Purposes Committee that this arrangement shall be reviewed at the end of three months in view of the rapidly changing condition of the market.

The estimates of the Electricity and Public Lighting Committee for the eighteen months to September 30th, 1946, provide for a total capital expenditure of £83,950. Among the items is domestic apparatus for hire (£17,800) comprising 550 cookers at an average of £13 each, 500 water heaters (£15), 350 wash coppers (£5) and 200 "unspecified types" (£7). Rental wiring for small dwellings is put at £1,500 (1,000 points complete with lamp and shade at 30s. per point). Rental wiring (all-electric) is shown at £1,200 (200 installations).

Battersea "B" Station

Additional Set With Hydrogen-Cooled Alternator

WHEN designs were being worked out in 1936-38 for the second half of the Battersea station of the London Power Co. the engineer-in-chief, Sir Leonard Pearce, decided that considerations of capital and running costs, space availability and expected load would justify raising terminal steam conditions to 1,350-1,420 lb. per sq. in. and 950-965 deg. F. with boiler feed at 400-420 deg. F. and vacuum of 29-29.1 Hg. (bar. 30 in.). This gives a "basic regenerative cycle efficiency"* (*i.e.* excluding plant efficiency) for the "B" station of about 48.9-49.5 per cent.—just over 11 per cent. better than the 43.5-44.3 per cent. achieved at the "A" station with its steam conditions of about 600 lb. and 875 deg. F.

The initial installation in the "B" station (advance particulars of which were given in the *Electrical Review* of September 17th, 1937) consists of a 100,000-kW turbo-alternator in two units. The primary 16,000-kW 3,000-RPM unit receives steam at 1,350 lb. per sq. in. and 950 deg. F. from two retort-stoker-fired boilers, each having a maximum continuous rating of 550,000 lb. per hr. and exhausting to a secondary 78,000-kW 1,500-RPM unit having a 6,000-kW house service alternator on the same shaft as the main alternator and operated at 600 lb. per sq. in.; in emergencies it can be connected to the steam main of the "A" station. To ensure oxygen-free feed-water under the elevated steam conditions, there is, in addition to the normal closed system, a de-aerator through which all feed-water is passed before going to the pump section.

New 60,000-kW Set

An extension now in hand includes a three-cylinder 60,000-kW 3,000-RPM turbine, the double-flow low-pressure cylinder of which exhausts to twin condensers; it is not interconnected with the 600 lb. per sq. in. steam mains. Its maximum and economic ratings will be the same. The alternator is to be hydrogen-cooled. Auxiliaries will be supplied by a 6,000-kW 3,000-RPM turbo-alternator taking steam at 600 lb. per sq. in.

Three retort-stoker-fired boilers, rated at 320,000-400,000 lb. per hr. each, are to be

installed. One of the new boilers will be designed to allow 20 per cent. of the coal to be burned in pulverised form. Their 80-ft. high combustion chambers will be lined on all sides with water-cooled walls arranged on a pitching corresponding to the external tube diameter so that the tubes touch, this arrangement being regarded as giving the maximum effective water-wall surface. Boiler convection surfaces will be single vertical banks of widely pitched bent tubes, through which the gases pass horizontally after turning at right angles from their ascent in the combustion chamber.

Immediately behind the boiler tubes is a vertical-tube pendant superheater in three banks. On leaving the superheater the gases descend vertically through a flue and ascend through a five-bank horizontal-tube economiser, passing thence to a regenerative air heater and to vane-control fans for discharge to the flue-gas washing plant. A triple-effect thermo-compressor central evaporating plant with a capacity of 45,000 lb. per hr. make up is being installed to compensate for increased consumption of steam required for soot-blowing with inferior coal.

Future Extension

These extensions will complete two-thirds of the "B" station and will leave space for a further 100,000-kW turbo-alternator and three more 400,000 lb. per hr. boilers, bringing the total capacity of the station up to 509,000 kW including 33,000-kW of house-service plant. Initial mechanical difficulties associated with the boilers (which formed the subject of a paper presented recently to the I.Mech.E.) have been overcome and the units are steaming regularly at a reduced rating. During a recent week's run a generated thermal efficiency of 31.5 per cent. was recorded for the "B" station and 29.9 per cent. for "A" and "B" stations combined. These percentages may be compared with those obtained for the "A" station (commissioned in September, 1933) of 27.24 (generated) and 25.65 (sent out) in 1934 and 28.98 and 27.63 in 1938. The plant installed in the older station comprises two 69,000-kW and one 105,000-kW 1,500-RPM turbo-alternators and six 250,000- and three 300,000-lb. per hr. retort-stoker-fired boilers.

* See Thomas Hawkesley Lecture 1939. Proc. Mech.E., 1940 (*Electrical Review*, January 26th, 1940).

A Pythagorean Chart

Avoiding Tedious Repetition

By G. F. Freeman, M.Sc. (Eng.), M.I.E.E., A.M.I.Mech.E.

THE application of the theorem of Pythagoras concerning the squares on the sides of a right-angled triangle to alternating-current calculations is direct and simple, but the very frequency with which the familiar sequences recur makes it desirable that the actual work shall be minimised.

A chart method avoids tedious repetition by presenting all possible shapes of triangle—size does not matter within the limitations imposed by accurate perception—so that each problem may be solved merely by inspection and scale conversion. It is also possible to increase precision, for a given chart area, by

angle ϕ , the power factor ($\cos \phi$) may be the fourth parameter. Only one quadrant is shown; the necessary adjustments of sign for the other quadrants are easily made.

Fig. 2 is the equivalent of Fig. 1, but with square-law instead of uniform length scales. The most useful part of the chart is nearly doubled, giving correspondingly better precision without increase in overall size. The Z circles have now become straight lines, a distinct advantage in constructing the chart. A working chart on the lines of Fig. 2 is given in Fig. 3, to a larger scale and with more subdivision.

Mark off along a horizontal line OR and an intersecting vertical line OX distances proportional to the squares of their corresponding scale numbers. Any convenient range may be used; in Fig. 3, 0 to 10 has been chosen. Now draw a series of horizontal lines (the X lines) and vertical lines (the R lines) through the scale markings, subdividing to an appropriate degree. The next step is to join corresponding points on the two axes by straight lines (the Z lines). The perpendicular distances from the origin are $1/\sqrt{2}$ times

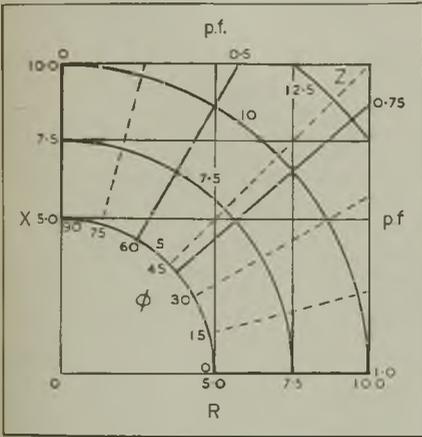


Fig. 1

the adoption of functional scales which emphasise the working region. Trigonometrical methods, including slide-rule manipulation, may be more precise, but the chart method is quicker and often quite adequate. It may also be used as a check on more exact calculations. Typical AC problems which lend themselves to chart solution are those which concern impedance, admittance and their components, load combination and power factor correction.

The chart to be described is a development of Fig. 1, in which rectangular co-ordinates R and X are correlated with polar co-ordinates Z and ϕ , using for convenience impedance symbols. Instead of the phase

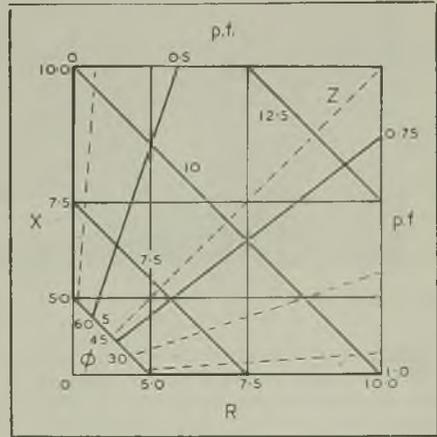


Fig. 2

those for the corresponding R and X lines; draw further Z lines on this basis to complete the series. Finally, draw radiating lines from the origin through the intersections of the

line $Z = 10$ with the lines $R = 9, 8, 7$, etc.; these are the power factor lines for $p.f. = 0.9, 0.8, 0.7$, etc. Alternatively, the radiating lines may be scaled in phase angle instead of power factor; in Fig. 3 the phase angle is indicated on a perimeter scale.

The R, X and Z scales are used directly for

factors may be introduced without difficulty (as with powers of 10 on the slide rule) in order to use a convenient part of the range. An alternative is to cut down the number of such factors by using a wider range (and somewhat larger chart) or by marking the chart with two or more scales. The essential

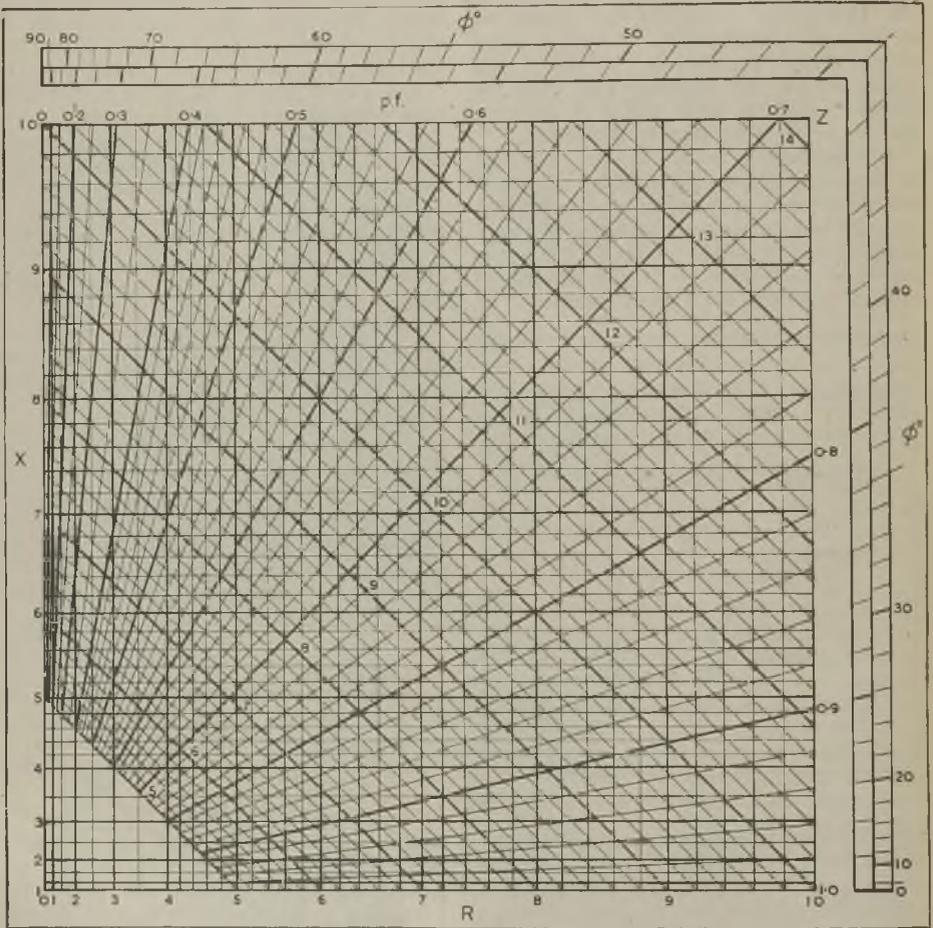


Fig. 3

impedance problems (Example 1); for admittance problems the Z scale is used for Y , the R scale for conductance, G , and the (negative) X scale for susceptance, B (Example 2). In power problems, the R scale is used for kW, the (negative) X scale for kVAR, and the Z scale for kVA (Examples 3, 4, 5). Percentage voltage and percentage impedance are treated as plain impedance (Examples 6, 7). In all cases, simple integral

procedure, however, is the same in all cases. The following examples illustrate some uses of the chart.

Example 1.—Given a resistance of 8Ω in series with an inductive reactance of 6Ω , it is required to find the impedance and its p.f. (or phase angle). The solution, by inspection, is $Z = 10\Omega$ at p.f. 0.8 lag, at the intersection of the lines $R = 8$ and $X = 6$.

Example 2.—Given an inductive admittance

of 0.2 mho, p.f. 0.5 (60 deg.), it is required to find the components. A convenient factor is 50. Noting that the line $Z = 10$ meets the line p.f. = 0.5 at $R = 5$, $X = 8.66$, the required conductance (dividing by 50) is then 0.1 mho, and the susceptance -0.173 mho (note the negative sign), the symbolic admittance being $Y = 0.1 - j0.173$ mho.

Example 3.—Given a 1,000-kVA load at 0.8 p.f. lag, to be improved to 0.95 lag by static condenser, it is required to find the final load kVA and condenser kVAR. From the intersection of $Z = 10$ and p.f. = 0.8, noting $X = 6$, follow the line $R = 8$ until it meets p.f. = 0.95 at $X = 2.62$, $Z = 8.42$. The new total load is thus 842 kVA and the condenser rating $100(6.0 - 2.62) = 338$ kVAR leading.

Example 4.—Initial load as in Example 3, but a 750-kVAR condenser used, the final load and p.f. being required. We now have $750 - 600 = 150$ net leading kVAR, so that the load point shifts to $R = 8$, $X = 1.5$, at which $Z = 8.14$, p.f. = 0.982. The final load is thus 814 kVA at 0.982 p.f. lead.

Example 5.—Given a 5,500-kVA load at 0.75 p.f. lag to be improved to 0.9 p.f. lag at the same total kVA, the necessary synchronous-motor input being required. This may be done using $Z = 5.5$, but for better precision use $Z = 11$. At p.f. = 0.75, $R = 8.25$ and $X = 7.27$; at p.f. = 0.90, $R = 9.90$ and $X = 4.80$. Hence the synchronous motor must take $500(9.90 - 8.25) = 825$ kW and $500(7.27 - 4.80) = 494$ kVAR leading. This amounts to 960 kVA at 0.86 p.f. lead.

Example 6.—Given full kVA load at 0.8 p.f. lag on a short transmission line with 5 per cent. resistance, 10 per cent. reactance. load voltage 100 per cent., it is required to find the percentage of the sending voltage, kVA and p.f. From the intersection of $Z = 10$ with p.f. = 0.8, note that $R = 8$ and $X = 6$. Add 0.5 to R and 1.0 to X , and note that $R = 8.5$ and $X = 7.0$, then $Z = 11.0$ and p.f. = 0.773. The required sending voltage and kVA are thus 110 per cent. of load values at p.f. 0.773 lag.

Example 7.—To find the p.f. at which the line of Example 6 has a sending-end voltage of 100 per cent., look along the line $Z = 10$ to find two points such that R differs by 0.5

while X differs by 1.0. This occurs for $R = 9.2$, $X = 3.92$ and for $R = 8.7$, $X = 4.92$; corresponding power factors are 0.92 (sending end) and 0.87 (load end), both leading. In this condition, the kVA are the same at both ends.

The square-law scales may also be used in the form of a slide rule. Such a rule, which correlates Z , R and X (but not ϕ) is illustrated schematically in Fig. 4, being shown in the

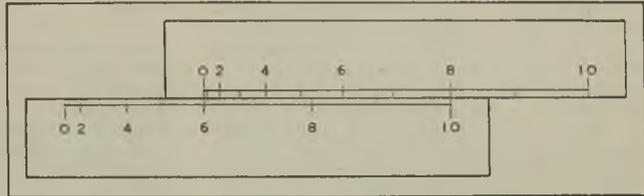


Fig. 4

position in which $R = 6$, $X = 8$, $Z = 10$. The theory is obvious, since $Z^2 = R^2 + X^2$. Somewhat similar rules have been used elsewhere in power factor correction calculators.

Providing very small values of Z are avoided, precision is always attainable with such a chart, and since all the lines are straight it is easy to draw variations to suit the user's needs. The form given in Fig. 3 is adapted for AC calculation, but in mechanical work, for example, an angle scale would usually be preferred to the cosine (p.f.) scale.

Locating Atmospheric Disturbances

ATMOSPHERIC disturbances caused by lightning and their location by radio methods are explained by MR. C. CLARKE in a paper presented to the London Students' Section of the Institution of Electrical Engineers.

After considering the nature of the discharge as well as the radiation of energy from it, reasons are stated for the oscillatory wave form of distant "atmospherics," especially those recorded during the daytime.

Principles governing the design of radio direction-finders used in this country for determining the positions of these transient disturbances are outlined: the several advantages of brilliance modulation of the cathode-ray indicator tube are pointed out; and reasons stated for the different kinds of trace appearing on the screen, which may range from the ideal straight line to a very complex pattern of superimposed ellipses of varying axes, bearing and eccentricity. The paper discusses the errors associated with position finding by means of the kind of apparatus described.

Views on the News

Reflections on Current Topics

REFERRING to my recent remarks about price control of appliances, a reader queries whether the control does not in fact apply only to wholesale prices and that retailers are not therefore at liberty to charge more or less what they like. This is by no means the case, the control being effective at all stages of marketing. Possibly my correspondent is confusing price control with purchase tax, which being based on the wholesale price of goods does not necessarily have to be passed on and collected in the retail price. This, of course, has the effect not of raising but of lowering the selling cost and though obviously manufacturers do not often extend their generosity to such limits, there are cases in which it has been felt desirable in order to overcome certain difficulties. For their part the Inland Revenue authorities have no interest in the matter so long as they receive the appropriate tax.

* * *

A very handsome brochure distributed to its employees by the West Gloucestershire Power Co. may perhaps be considered a sign of the times. Its aim is to give the company's men and women a survey of the results of their efforts during 1944 and to place before them in simplified form a statement of the company's earnings and expenditure and the contribution which it has made toward the welfare of the community. There is a foreword by the chairman (Mr. T. Blundell Brown) and an explanation of the nature of the company's business as contrasted with that of purely trading concerns. Stress is laid on the great amount of capital sunk in distribution. The accounts are then summarised and analysed; it is shown that interest and dividends took no more than 5.8 per cent. of the revenue of £577,654, which was £333,535 more than in 1938. At the same time, it is mentioned, charges have gone down in spite of doubled coal prices. Understanding of salient facts is assisted by many clever little drawings and diagrams.

* * *

Getting up these cold mornings is not something to look forward to, but it is interesting to see how they are making the best of a bad job in the United States. If we are to judge from current advertisements, the alarm clock, even the electrically operated variety, appears to be quite out of date, and the modern American is awakened either by a light flashing on his face or by music from his radio set. The former method is said to be quite effective and to be particularly welcomed by the hard-of-hearing. Apart

from the special time switch units for operating the radio, some radio receivers are now available with built-in time switches. I still think, however, that the devices on the market before the war for making a cup of tea by the bedside and calling you when it is ready—I don't mean a wife—take a lot of beating.

* * *

Low temperatures that last for only two or three days do not, so far as I can ascertain, add to the peaks of supply undertakings in anything like the same way as when they are extended over a week or more. Possibly this is because people will put up with cold weather for a short time before doing anything about it. Their fortitude exhausted, they then buy additional electric fires, especially if they still employ alternative means of heating and wish to remedy the deficiencies of the latter by adopting a method that allows them to have the warmth just where it is required.

* * *

Heath Robinson would have liked the "electronic ratter" by which, says the American journal *Food Industries*, food and other industries have "gotten rid of their rats at as high as eighty in a night." To the rat the gadget looks like an open tunnel placed over his runway, so he starts through. But, continues the description, he breaks an electric eye beam causing doors to close at both ends of the tunnel and a side door to open. To escape he rushes through the side door into a small compartment and runs up a ramp leading to an execution chamber, his weight on the ramp closing the small door behind him. As he enters the death box he is gripped firmly by electrodes which kill him with 110-V current. Then the death-chamber floor drops and the dead rat falls into a wire basket, the trap then automatically resetting itself in readiness for the next victim's arrival.

* * *

The same journal also mentions a high-frequency cooker for potatoes. The potatoes are immersed in saline solution in a Pyrex container between two electrodes connected to a 12-kW, 250,000-cycle spark-gap h.f. generator. This method of blanching before dehydration is expected to give more uniform quality and reduce the losses of soluble solids, flavour and vitamins. The operating cost is calculated at 0.062 cent per lb. at 58 per cent. efficiency. No indication is given of the cost of the plant itself.—

REFLECTOR

PERSONAL and SOCIAL

News of Men and Women of the Industry

THREE members of the Swedish Directorate of Telegraphs are expected to arrive in London on January 11th to study the British overseas system controlled by Cable & Wireless, Ltd., which operates a direct photo-telegraph circuit with Stockholm. The party will comprise Mr. S. A. Gejer and Mr. K. J. T. Ekstrom, engineers of the Board of Swedish Telegraphs, and Mr. G. T. A. Widlund, superintendent of the Stockholm Radio Centre.

Mr. T. G. Martin, A.M.I.E.E., A.I.Mech.E., recently left the Army and has joined Gresham Transformers, Ltd. During the war he was mentioned in despatches and was awarded an American decoration, the Bronze Star. Before the war he was with Central London Electricity, Ltd.

Mr. C. Anderson, A.M.I.E.E., who before joining the Forces was chief assistant engineer to the Douglas Corporation Electricity Department, has been appointed electrical and mechanical engineer in charge of construction in Nigeria, West Africa. During the war he served with the R.E.M.E. attaining the rank of lieutenant-colonel. Before going to Douglas, he served on the staff of the Manchester Electricity Department, and with the English Electric Co., Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and Ferguson, Pailin, Ltd.

Mr. A. E. Aldridge has resigned the position of assistant mains engineer in Hackney Electricity Department to take up an appointment with the Walthamstow Borough Council.

The retirement of **Mr. W. J. Rudd**, after forty years' service as registrar of the English Electric Co., Ltd., Stafford, was marked by a complimentary dinner on December 14th, when he was presented with a clock and a cheque. The presentation was made by Mr. G. W. E. Hooper, secretary, who also handed to Mr. Rudd a long-service certificate.

Mr. N. Corcoran, B.A., B.Sc., M.Sc.Tech., A.Inst.P., is leaving his present radar research post with the Ministry of Supply to take up an appointment as lecturer in physics at Stockport College for Further Education, on January 1st, 1946. Before joining the Ministry of Supply in 1941 Mr. Corcoran was for some years responsible for illuminating engineering in the Manchester office of Metropolitan-Vickers.

Mr. H. Carpenter, A.M.I.E.E., deputy electrical engineer and manager to the Thornton Cleveleys U.D.C., has been appointed to the position of chief electrical engineer and manager in succession to the late Mr. A. G. Cooper. Mr. Carpenter has been with the Department for nineteen years, receiving his practical and general training from 1926 to 1931, when he became technical assistant. He was appointed

chief assistant in 1933 and deputy electrical engineer in 1938. Since 1940 he has been serving as temporary experimental officer to the Admiralty; he was attached to the staff of the Superintendent of Degaussing until 1942 and latterly to the staff of the Superintendent of Mine Design.

Mr. E. Smith has been appointed sales organiser of Frank Westerman (Wholesale), Ltd., Birmingham, on his return from service in the R.A.F.

Thirty-five applications have been received for the post of borough electrical engineer and manager at Barnsley, where Major E. A. Barker, M.C., is about to retire.

Before the factories closed down last Monday for the two-day Christmas holiday A. Reyrolle & Co., Ltd., Hebburn, arranged for their work-people to have a "social hour" in which they could visit friends in other departments. Entertainment was also provided and arrangements were made for the event to be broadcast.

The December issue of the *Electrical Power Engineer* contains appreciations of the services of **Mr. W. Arthur Jones**, the general secretary of the E.P.E.A. for twenty-six years, who retires on January 1st, and a farewell message from Mr. Jones. At the November meeting of the General Purposes Committee of the Association it was decided to defer until the next meeting the question of appointing an assistant general secretary to succeed **Mr. J. F. Wallace**, the new general secretary.

The Birmingham Electric Club has arranged a children's party to be held at the Grand Hotel, Birmingham, on January 5th from 3 to 6 p.m.

Mr. L. A. Lee, district engineer at Market Harborough for the Kettering Electricity Department, has been appointed assistant consumers' engineer to the Mid-Lincolnshire Electric Supply Co.

Development and Nationalisation

THE Minister of Fuel and Power (Mr. E. Shinwell), accompanied by the Electricity Commissioners, last week met representatives of the electricity supply industry to discuss arrangements to be made for maintaining the development of the industry before nationalisation. The following organisations were represented:—The Incorporated Municipal Electrical Association, the Incorporated Association of Electric Power Companies, the Provincial Electric Supply Association, the London Electricity Supply Association, the Conference of Joint Electricity Authorities and Joint Boards, and the Central Electricity Board. Spokesmen representing these bodies assured the Minister that in the interim period normal development would proceed.

CORRESPONDENCE

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

Stand-by Storage Batteries

THERE is now appearing in the national press an advertisement by the Ministry of Fuel and Power warning people that electricity cut-offs are probable. While we agree with the principle which has inspired the advertisement, it seems to us extraordinary that when the Ministry is talking about peak loads, it should be guilty of making the flat statement that "... it is impossible to store electricity."

It is appreciated that the storage of a sufficient quantity of electricity appreciably to relieve peak loads over the entire grid system is at present impracticable, but at the same time a strong case can be made for large peak-load batteries in particular cases. It is well known in the industry that the Heston and Isleworth undertaking has, to some extent, eased its peak-load problems by installing a 460-V 5,000-Ah battery.

On the purely storage question, cinemas and other places of entertainment are required by law to have an emergency lighting supply in case of an interruption of the mains supply. For this purpose, many storage batteries are in use. It is also a fact that most hospitals have "stored electricity" standing by to supply lighting current for the operating theatres in case the mains supply is interrupted during a vital operation. Again, a number of retail stores have found that it is in the public interest to have a stand-by supply of electricity from a storage battery available.

In view of these facts, we find it difficult to reconcile the Ministry's statement with our own experiences.

CHLORIDE ELECTRICAL STORAGE CO., LTD.,
London, S.W.1. W. FEARNLEY.

Staff Association Wanted

IN your issue of December 14th, under the above heading, a letter signed "Accountant" suggested the formation of an association to represent the clerical and administrative staffs of power and supply companies. It is rather surprising that the suggestion should be put forward when an association which exists for the very purpose outlined by "Accountant" was formed as far back as January, 1919, in consequence of

the report of a Committee appointed by the Board of Trade to inquire into the question of the supply of electricity throughout the country. This is the Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain (A.O.E.C.).

The membership of the Association comprises members of the administrative, commercial and clerical staffs of companies in all parts of England, Scotland and Wales, the Association having on its books members of the staffs of over 80 holding, power and supply companies. The membership of one of the larger power companies totals over 200, whilst one of the provincial electricity supply companies is able to record a membership of considerably over 100.

If "Accountant" will communicate with me at "Kingsway," Sutton Road, Seaford, Sussex, I will be pleased to send him any further particulars he may require.

Seaford, Sussex. JOHN J. GIBBONS, F.C.I.S.,
Acting Secretary.

Plant Breakdowns

Repair Facilities Described

A LECTURE on this subject was given on December 17th by Mr. J. Ashmore, M.I.E.E. (British Electrical Repairs, Ltd.) to the Birmingham Electric Club. Mr. Ashmore said that breakdowns could be classified broadly as electrical and mechanical and he emphasised that in such work the fundamentals must always be remembered and particularly the laws of electricity and their effects.

The mechanism of electro-magnetic forces and the short circuit were dealt with by demonstration and lantern slides. Some interesting illustrations of mechanical fault diagnosis were shown, culminating in a demonstration of a Watford "Strobolyser." Many slides were shown of electrical plant casualties.

Finally, Mr. Ashmore gave some insight into the repair facilities available, making it clear that this section of the electrical industry had adequately kept pace with the demands on its service due to the rapid growth in the use of electricity. In conclusion a slide was shown of enemy action damage to a Birmingham repair works, and also a turbo-alternator repaired after being sent to this country just after "D" Day by the Forces in the field to be repaired in the works, rebuilt after the blitz damage.

Meter Comparator

Discussion on New Precision Instrument

THE discussion before the Measurements Section of the Institution of Electrical Engineers on the new instrument for more accurately testing laboratory standard AC meters described in a paper by Messrs. G. F. Shotter and H. D. Hawkes (see *Electrical Review*, December 21st) was opened by MR. R. S. J. SPILSBURY (National Physical Laboratory) who said this comparator was complicated and he was not very much in love with null methods. The inherent standardisation was really a form of calibration by means of another instrument to which was applied a reverse torque. That was a very nice and simple way, but it forced one, for practical reasons, to adopt a low-range milliammeter as the instrument which was calibrated; some of the many steps between the latter and the wattmeter finally used should be cut out. While the authors had eliminated practically all the troubles that could be avoided fairly easily, there were still the more difficult errors to be dealt with.

An Earlier Astatic Form

MR. D. C. GALL (H. Tinsley & Co.) said the authors were only applying known principles which Dr. Drysdale used with considerable success as far back as 1910; his instrument had the advantage that it was astatic. The accuracy of the method depended on a knowledge of the impedance of the circuit and, as it was a copper circuit, he did not see how one could expect an accuracy of 2 parts in 10,000. That was a reason why direct calibration under the conditions in which the instrument was to be used would be preferable, but for routine testing, the new instrument would have considerable advantages if it could be simplified. A very similar system had been developed in which the balancing of the torque was carried out automatically, which seemed to be an advance in technique and avoided some of the complications of the double adjustment. The automatic system could also be made astatic, thus avoiding the use of magnetic screens, which he contended must be a source of error.

MR. L. B. S. GOLDS (Edmundsons Electricity Corporation) said he would have preferred the new comparator to be made

completely astatic without the necessity for using "Mumetal," which might be a source of nuisance. The beauty of the instrument was that it was self-checking, with the exception of the voltage circuit resistances, which should be provided with tappings so that they could be cross-checked against the volt box of the potentiometer. There were a number of undertakings with annual incomes from meters of £1,000,000 (his own undertaking's was £7,000,000) which meant that with the ordinary wattmeter it was impossible to guarantee revenue nearer than £1 in £1,000. But the author's instrument made it possible to improve the accuracy of the fundamental standard by five times, so standing an even chance of paying the whole cost of the instrument in even a small undertaking in one year. The manufacturers should consider making the instrument in a portable astatic form for works or site tests of Petersen coil losses and insulation power factor. He was sure the instrument would, in time, have a wide field of application.

MR. H. EASTON (Ferranti, Ltd.), after referring to a number of deflectional instruments, as opposed to the authors' null method, called attention to the description in the appendices to the paper of the method used at the American Bureau of Standards by F. B. Silsbee, which seemed to be the ideal arrangement because it did not depend on the torsion of a shaft connecting two elements trying to operate in opposite directions.

Apparatus "Complex and Massive"

MR. F. E. J. OCKENDEN (Everett, Edgcombe & Co., Ltd.) said the results obtained by the authors were self-evident and it was quite impossible to criticise their accuracy, but the apparatus was complex and massive. Was it really worth while compared with what could be obtained with an astatic torsion-head dynamometer instrument, of which he regarded Dr. Drysdale's as the ideal?

DR. G. F. TAGG (English Electric Co., Ltd.) said he was a little worried about the correction for temperature. Although the authors adopted an old idea used by Dr. Weston, whereas he measured the resistance of the whole of the circuit, the authors only measured

part of it. How could one be certain that the part of the winding tapped off was at the same temperature as the whole of the instrument?

MR. W. L. BECK (Cambridge Instrument Co., Ltd.) said the remark about the use of magnetic material in the core of the wattmeter making an error on the AC-DC change over unavoidable might be true, but the authors had given no proof of it nor any indication of its probable extent.

MR. F. BYRNE, speaking from the user's point of view, also suggested that it would be an advantage if the instrument were astatic, to avoid the influence of stray fields, and

added that a stabilising device was required for its successful operation.

MR. G. F. SHOTTER (Northmet Power Co.), replying in part to the discussion, pointed out that the instrument had been in use for six years and had passed all the N.P.L. tests in such a manner that practically no error could be found. His experience over many years had been that some instruments were not as astatic as they appeared to be unless the field was uniform. The instrument as it was at present did not present any difficulty in operation, as his colleagues would confirm, and work was proceeding on a stabiliser, which would be the subject of another paper.

Mineral-Insulated Conductors

End-Seal Method Criticised

OPENING the discussion on the paper on "Mineral-Insulated Metal-Sheathed Conductors" by Messrs. F. W. Tomlinson and H. M. Wright (*Electrical Review*, December 14th) before the Installations Section of the Institution of Electrical Engineers, MR. E. JACOBI said he wished more space had been given in the paper to the qualities and capabilities of the cable for use under normal wiring conditions. There was no indication that the cable had been manufactured for other shields than copper, and it would be interesting to know the degree to which it would stand up to various difficult conditions. The principal weaknesses were the terminations and the necessity to use glands. In one particular case 46 different sizes of cable were listed, of 34 different diameters, which involved a considerable number of glands and fittings. If only one of the fittings were missing on a job there would be considerable delay. So far as glands were concerned, he suggested the possibility of some chemical into which the end of the cable could be dipped to form a sealing compound. Terminations were made in conjunction with accessories for ordinary conduit, but something better should be evolved. He also urged that the opportunity should be taken to size cables by current carrying capacity instead of by strands per sq. inch. Initial cost was not the only factor. Maintenance cost and ultimate life seemed from experience to date likely to be very satisfactory.

MR. D. E. BIRD said he had been responsible for using considerable quantities of this cable during the past seven or eight years in power

station work and it had been completely satisfactory in operation. It was now used for complete lighting, small power and pilot cable installations in power stations and he had also used it for substation work. The chief attractions were ease of installation in awkward places, the small amount of room taken up and its heat and fire resisting qualities. He disagreed with the suggestion to rate these cables on current carrying capacity, but enforced the plea for a simple sealing arrangement, although the present seal had been quite adequate. In one instance, where there were 20,000 seals, there had only been five failures in four years, but an easier method of sealing would be useful. He also thought that special fittings should be made for these cables instead of making use of conduit fittings.

MR. W. S. LOVELY also spoke highly of this cable in use. While the sealing of the ends had been the chief source of worry, that had been largely overcome by the latest type of end seal. There was, however, need for a more suitable sealing compound, which more nearly matched the filling of the cable and could be poured or squeezed out of a tube into the end box to form a homogeneous connection with the filling in the end part of the cable.

MR. H. G. GAMBLE remarked that he had used the cable for power station work and also for domestic electric cookers. It had advantages, but it would be necessary to cheapen the glands and accessories, for the ordinary wireman took far too much time to assemble them and, moreover, the planning of installations must be much more accurate

than for ordinary types of cable. The cutting of lengths must be absolutely correct as it was not possible to tuck away any surplus and the average operative did not like to have to work so accurately.

Mr. G. J. MAUGHFLING asked for further details of the method of making the cable.

Mr. G. F. FREEMAN said he had worked with Backer when he came to this country with his patent processes just over twenty years ago and the processes described in the paper were, with very minor variations, unchanged. He had a heating element in a nickel-chrome tube which was nineteen years old and still serviceable. Admittedly the end connections were a trouble, particularly on DC which made electrolysis more noticeable.

The chairman (Mr. FORBES JACKSON) asked for information about the use of this cable in houses, but nobody responded to the invitation.

Mr. D. B. MCKENZIE disagreed with the authors' statement that cables designed specially for aircraft wiring, together with the necessary tubing or casing, were no lighter than mineral-insulated cables. He would not consider the latter for high frequency in preference to polythene cables and

questioned whether they would be competitive with polythene cables at high temperatures. Trouble had been experienced on aircraft due to corrosion when mineral-insulated cables were in close proximity to other metals.

Mr. C. A. CAMERON BROWN thought there was something to be said for the new cable as a low-temperature conductor for slow warming. The possible drawback was cost, which would always be a determining factor in farm installations.

Mr. J. G. PARKER did not think the sealing of the ends was as bad as had been made out by many speakers.

Mr. G. D. CLOTHIER, who deputised for Mr. Tomlinson (one of the authors, who is in the U.S.A.) replied to the discussion. He said that work was in hand with the object of improving the end-seal and first tests with silicone compounds had been most promising.

Mr. WRIGHT, who also briefly replied, said the remark about aircraft wiring was based on a statement by a well-known firm of aircraft manufacturers which had compared weights, not of ordinary cable, but of an equivalent fireproof cable to run over the engine.

Walsall's Jubilee

New Station Planned

AT a dinner arranged by the Walsall Corporation Electric Supply Committee to celebrate the jubilee of the undertaking, on December 14th, Mr. C. Heathcock, chairman of the West Midlands Joint Electricity Authority announced that it was intended, as soon as labour was released, to commence building a £5,000,000 generating station at Walsall, in every respect a replica of the Ironbridge station. The size of the plant might be increased, he said, and the final cost might be in the region of £8,000,000.

The Mayor (Councillor M. J. Kavanagh), with the Mayoress and Alderman D. Cartwright (chairman of the Committee) received the 135 guests, who included Alderman Sir William Walker, president of the Incorporated Municipal Electrical Association, and representatives from many Midland authorities. During the fifty years' existence of the Walsall undertaking consumers have increased from 77 to 31,269 and electricity sold from 67,000 kWh to 91,924,000 kWh. The average price per kWh has been reduced from 5.50d. to 0.94d. In 1927 Walsall merged with the West Midlands J.E.A.

Sir William Walker, criticising stand-still restrictions which hindered normal electrical

development, said that for Councils to decide that in new housing districts half of the houses should have electricity and half gas was rubbish. Local authorities had no right to select what medium a tenant should use for lighting, cooking or heating, but should allow free choice. As an all-electric user himself, he objected to some of the electricity profits being given to the relief of rates to help the man next door who used electricity only for lighting.

Technical advances in electricity he described as "one of the greatest miracles of modern times"; the industry was proud of the fact that, during the war, there was no single instance where the starting of a munitions factory had been delayed because electricity was not available.

Sir William complained of discrimination against the electricity supply industry in the cost of fuel which, he said, had risen from 18s. 3d. per ton in 1938 to 32s.-34s. in 1945. Constant research had enabled them to use grades of coal for which there was previously no market and thus help the coal-owners, yet electricity's penalty was to pay the largest percentage of the increase. Referring to atomic energy, Sir William said: "If man is not capable of controlling himself he ought not to have control

of an atomic bomb, which, if not rightly handled, may lead to the end of us all."

Responding for the guests, Mr. Heathcock said he viewed with the greatest apprehension any attempt to force outside control on undertakings with such a long and faithful record. Electricity supply was one of the supreme examples of industrial progress. Output and the number of consumers doubled every seven years up to the outbreak of war, and estimated progress for the next five years was greater than in any similar period. On the one hand was an industry which was strong, efficient and still growing while on the other were shortages of most manufacturing outputs and a national economy so disturbed that the whole standard of life was threatened. Therefore he considered the business procedure would be to concentrate every energy on putting these broken industries on their feet again, rather than endeavouring to apply an untried theory to a department in full and robust health.

The only reasonable basis for interference, he said, was to show savings in charges to consumers. In the 1926 Act, Clause 13 was included to protect the efficient against an increase over the cost at which they proved they could generate. Because of this the West Midlands J.E.A. obtained a large annual credit from the regional charges and Walsall was able to purchase its supplies below the regional tariff, which meant a saving to the town of over £20,000 a year. If there was to be any change in ownership and control, he said, it was not unreasonable to suggest that electricity undertakings should again combine and request that the interests of their consumers should be protected against charges that might be to their detriment. Such protection should be specific and incorporated in any Act to alter the control and ownership of the industry.

Coal Nationalisation

Methods of Acquisition and Control

LAST week the text of the Coal Industry Nationalisation Bill was issued. It is proposed to set up a Tribunal consisting of two judges and an accountant to assess the value of the assets to be acquired, a task which is expected to take two years to complete. The Tribunal will fix a total sum which will be apportioned between the various undertakings (there are 850 of them) by District Valuation Boards which will separately assess the value of subsidiaries to be taken over—including in some cases electricity generating plants. Compensation will be paid in Government stock and will be assessed as though the industry were one unit sold in the open market by a willing seller to a willing buyer. The basis will be the net annual maintainable revenue and the number of years' purchase to be applied thereto.

Control and operation of the industry will be exercised by a National Coal Board consisting of nine persons appointed by the Minister of

Fuel and Power under whose general directions the Board will operate. It will be advised by two consumers' councils—industrial and domestic. The members of the Board will be chosen for their ability and proved efficiency in all aspects of commercial and industrial administration, including the organisation of labour. It is intended that the Board shall work as a business corporation free of the Civil Service and too much centralisation in the actual operation of production will be avoided.

Existing retail channels will be retained but the Board may undertake distribution where this has been customary. Although there will be no regional boards it may be desirable to appoint regional directors in some areas.

The Bill provides for advances to the Board of sums up to £150 million within the first five years after its passage and subsequently as Parliament may determine for the development and improvement of the industry; the Board will also be empowered to borrow up to £10 million temporarily. The advances are to be repaid to the Government and any default will be reported by the Minister to Parliament.

Forthcoming Events

Monday, December 31st.—*London.*—Alliance Hall, 12, Caxton Street, S.W.1, 6 p.m. Institution of Electronics. Discussion on "The Nature and Uses of Atomic Energy," introduced by Dr. L. E. C. Hughes.

Tuesday, January 1st.—*London.*—Institution of Electrical Engineers, 6 p.m. The Television Society. "A Test Signal Generator for Television Receivers," by F. A. Inskip, and "Cathode Ray Tube Quality Measuring Apparatus," by A. M. Spooner.

Thursday, January 3rd.—*Birmingham.*—Grand Hotel, 6 p.m. I.E.E. South Midland Centre. "Atomic Energy," by Prof. M. L. Oliphant.

Friday, January 4th.—*Birmingham.*—Imperial Hotel, 6 p.m. Illuminating Engineering Society (Birmingham Centre). "The Physical Nature of Light," by H. J. Cull.

Monday, January 7th.—*London.*—Institution of Electrical Engineers, 7 p.m. I.E.E. London Students' Section. "Electrical Measurement of Temperature," by R. J. Redding.

Liverpool.—Royal Institution, Colquitt Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "Operational Control of Electricity Supply Systems," by W. Kidd and E. M. S. McWhirter.

Rugby.—Corporation Electricity Showrooms, 7 p.m. I.E.E. Rugby Sub-Centre. "Factors Influencing the Design of Electric Lighting Installations for Building Interiors," by R. O. Ackerley.

Tuesday, January 8th.—*Manchester.*—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre. "Some Notes on Transformer Practice with Reference to Standardisation," by A. G. Ellis.

Wednesday, January 9th.—*Edinburgh.*—Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. Joint meeting with Institution of Post Office Electrical Engineers. "Frequency Modulation," by K. R. Sturley.

COMMERCE and INDUSTRY

Lower Electricity Output. Interrupted Apprenticeships.

Building Materials

It is announced by the Ministry of Works that its Directorate of Building Materials is being reorganised to meet the added responsibilities placed on the Ministry by the Building Materials and Housing Bill, 1945. The Minister has agreed to release Mr. Lockhart W. Hutson, F.R.I.B.A., from the position of Director of Building Materials to enable him to return to private practice. He will be succeeded by Mr. F. W. Smith, M.C., Principal Assistant Secretary in the Ministry. These changes will take effect on January 1st.

Purchase Tax

Notice No. 77 has been revised and reprinted, and copies are being sent to all registered traders by the Secretaries' Office, Customs and Excise, City Gate House, Finsbury Square, E.C.2. This notice supersedes all previous editions, and the more important changes involved are indicated on the front page.

Generation of Electricity in November

The Electricity Commissioners' official returns show that 3,463 million kWh was generated by authorised undertakings in Great Britain in November, as compared with the revised figure of 3,598 million kWh in the corresponding month of 1944, a decrease of 135 million kWh, or 3.7 per cent. During January-November the total generated was 33,601 million kWh as compared with the revised figure of 34,612 million kWh for the corresponding period of 1944, a decrease of 1,011 million kWh or 2.9 per cent.

New Telecommunication Laboratories

A central laboratory organisation to undertake long-term research and development in the telecommunication, electronics and allied fields has been established by Standard Telephones & Cables, Ltd. The new laboratories, to be known as Standard Telecommunication Laboratories, Ltd. (the formation of the company was announced in our issue of December 14th, page 879) will be housed at Progress Way, Great Cambridge Road, Enfield, pending the erection of suitable permanent premises. They will have as their principal object the intensification of research and development in all aspects of telephony, telegraphy, electronics, cables, radio, television, etc., and the various divisions will be under the direction of well-known specialists in the different spheres.

Hull Electrical Contractors

Proposing the toast of "The Electrical Contractors' Association" at a dinner-dance held by the Hull and East Yorkshire Branch, Mr. D. Bellamy, general manager of the Corporation Electricity Department, said that through the co-operation of the members the whole of the work of restoring street lighting in Hull was completed in four days, although practically

every fitting required replacement. Councillor W. O. Honor responded to the toast. "The Electrical Industry" was proposed by the Lord Mayor (Councillor H. Harrison), Mr. B. E. Gray replying. Mr. J. W. Rattle, chairman of the Branch, who presided, proposed the health of the guests, to which response was made by Alderman J. Robinson.

Northern Ireland Board's Offices

The *Belfast Telegraph* reports that the Electricity Board for Northern Ireland has purchased, for £25,000, the house and 20-acre estate of Danesfort, Malone Road, Belfast, for use as head offices and stores. The grounds are to be used as playing fields and for limited housing development.

Paper Salvage

Waste paper is as useful in peacetime as in war and paper rationing means that there is less for salvage than in normal times. It is as well, therefore, to be reminded from time to time that efforts to gather up waste paper should still be sustained. Such a reminder comes from the Thames Board Mills, Ltd., in the form of a little bulletin dealing with paper salvage from a number of aspects. It is mentioned that a ton of waste paper helps to produce 12,000 sq. ft. of plaster board, sufficient for the ceilings of twelve houses, or cartons for 40,320 lb. of sugar.

Interchangeability of Cooker Parts

The Electric Cooking Committee of E.D.A. has now issued a specification for the interchangeability of replacement parts of electric cookers. The items covered include boiling plates, grills and grill boilers, grill pans, plugs and sockets, cradles (carriages and supporting screws), cable entry, fuses and screws. Cooker manufacturers have agreed to adopt the specification for all their post-war designs.

C.E.B. Borrowing Powers

The Central Electricity Board has applied to the Electricity Commissioners for a Special Order authorising it to increase its borrowing powers. We are informed that the increase is to be from £70 to £100 million.

Bournemouth Contractors' War Work

An interesting story can now be told of the wartime activities of the Bournemouth electrical contractors, Aish & Co., Ltd. After completing installations at the Royal Naval Air Station at Yeovilton and the Cunliffe-Owen aircraft factory at Eastleigh, the company turned its attention mainly to Admiralty work, completing installations in over a thousand craft of all types. Eventually more than 90 per cent. of the organisation was engaged on contracts for the Royal Navy and the Fleet Air Arm, its men working in shipyards all over the country. Shortages of materials made it necessary for the company, after a break of twenty-five years, to resume manufacturing and the output of the factory which was opened

soon not only met the company's own needs but supplied considerable quantities of equipment to the Royal Dockyards and shipbuilders. The articles produced included switchboards, control boards, dimmers and many other important small components. Radio interference suppression and screening problems were also investigated and much special apparatus was constructed. In preparation for D-Day a large floating dock and launches were electrically equipped, the latter with very sensitive telecommunication instruments and radar. Ship repair work and the provision of apparatus specially treated for tropical service occupied the company's attention during the closing phases of the war.

Interrupted Apprenticeships

The director of the Electrical Contractors' Association (Mr. L. C. Penwill) has informed his members that it is hoped to introduce soon a scheme for the re-entry into the industry of apprentices whose terms have been interrupted by war service. The scheme is being negotiated with the Ministry of Labour which will be interested in its operation in view of the payment of State grants in certain circumstances. Pending the introduction of the scheme the Ministry of Labour is prepared to operate its model scheme in respect of former apprentices who have already been discharged from the Forces. Members with returning apprentices are therefore advised to consult the local office of the Ministry of Labour in this matter.

Employment of Disabled Persons

Mr. George Isaacs, Minister of Labour and National Service, announced in the House of Commons last week that he had made an Order under Section 10 of the Disabled Persons (Employment) Act, 1944, specifying 2 per cent. as the standard quota with effect from March 1st. As from that date employers with twenty or more workers will be obliged to employ their quota of disabled persons. Further details of the scheme for the employment of disabled persons appeared in our issue of September 28th, page 450.

Mr. L. C. Penwill, director of the Electrical Contractors' Association, has drawn his members' attention to the Ministry of Labour's training centres for disabled persons (in the first place) and for able-bodied persons qualifying for Government Training Courses. He says that at the moment only disabled persons are undergoing electrical training courses. Arrangements have been made by which the Ministry will notify the E.C.A. as these people complete their training with a view to arrangements being made for their employment in the electrical contracting industry.

Experience has shown that the course justifies the employment of trainees as electricians' assistants; "up-rating" to journeyman status will be dependent upon individual circumstances. They will have to be registered as "dilutees."

Trade with the Indian States

Good progress is reported by the Indian States Trade Delegation now in Britain to make contacts with British manufacturers with a view to placing of orders for machinery, equipment and other consumer goods. Electrical goods

are particularly mentioned among the articles for which negotiations are proceeding satisfactorily. Following his recent visit to the United States, Sir Maqbool Mahmood, deputy leader of the Delegation, suggests the urgent need for a British Commonwealth economic conference to which India might well be invited to be represented by leaders of the political parties and the Chamber of Princes.

Gauge and Tool Makers' Exhibition

Speaking of the exhibition which the Gauge & Tool Makers' Association is to hold at the New Hall, Vincent Square, London, S.W.1, from January 7th to 18th, Mr. F. W. Halliwell, chairman of the Association, last week drew attention to the fact that the exhibition would have the distinction not only of being the first to be organised in this country by the gauge and tool making industry but also of being the first exhibition of a national character to be organised by any industry in this country since the end of the war. Mr. John Wilmot, Minister of Supply and Aircraft Production, will open the exhibition.

Codes of Practice

Two further chapters, viz., 1 (C) and 7 (F), of the Code of Functional Requirements of Buildings have now been published in final form for the Codes of Practice Committee by the British Standards Institution.

In view of the present housing emergency, their scope is limited to houses, flats and schools. Chapter 1 (C) lays down recommended standards of ventilation, both natural and mechanical, and Chapter 7 (F), dealing with the provision of artificial light, is divided into two parts—houses and flats, and schools. It describes the functional requirements of a good lighting system and the factors to be considered in the choice of a fitting and the size of source. It also includes tables giving recommended illumination values for particular purposes.

Copies may be obtained from the British Standards Institution, 28, Victoria Street, S.W.1, at 6d. post free for Chapter 1 (C) and 2s. for Chapter 7 (F).

Alleged Television Cartel

The New York correspondent of *The Times* reports that the Department of Justice, in a complaint filed in the Federal Court has accused several motion picture companies of conspiring to prevent the use in the western hemisphere of advanced British patents so as to keep television from becoming a competitor in their industry. The court was asked for an injunction restraining the defendants from executing contracts they had made for this alleged purpose. The Department of Justice is seeking further to free the patents involved, and to have the court declare that a cartel exists which violates the anti-trust laws and makes the entire agreement between American concerns and the British company, Scophony, Ltd., void.

The complaint asserts that the outbreak of war made it impossible for the further development in England of two new television ideas, the "Supersonic" and "Skiatron" systems, controlled by Scophony, Ltd.; that because it could not transfer funds from England to continue in this country work it had done there, the company sought American financing; and

that this it secured from Paramount and Twentieth Century Fox interests, but on condition, it is alleged, that these companies or their subsidiaries involved would not be under obligation to turn over rights under Scophony inventions to their competitors in the electronic field.

New All-Electric Colliery

A modern all-electric colliery to be exhibited by the Alloa Coal Co., Ltd., near the village of Kennet, Clackmannanshire, will be so highly mechanised that the coal will be untouched by hand as it passes from the coal face to the wagons awaiting it at the siding. Underground the mine will be similar to the show Comrie Pit, Fife, but a new system of pithead working will make it superior to any in the country.

The coal will be cut, loaded, conveyed, and raised to the surface by electrical machinery. At the pithead it will be conveyed by rubber belt to the washing machines, where it will be cleaned, graded, and loaded by electrical devices. This will reduce the number of men required at the pithead from 400 to 50. Shafts will be from 2,400 to 2,700 ft. deep, to reach the lowest seams of coal ever worked in Scotland. The owners aim at extracting 3,000 tons of coal a day, and for the 2,000 men to be employed a new town will be built.

Retail Trade Restrictions Removed

Sir Stafford Cripps announced last week that the operation of the Location of Retail Businesses Order would come to an end on December 31st and after that date anyone would be able to set up in the retail trade without a licence. The Register of Withdrawn Traders would be closed at the same time.

Anglo-Belgian Industrial Conversations

On January 14th the Federation of British Industries is expecting a visit from a delegation of the Central Industrial Committee of Belgium, under the leadership of its president, M. Van der Rest. M. Rest will be accompanied by M. Delbaere, the president of the Flemish Economic Union, and by M. Gérard, director of the Industrial Committee. The delegation will also include representatives of the textile, iron and steel, coal, chemical and engineering industries.

Liverpool Cattle Show

Liverpool Corporation Electricity Department had a stand in the trade exhibition at the Christmas Cattle Show, Stanley, Liverpool, on December 12th. Refrigerators suitable for butchers' premises were among the apparatus exhibited.

Fatalities

Cleaning Transformer Insulators.—An inquest was held recently on Kenneth Ramsden (16), an apprentice electrician, who was found dead near a live transformer at the Thornhill power station of the Yorkshire Electric Power Co. It was stated that he was cleaning insulators on a "dead" transformer which he left to smoke a cigarette, and a little later the accident occurred. Another apprentice said it appeared that on his return Ramsden climbed up on the "live" transformer.

Wireless Lead to Bath.—A lead from a radio set to a pair of head-phones which he was using while having a bath is reported to have caused the death at Rousham Park, Oxon, of Adriaan Willem Mosselmans (19), the son of a retired Dutch consular official. There was about six inches of non-insulated wire touching the bath and the youth's neck.

Trade Publications

W. T. Henley's Telegraph Works Co., Ltd., 52, Hatton Garden, London, E.C.1.—Illustrated booklet describing impregnated gas cushion cable for 132 kV of the type in which gas pressure is applied directly to the dielectric inside the lead sheath, which is reinforced against internal pressure. The constructional details of the cable joints and sealing ends are described and particulars are given of a comprehensive series of tests which demonstrate the stability and margin of safety of the cable and its joints and terminals. Particulars of the gas charging and gas leakage protection system are also included.

Ransomes & Rapier, Ltd., Waterside Works, Ipswich.—Leaflet describing the "Centum" mobile tender for saving travelling crane time. The vehicle is driven by a Ford 10-HP petrol engine at 4 MPH when carrying a 6-ton load and can travel straight or in curves of diminishing radii until turning on its own centre.

London Transformer Products, Ltd., Cobbold Estate, Willesden, London, N.W.10.—Illustrated brochure technically describing transformers and chokes, fixed and portable, for most uses, including mercury arc rectifiers.

Trade Announcements

Linealux, Ltd., announces that it is now in a position to supply "Linealux" reflector fittings, and can make improved deliveries of standard types of aluminium reflectors.

A. J. Evans & Son are concentrating their entire business at the main offices at 3, Fulbourne Street, London, E.1, and the offices at Buchanan Buildings, Holborn, will be closed on December 31st.

The London sales office of the Hayes Conduit Co., Ltd., R. & A. G. Crossland, J. Engl, Ltd., and the Ray Engineering Co., Ltd., has been moved to 17, Elm Street, London, W.C.1. The telephone number remains Terminus 3712.

The Repton Engineering Co., Ltd., has moved to larger premises in Albion Street, Birmingham, 1.

Calendars and Diaries

The Londex diary for 1946 contains 144 pages of useful electrical data covering electricity and magnetism, electrical machinery and transformers, power distribution, batteries, illumination, wiring of buildings, automobile electrical equipment, and mathematical and electrical tables.

A neat diary from the Cressall Manufacturing Co., Ltd., is bound in blue leather.

"Radiance" is the title given to the portrait of a girl in an autumnal setting appearing on the calendar of Linealux, Ltd.

The Rainville Engineering Co.'s calendar has easily-read monthly sheets.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Magnetic Oil Filter

IN addition to a magnetic oil filter for the lubrication system of machine tools PHILIPS INDUSTRIAL, Century House, Shaftesbury Avenue, London, W.C.2, has now developed a combination model known as the "Filtricator" which removes fine ferrous particles and, at the same time, indicates oil flow through a clear glass window of large diameter in the light



Combined magnetic oil filter and flow indicator

alloy casing. The inside of the flow chamber is painted white to enable even the cleanest oil to be seen. The vertical cylindrical part contains the filter, which comprises a small "Ticonal" magnet surrounded by a mild steel cage containing air gaps in which ferrous particles are caught, the whole being attached to a removable cover, which is screwed on to the housing.

Oil enters through a nipple at the back, the maximum capacity being about 50 gallons per hour. Collected particles are removed by unscrewing the cap and sliding out the filter cage, which can then be washed clean, since it does not retain the dross when out of contact with the permanent magnet. This filter is 3 in. high by $2\frac{1}{2}$ in. wide by 3 in. from back to front.

Machine-Tool Motors

Certain machine tool drives require that the speed should remain reasonably constant with wide variation of running torque, which requirement is generally satisfied by the standard squirrel-cage motor. When the machine tool is fitted with a flywheel it is essential that the drive should allow a pronounced drop in speed, otherwise the motor would have to meet the peak power demands without assistance from the flywheel. The slight drop in speed permitted by standard induction motors is only sufficient to allow the flywheel to give up a comparatively small part of its stored energy.

The use of belt slip is an inefficient method of obtaining the requisite drop in speed, so

the "Hyslip" motor has been developed by CROMPTON PARKINSON, LTD., Electra House, Victoria Embankment, W.C.2, to combine the advantages of the extremely robust squirrel-cage class with the drooping speed characteristic of a slip-ring motor provided with an external slip resistance. The starting torque is similar to that of the "Tork" type, but it has a larger percentage variation of speed with load. These characteristics are obtained by increasing the inherent resistance of the rotor, which increases both the starting torque and the slip.

As the speed drops the torque and current increase, but not to the same extent as with the "Tork" and standard motors; hence a correctly proportioned flywheel will at a particular speed supply the difference in torque. For example, at 85 per cent. speed a standard motor develops 250 per cent. of full load torque with 275 per cent. of full load current, whereas the "Hyslip" motor develops 130 per cent. of full load torque with 130 per cent. of full load current for the same speed reduction.

Although performance is inferior it is practicable in certain circumstances to reduce energy consumption because, despite the lower efficiency and power-factor, when the peak load power is largely supplied by the flywheel the HP rating of the required "Hyslip" motor is lower than that of a standard motor. In this way the losses in the motor are reduced because, as they are expressed as a percentage of a smaller HP, there is a considerable saving when running light. The power-factor is also improved because the magnetising current is correspondingly reduced.

Plastic Heating Panels

Heating panels of plastic material are being supplied by the "YARWORTH" ELECTRIC PANEL Co. (controlled by Reinforced Plastics, Ltd.), Glencoe, Queens Road, Kingston-on-Thames, for use as bed warmers, room or cupboard heaters, railway carriage mats, etc. These panels have the heating wires interwoven in a fabric, this being moulded and completely encased in an insulating material. The hard, glossy panels thus formed are only $\frac{3}{8}$ in. thick, light and flexible, and they do not need painting or varnishing.

With a loading of up to 75-W per sq. ft., the elements operate at black heat and are thermostatically controlled; the makers state that a 36 in. by 19 in. bed-warmer can be used for seventy hours for the consumption of only 1 kWh. The units are claimed to be non-inflammable, damp-proof and non-corrodible.

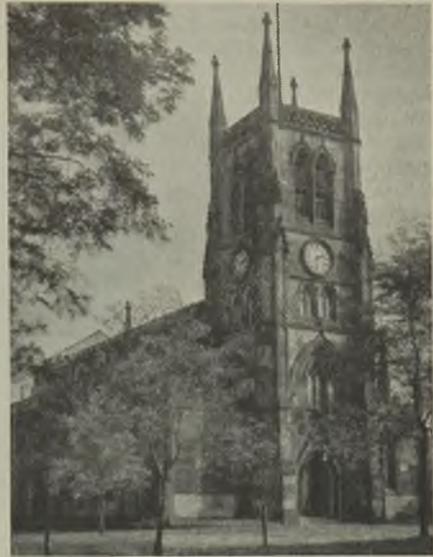
Cathedral Heating

Potentialities of Electrode Boilers Demonstrated at Blackburn

THE provision of an electrode boiler installation at Blackburn Cathedral opens up a new field for the application of this method of electric heating. To the Provost, the Very Rev. W. Kay, M.A., D.S.O., M.C., in co-operation with the Blackburn Electricity Department, must go the credit for this innovation, and experiences over a four-year-period show that the experiment was more than justified. The Provost finds that the running cost (with electricity at 0.33d. per kWh, plus a coal clause) is less than for solid fuel, even without taking into consideration the saving of labour resulting from the completely automatic operation of the plant.

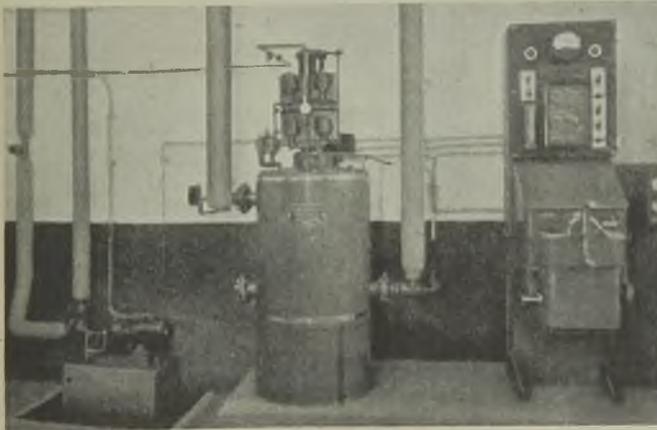
Although the 200-kW, 400-V, 3-phase Bastian & Allen electrode boiler now installed caters only for the existing building, it has already been decided to extend the system to serve the additions to the Cathedral which will increase its size fourfold and will require probably another 600 kW of electrode boiler plant. A further extension of the system to some of the 640 churches in the Blackburn diocese is also envisaged.

The Cathedral as it now stands has a floor area (excluding the crypt, which is separately heated by "Neo-classic" radiators) of 5,120 sq. ft. and a capacity of 196,000 cu. ft. (approx.). It is practically as broad as it is



long so that instead of trying to get all the heating from the eighteen "Neo-classic" radiators close to the walls, the centre of the building is warmed by eight radiators of a special low type placed at the foot of the pillars. Furthermore, to overcome the natural chimney effect to be found in a lofty building of this kind, carefully camouflaged heating pipes have been run round the apices of the pillars, just below the clerestory. From the heating point of view the entrances are poor and there is considerable heat loss.

For heating purposes the Cathedral is divided into five sections—crypt, south, north, centre and clerestory. Each of these has its own separate water circuit controlled by motorised valves, which in turn are automatically controlled by variations in air and water temperatures. This makes it possible to cut out any particular section at will and also to adjust the heating of each section to suit the requirements of the moment. Control of the boilers



The electrode boiler plant

is designed to be either manual or completely automatic by means of thermostats, rheostats giving the proportion of the load desired. Operation is completely foolproof, all the usual devices being incorporated to ensure safety and efficient operation under all conditions. There is practically no maintenance required.

Normally the apparatus is set by means of a time switch to operate automatically throughout the

The following shows the comparative costs of electricity and solid fuel for the exceptionally severe 1941-42 season:—

Electricity.—113,227 kWh, £208 18s. 6d. ;



Above : Heating pipes, almost unnoticeable, have been run round the tops of the pillars to overcome the natural chimney effect. Left : Special low radiators at the base of the pillars for warming the centre of the building

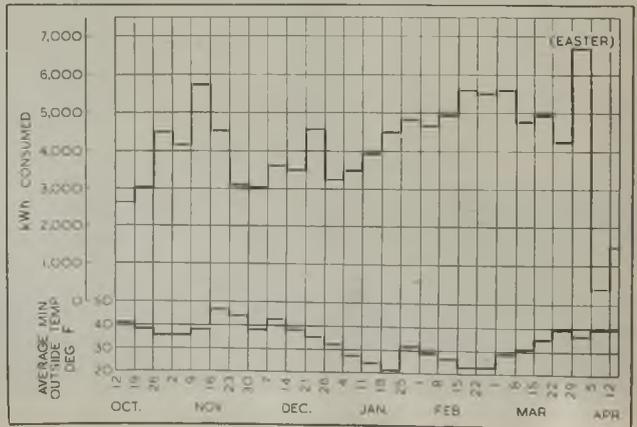
depreciation, £10; total cost, £228 18s. 6d.

Solid fuel (estimated).—80.88 tons of coke at 46s. 3d. ton, £187 0s. 8½d.; labour, £21; maintenance and depreciation, £30; total cost, £238 0s. 8½d.

In comparing costs, the saving effected by the high efficiency of electrical apparatus must be taken into account, also the economy in labour, maintenance and depreciation. The operation of the coal price adjustment clause accounted for approximately 27.3 per cent. of the cost. Under normal conditions

week, switching on the boiler to warm up the Cathedral for the weekday and Sunday services; manual control is necessary only on the occasion of special services. A rise of two degrees F. an hour is possible even in the coldest weather and the Provost says that switching on as much as twelve hours before a service has never yet been necessary, from five to eight hours' heating being generally sufficient. Actually the plant has been running at only two-thirds of its full load, *i.e.*, approximately 130 kW.

The heating installation was first put into service in 1941. It has thus been in operation for four seasons.



Electricity consumption during the 1941-42 season

this adjustment is considerably smaller and materially affects the operational cost for heating the building. The total consumption is considerably below that estimated for, the number of services held having been less than was anticipated.

The electrode boiler plant was installed by Bastian & Allen, Ltd., the electrical work

being undertaken by the Blackburn Electricity Department. We are grateful to the Provost for permission to inspect the plant and also to Mr. R. H. Harral, the borough electrical engineer and manager, and Mr. J. B. Ashworth, sales and development engineer of the undertaking, for their help in the preparation of this article.

ELECTRICITY SUPPLY

Bexley's "All-Electric" Houses. Hire Charges at Liverpool.

Battersea.—**DISTRIBUTION WORKS.**—The Electricity Committee is to re-lay mains in the Shaftesbury and Beaufoy estate roads at a cost of £5,105 and increase plant at substations (£2,916).

Bedford.—**FARM SUPPLIES.**—The Electricity Committee proposes to give supplies to a number of isolated farms and other premises at Marston, Haynes, Houghton Conquest, Stewarby and Milton Ernest, involving the construction of additional lines costing £995.

Berwick.—**PETITION FOR ELECTRICITY.**—The Town Council has received a petition from thirty-six tenants of Council houses in Osborne Crescent asking for electricity. The Scottish Southern Electric Supply Co., Ltd., has been asked to carry out the work.

Bexley.—**"ALL-ELECTRIC" HOUSES.**—Recommendations of the Housing Committee which have been approved by the Council provide that all houses to be erected by the Council, with the exception of two small estates, shall be "all-electric." The electrical services will comprise auxiliary water heating, cooking, lighting and space heating.

Blackburn.—**SUPPLY TO MILL.**—The Town Council has approved a supply of electricity to Prospect Mill, Walter Street, Blackburn, involving an expenditure of £2,700.

Brighton.—**STREET LIGHTING.**—A scheme costing £1,455 for lighting a trolley-bus route, has been approved by the Electricity Committee.

Cardiff.—**STREET LIGHTING.**—The Highways Committee has approved a supplementary estimate of £11,850 for improved street lighting.

Colchester.—**INDUSTRIAL AND DOMESTIC TARIFFS.**—A survey indicates that the Council's standard industrial power tariff produces the lowest average price per kWh in East Anglia. The survey was made at a load factor of 26.6 per cent. and a power factor of 0.76, and Colchester's tariff averaged 1.15d., other undertakings' tariffs averaging between 1.22d. and 1.68d. The average price for power over the whole of the Council's undertaking is 1.216d. per kWh. The Colchester Borough Development Committee states that it can find no evidence in support of the contention that local domestic consumers of electricity are subsidised by industry. The present average for domestic tariff consumers is 1.408d. per kWh over the whole undertaking, including the rural areas.

Dartford.—**MAINS EXTENSION.**—The Electricity Committee is to extend the mains to housing estates at a cost of £1,084.

Hazel Grove and Bramhall.—**REDUCTION IN CHARGES VETOED.**—An amendment against the acceptance of a 10 per cent. reduction in certain charges as recommended by the Electricity Committee was carried by 11 votes to 5 at a meeting of the Urban District Council. Councillor R. Dean, moving the amendment, said the time was inopportune and the recommendation disregarded the officials' statement on the position of the undertaking. The recommendation for the reduction was also inequitable to industrial consumers and the undertaking's future was imperilled. The Council was not alone in having increased its charges for no less than 85 per cent. of the authorities in the country had done so. People in Hazel Grove said electricity would be cheaper if it were not for the extravagant offices. The facts were that taking into consideration loan charges, rates, lighting and heating the offices were costing one-eighth of a penny per unit sold.

Councillor L. Kirkham said that electricity was a serious topic in Hazel Grove. The increase of 20 per cent. in 1943 was a shock to the community. Councillor H. Cochrane also spoke of the bitter feeling about the increase.

Hull.—**DECORATIVE LIGHTING AT BATHS.**—A scheme for decorative lighting at the Beverley Road Baths which is estimated to cost £3,000 is being considered by the Baths Committee.

Inverness.—**INQUIRY DECISION.**—The Commission presided over by Lord Teviot which recently conducted an inquiry into the Corporation's application for a Provisional Order to obtain a supply of water for domestic purposes from Loch Duntelchaig found the preamble to the Order proved, and the opposition of the North of Scotland Hydro-Electro Board thus fails.

Lichfield.—**FARM ELECTRIFICATION.**—The Electricity Committee is to provide a supply to Mere Pits and Birdsley farms, Elford, and Haselour Hall and adjoining farms.

FEEDER.—The electrical engineer has reported to the Electricity Committee that he is in communication with the engineer of the West Midlands Joint Electricity Authority with regard to the provision of a second main feeder.

Liverpool.—**INCREASED HIRE CHARGES.**—The Electric Power & Lighting Committee proposes to increase the hire charges for electric cookers and water heaters. The quarterly rental of existing cookers, now 5s. for the standard size and 4s. for the kitchenette size, is to be increased to 7s. 6d. and 6s. respectively. For water heaters, the quarterly charge will be 4s., and

for wash boilers 3s. 6d. against the present rates of 3s. and 2s. 6d. A charge of 10s. a quarter is to be made for new cookers of standard size, and the new smaller size cookers will cost 7s. 6d.

Lossiemouth.—ALTERNATIVE TARIFF.—The Town Council has adopted a new optional two-part tariff consisting of 15s. per annum per room for the first three rooms and for each additional room 10s. per annum (minimum £2 per annum) and a "unit" charge of 3d.

Lowestoft.—SUPPLY TO SILK WORKS.—The Electricity Committee is to provide an additional supply to a silk factory in Victoria Road at a cost of £300.

Morecambe.—SUBSTATIONS.—The Electricity Committee is to erect substations at Pembroke Avenue (£3,401) and Stanley Road (£3,514).

Nelson.—ELECTRICALLY-DRIVEN LOOMS.—A local textile manufacturer is to co-operate with the Electricity Department in experiments for the conversion of looms to electrical operation.

North-East England.—WEEKLY ELECTRICITY CHARGES.—The North-Eastern Electric Supply Co., Ltd., is submitting to local authorities a plan for collecting electricity charges weekly from the tenants of houses. The scheme is calculated on an estimated yearly consumption and is based on the consumers' connected apparatus. Provision is also made for the purchase of electric kettles, pans, irons, etc.

Nuneaton.—CHEAPER FARM SUPPLIES.—The Corporation is reducing its charges for electricity for farms and smallholdings as follows:—Winter quarters: First 40 kWh, per quarter, 5d. per kWh; next 500 kWh, 3d.; all in excess, 1/2d. Summer quarters: First 20 kWh, per quarter, 5d. per kWh; next 500 kWh, 3d.; all in excess, 1/2d. Accounts are subject to a temporary war increase of 15 per cent. and a discount of 5 per cent. for prompt payment.

Osgoldcross (Yorks).—REQUEST FOR ELECTRICITY.—The Electrical Distribution of Yorkshire, Ltd., has been asked to supply electricity to East Hardwick, Cridling Stubbs, Burton Salmon, Birkin, Heck, Baine and Stapleton.

Paisley.—LOAN.—The Corporation Electricity Committee is to apply for consent to borrow £2,195 for mains and plant.

Richmond (Yorks).—SUPPLY TO VILLAGES.—The Rural District Council is to discuss with the North-Eastern Electric Supply Co., the question of supplying electricity to certain villages in the area.

Southport.—CONTROL GEAR.—The Electricity Committee is to install control gear at the power station in connection with proposed alterations to the grid supply to Ormskirk.

Stanley (Co. Durham).—H.V. CABLE.—It is proposed to lay a h.v. cable from South Moor to improve the supply in the Quaking Houses area.

Sunderland.—SUBSTATIONS.—The North-Eastern Electric Supply Co., Ltd., is to build two substations on the Thorney Close estate.

Swansea.—SUPPLY TO I.C.I.—The Electricity Committee has arranged terms for the supply to Imperial Chemical Industries, Ltd., at factories at Landore, Waunarlwydd and any other factories to be erected.

Torquay.—STREET LIGHTING.—The Electricity Committee has arranged to provide supplies for public lighting in Kerswell, Ugborough and Ipplepen.

METERS.—Application is being made to borrow £2,500 for meters.

Wallasey.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to borrow £2,307 for supplying temporary houses and £15,206 for supplying the Mariners' Home and Manor Road areas.

Warrington.—STREET LIGHTING.—The Highways Committee has decided upon electricity for street lighting on the new housing estates.

Overseas

Eire.—ELECTRICITY FROM TURF.—Our Dublin correspondent states that although the daily press has recently referred to the starting "soon" of the new Clonsast (Portarlinton) generating station which is to use turf as fuel, no official indication has yet been given of the date for commencing the erection of the station, which will take about two years.

Unofficial particulars so far been published are that three boilers—the first large turf-burning ones to be erected in Eire—have been ordered in Britain, together with the generators and turbines. The new station, estimated to produce 60,000,000 kWh per annum, will be equipped with boilers having each a capacity of 125,000 lb. of steam per hour.

NEW BOARD.—More than £3,000,000 is to be spent on a new nation-wide development plan under the ægis of the Bord na Mona which is organised in a somewhat similar way to the E.S.B. It will be responsible for the production of machine-won turf for industrial and domestic purposes, including the generation of electricity. The Turf Development Bill, presented to the Dail on December 13th, 1945, provides for the establishment of the new Board that will replace, and absorb the property of, the existing Turf Development Board, Ltd., which operates the Clonsast Bog and employed 4,000 men at peak production. The average prices a ton were: 1939-40, 14s. 6d.; 1944-45, £2. As less than one half of the necessary machines have been available it has not been possible to reach the planned output of 120,000 tons a year, and that circumstance has had effect on the cost of production. The expenditure to date on the Clonsast electricity station amounts to £6,694.

Mercury-Vapour Projector Lamps

AT the monthly sessional meeting of the Birmingham Centre of the Illuminating Engineering Society on December 14th, a paper was presented by Mr. H. K. Bourne, entitled "Mercury-vapour Projector Lamps." The author drew attention to the requirements of a light source for projection purposes, and after outlining the types available and to come, demonstrated their use by lantern slides, using a mercury-vapour lamp as the projection source. Those who were photographers among the audience were particularly interested in Mr. Bourne's explanation of the use of the lamps for photographic work.

Fault Localisation

Fall of Potential Tests

EACH of the two simple indirect methods of locating earth faults, the slide-wire bridge and the fall of potential methods, is subject to two kinds of errors—those inherent in the method and those due to inaccuracy of the testing instruments. Errors of the first kind can often be avoided by a suitable arrangement of the testing connections, while the possible magnitude of errors of the second

By **G. W. Stubbings**,
B.Sc., A.M.I.E.E.

noted and the fault position is exactly given by substituting the observed instrument readings in the usual simple formulæ.

In the first kind of fall of potential test (Fig. 1), the voltmeter *V* is connected to the ends of the cable loop. Testing current maintained at a constant value, as indicated by the ammeter *A*, is passed first into the end *P*, giving an instrument reading *V*, and then into *Q*, giving a second reading *V*₂. Suppose that the resistance of the voltmeter is equal to *K* yards of the cable loop, and that the fault divides the length of this loop *L* into two components *x* and *y*. If a current of, say, 1 A passes into *P*, there are two paths for this current, one of resistance proportional to *x* direct to the fault, and the other of resistance corresponding to *y* + *K* through the voltmeter. The voltmeter current will therefore be $\frac{x}{x + y + K}$ or

$\frac{x}{L + K}$. Similarly, if 1 A is passed into *Q*, then, as the resistances of the two parallel paths are proportional to *y* and *x* + *K*, the voltmeter current will be $\frac{y}{L + K}$. If the voltmeter readings *V*₁ and *V*₂ are accurately proportional to the currents causing these readings, then $\frac{V_1}{V_2} = \frac{x}{y}$, so that $x = L \frac{V_1}{V_1 + V_2}$, and the shunting effect of the voltmeter is eliminated.

The second way to make a fall of potential test (Fig. 2) is to pass a constant current

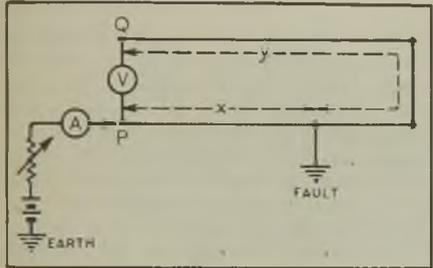


Fig. 1

kind ought clearly to be realised when, after a test, an excavation is made to discover the cable fault.

The accuracy of the bridge method of localisation is independent of instrument accuracy, but it does depend upon uniformity of the resistance of the slide wire and upon the correction made for the effect of the leads connecting the cable loop to the bridge. The accuracy of a fall of potential test depends upon that of the voltmeter and upon the exact constancy of the electrical conditions in the cable loop while these measurements are made. If the resistance of the cable loop represents an appreciable fraction of that of the voltmeter, the observed readings of the latter will not be exactly equal to the component drops before the instrument is connected. These are determined by the fault position, and the connection of the instrument will tend to reduce the drop in the section of the loop concerned.

A fall of potential test can be made in one of two ways: the testing current can be passed round the whole cable loop or it can be made to flow through the fault *via* each end of the loop in turn. In either case the testing conditions can be arranged so that the shunting effect of the voltmeter is elimi-

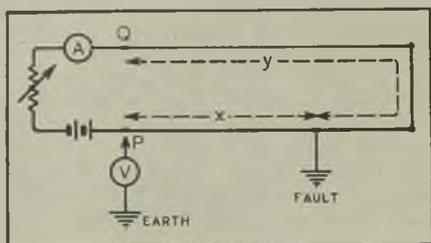


Fig. 2

round the loop, the voltmeter being used to measure first the drop *P* to earth *V*₁, and then the drop *V* from *P* to *Q*. If the current in the loop is 1 A, then, if there is no e.m.f.

in the fault, the voltmeter current when connected to P will be $\frac{x}{x+K}$, for the 1 A will divide and flow in two parallel paths of resistances proportional respectively to x and K . When the voltmeter is connected to P and Q, the resistances of the parallel paths will be proportional to L and K and the voltmeter current will be $\frac{L}{L+K}$.

In this case the voltmeter currents are not proportional respectively to x and L , and if the readings V_1 and V are used in the simple formula $x = L \times \frac{V_1}{V}$, the calculated distance of the fault will be in error unless K is very large relatively to L . Thus, suppose that the

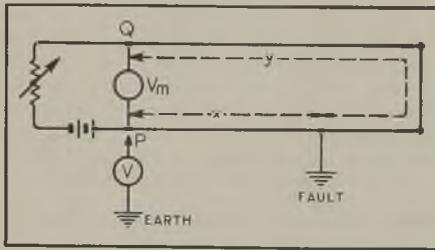


Fig. 3

loop resistance is 6 ohms and the voltmeter resistance is 300 ohms, then $K = 50 L$. V_1 will be proportional to $\frac{x}{x+K}$ or $\frac{x}{x+50L}$ and V to $\frac{L}{L+50L}$. If the true value of x is 0.2 L, or four-fifths of the length of the faulty cable, then $\frac{V_1}{V} = 51 \times \frac{0.2}{50.2} = 0.203$, and the result will be in error by about 1.5 per cent. If the distance x of the fault is 500 yd., this error will correspond to $7\frac{1}{2}$ yd.

This source of error can be eliminated by modifying the test arrangements and procedure as illustrated in Fig. 3. Instead of the testing current being maintained constant, the voltage drop in the loop, as indicated by a second voltmeter V_m , is maintained at a constant magnitude by adjusting the rheostat in the battery circuit. If the measuring voltmeter is connected between P and earth to give a reading V_1 , then the resistance of the

loop in terms of cable lengths will be $y + \frac{xK}{x+K}$ or $\frac{xy + LK}{x + K}$. The current in the loop with 1 V at its terminals will be $\frac{x + K}{xy + LK}$, and the fall of potential in the section x of the loop

shunted by the voltmeter of resistance $\frac{xK}{x+K}$ will be $\frac{xK}{xy + LK}$, and this will be the reading V_1 given by the voltmeter. If the voltmeter is then connected between Q and earth the resistance of the loop will be $x + \frac{yK}{y+K} = \frac{xy + LK}{y + K}$ and with 1 V drop in the loop, the current will be $\frac{y + K}{xy + LK}$. The resistance of the component shunted by the voltmeter will be $\frac{yK}{y+K}$, so that the voltmeter reading V_2 will be equal to $\frac{yK}{xy + LK}$, and $\frac{V_1}{V_2} = \frac{x}{y}$ so that $x = L \times \frac{V_1}{V_1 + V_2}$. Thus, by maintaining a constant total drop in the loop and by measuring the voltages of the two ends to earth, the shunting effect of the voltmeter is eliminated.

All that is required of the measuring voltmeter in fall of potential tests is that scale readings are accurately proportional to the current causing these readings; percentage errors constant throughout the scale range are immaterial. Differences of percentage errors can, however, lead to serious inaccuracy in the calculated fault distance. Thus, if the fault distance x is calculated from the formula $x = L \times \frac{V_1}{V}$ and V_1 and V are in error by fractional amounts α_1 and α respectively, then the true fault distance will be $L \times \frac{V_1(1 + \alpha_1)}{V(1 + \alpha)}$ which is approximately equal to $L \times \frac{V_1}{V} \{1 + (\alpha_1 - \alpha)\}$, so that the fractional error in the determination of x will be $(\alpha_1 - \alpha)$.

In practice V will be of the same order as the full-scale reading, and V_1 will be less than one half of V . In a high-grade instrument α may be very small, but if V_1 is less than one quarter of V , α_1 may be considerable. Thus α may be $\frac{1}{4}$ of 1 per cent., while α_1 may be 2 per cent. in the lower part of the instrument scale, so that an error of 1.7 per cent. of L in the determination of the distance x is possible with a good instrument.

If two component voltage drops are measured so that the $x = L \times \frac{V_1}{V_1 + V_2}$ and V_1 and V_2 are fractionally in error by α_1 and α_2 respectively, then the true value of x will be $L \times \frac{V_1(1 + \alpha_1)}{V_1(1 + \alpha_1) + V_2(1 + \alpha_2)}$, which is approximately equal to $L \times \frac{V_1}{V_1 + V_2} \{1 + \frac{V_2}{V_1 + V_2}(\alpha_1 - \alpha_2)\}$. With

this kind of test V_1 may be nearly equal to V_2 , so that $\alpha_1 - \alpha_2$ will generally be less than $x - x_1$, when the total drop in the loop is measured directly. Thus, generally, the effect of instrument errors on the accuracy of the determination of x the fault distance

is less when component drops are measured than when one of the instrument readings is the total drop in the loop. A high-grade voltmeter calibrated regularly should be reserved for fall of potential tests, with a correction sheet or graph attached.

Atmospheric Pollution

Results of Investigation

WITH the object of measuring the distribution of pollution of the atmosphere in the neighbourhood of an industrial town and of determining the chief causes and their variations with the habits of the population and meteorological conditions and its means of escape from the atmosphere, the Department of Scientific and Industrial Research initiated a three-years' investigation, from 1937 to 1939. Leicester was chosen largely because of the central position of its factory chimneys, its suitable topography and its relative isolation.

The results of this investigation have now been published as Technical Paper No. 1 (161 pages, Stationery Office, 3s. net) of the Atmospheric Pollution Research Committee, of which Dr. G. M. B. Dobson is chairman. The survey under mention was in charge of Dr. A. R. Meetham.

Types of Impurity

Atmospheric pollution consists of coarse solids (grit) quickly deposited near their source, fine solids (smoke), which remain suspended in the air for a relatively long time, and gases, e.g. SO_2 , emitted from chimneys. About 30 per cent. of the first group was combustible and largely caused by unburnt fuel. Suspended solids were 85 per cent. combustible and, like the SO_2 , were generally found in highest concentration within half-a-mile of the centre of Leicester, irrespective of the direction or the velocity of the wind.

Concentration of each varied with the weather and sometimes reached six times the average (0.5 mg. per cu. metre in winter and 0.2 in summer). Smoke and SO_2 differed in their distribution and in their weekly cycles. Twice as much smoke was produced per ton of coal in residential as in industrial areas and smokeless combustion in domestic fires would cut smoke emission in Leicester by more than one half.

The amount of smoke at the centre of the

town was approximately proportional to the square root of the population. Pollution reaching the broad agricultural belt surrounding Leicester from the nearest industrial districts varied between 10 and 40 per cent. of that at the town's centre. Impurities were identified as coming from as far away as Birmingham, the West Riding, Lancashire and London. Above ten miles, pollution from the town's centre diminished as the square of the distance.

Benefits from Smoke Elimination

A specially designed daylight integrator showed that through elimination of smoke at least 30 per cent. more ultra-violet radiation would reach the centre of the town in the critical winter months. Regarding aviation and transport, as little as 0.5 gm. of smoke per cu. metre was enough to blot out vision, so that on an average winter day visibility was limited by smoke to less than 1,300 yd., irrespective of fog or rain droplets; on the smokiest days the distance was reduced to 200 yd.

A smoke particle is usually removed from the air by settling or otherwise in six days and a molecule of SO_2 in three days. Much of the pollution is diffused upwards because of atmospheric turbulence, in the absence of which fogs occur. Smoke from a single chimney, concentrating at a point directly down wind, was inversely proportional to wind velocity, but where chimneys were widely spread the concentration was more nearly independent of wind.

Smoke forecasting is suggested as a possibility which is likely to be of interest to power station engineers. The effect of instituting smokeless zones is considered and an account is given of an investigation in Hyde Park to test the conclusions. Half the cost of the above investigations was met by the Department, the other half being subscribed by fifty-seven municipal authorities and five other interested bodies.

Efficient Electricity Supply

Main Principles of the 1936 P.E.P. Report

By "Cincinnatus"

IN the *Electrical Review* of November 9th an article appeared by "Borough Electrical Engineer" on "Calm Before the Storm," which urged further discussion instead of reticence about the future of the electricity supply industry. In this article, the author stated his views that, having carefully studied all the many reports about reorganising the industry, he was most favourably impressed by the P.E.P. "Report on the Supply of Electricity in Great Britain" as being thoroughly objective in character.

An examination of this Report shows definite differences in approach from the way in which sections of the industry have considered modern supply problems. The P.E.P. group are not so much concerned with form of ownership as with efficiency of operation and management. They want to co-ordinate and simplify all the existing electricity supply legislation and to remove anomalies and restrictions which have grown up and hinder development. They propose to increase the powers of the Electricity Commission and to tighten up on holding company control. Their two main proposals call for a Committee of Investigation to examine the efficiencies of undertakings and the potentialities of their areas and for the creation of a new body with wide powers, the Electrical Development Authority.

Reorganisation Without National Ownership

Thus this Report rejects nationalisation as a cure for the defects and difficulties of the industry and advocates overhaul, consolidation and development. It lays down a set of guiding principles which state that:—

- (a) Before undertakings can provide the best service to consumers, anomalies and restrictions outside the undertakings' control, and also abuses in control, must be removed by legislation.
- (b) Before reorganisation can be carried out intelligently, proper assessment of the efficiencies of individual undertakings must be made.
- (c) Efficient undertakings, whatever their size or ownership, should be preserved.
- (d) Size and efficiency are not directly related.
- (e) Amalgamation of undertakings is no guarantee of efficiency.
- (f) Form of control as between a local

authority and a private company, is not a major factor in efficiency.

(g) Areas of supply may be either too small or too large for efficient operation.

(h) Management may, of itself, make an undertaking efficient or the reverse.

Unlike the McGowan Report, P.E.P. does not give an unqualified blessing to the very large-scale undertaking but raises a number of pertinent points about the efficiency of types of undertaking in relation to size. It suggests that the great need is for an efficient unit to absorb an inefficient unit in the same district, irrespective of size or type of ownership. It goes on to express the view that undertakings may be either too small or too large for efficient operation and that more study of this matter is needed and of the conditions that constitute an economic area of supply.

Preference is shown for the medium-size unit on the grounds that it does not suffer from the administrative difficulties and bureaucracies of the very big unit.

Holding Companies

The removal of anomalies and restrictions is an important point. Here the Report advocates the separation of gas and electricity interests whenever companies are supplying both forms of service. It considers that the Electricity Commission should determine maximum prices to be charged by supply companies. In general, the holding companies come in for some criticism and it is recommended that there should be compulsory publication of details regarding their financial operations; that their accounts should be audited by auditors appointed by the Commissioners; that their issues of capital should require the approval of the Commission; and that government auditors should examine the accounts of their operating companies as well of the holding groups. The authors of the Report state that "at the present time (1936) 12 holding companies control 166 supply companies or 27 per cent. of the total number of undertakings in Great Britain," and go on to point out that six groups have no fewer than 127 subsidiary companies.

The proposed Committee of Investigation

would have powers to assess the efficiency and potentialities of supply undertakings bearing in mind the need for replanning or increasing existing supply areas on economic lines to obtain the maximum development. In this work, proposals are to be made as to the amalgamation and co-ordination of existing undertakings necessary and the forms of ownership and control which should be applied. It is a cardinal point that before carrying out amalgamations of a theoretical type, there should be a practical assessment of the sort of undertakings which it is proposed should be amalgamated.

Other recommendations are to increase the powers of the Commission to require undertakings to equip showrooms and provide for sales and hire or hire-purchase of appliances and assisted wiring schemes; to prescribe model forms of tariff and to issue special orders following the plans of the Committee of Investigation's recommendations. These orders would cover the transfer of distribution areas from one undertaking to another and the creation of new distribution undertakings through amalgamations of various areas or parts of areas. Thus, the problem of efficiency is to be solved gradually through reconstructing the distribution side of the industry and planning for research and development nationally.

Electrical Development Authority

While P.E.P. advocated increased powers for the Electricity Commission, it distinguished between (1) regulatory and judicial functions appropriate to the Commission and, (2) promotional and constructional functions to be exercised by a new body, the Electrical Development Authority. The argument for this new body rests on the fact that there is no central body of national status which evolves long-period development policies and furthers the interests of the industry through research, publicity, economic and marketing studies and testing and approving of consumers' equipment. This deficiency is evident from the fact that the Electrical Research Association has had to broaden its normal range and include such activities as agricultural electrification and economics of electricity supply within its work because there is no other body capable of dealing with these important subjects.

The Authority would have a constitution similar to that of the Central Electricity Board and would exercise a number of important functions, including those of

development and research, transfer and administration of purchase rights, central testing, central purchasing, publicity, statistics and design. Thus, this new body would combine the features of such organisations as "Kema" at Arnhem, Holland, the Electric Home and Farm Authority and the Rural Electrification Administration in the United States.

Many and Varied Functions

It is clear that the Authority would have diverse functions; it would be empowered to finance experiments in the application of electricity to agricultural, industrial, commercial and domestic uses; to finance (if necessary) the extension of electricity supply to outlying areas, and to finance new water power schemes where a public supply of electricity was involved; it would advance money for standardisation of distribution systems and voltages. In addition, the Authority would approve appliances for use and act as a central purchasing organisation for the industry generally; it would raise the standards of design and construction of buildings in the industry and would take over the function of co-operative publicity and the function of statistical work bearing on electrical development.

These proposals are aimed at co-ordinating a number of activities at present carried out by other bodies and other activities which cannot be attributed to any specific organisation. There have been various changes affecting such recommendations since 1936, the date of the P.E.P. Report, but the imaginative and original treatment of many of the industry's problems shown in these outlines is worth study. The emphasis is on planned development and research by the industry as a whole. Throughout the Report, the basic importance of management is stressed with a very practical outlook. In addition, the survey presented of the growth of the industry's markets and of their potentialities provides a balanced account of achievements to the credit of the industry. Now that the State is proposing to carry out a nationalising plan it is as well to remind ourselves that these are substantial achievements that bear comparison with those of the supply industry of any other country.

Canadian Hydro-electric Scheme. — Stewartville, on the Madawaska River about forty-three miles west of Ottawa, is to be the site of a \$7,000,000 hydro-electric plant expected to develop 50,000 HP.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Johnson & Phillips, Ltd.—At an extraordinary general meeting last week a resolution for increasing the company's borrowing powers to £1,600,000 was carried unanimously. Mr. G. Leslie Wates (chairman), referring to the refusal by the Capital Issues Committee to sanction the terms of the proposed share issue (see *Electrical Review*, December 14th, page 879, and 21st, page 917), said that the directors had carefully studied the personal and capital history of the company and the plans for developing its activities, and they also had before them figures of issues recently approved by the Committee in which the difference between the issued and market prices was similar to, or greater than, in their own case. He thought that the attention of authority should be drawn to the results which flowed from the methods followed at the present time to give a meaning to the phrase "element of bonus." The Capital Issues Committee had a very difficult task. He submitted that whatever might be the proper yardstick of value the current Stock Exchange price certainly was not. The assumption upon which the Capital Issues Committee had worked that because a few shares had changed hands at a high price therefore the whole share capital of the company was worth 800,000 times the price at which one share changed hands was a fantasy.

Perak River Hydro-Electric Power Co., Ltd.—Speaking at the annual meeting in London Mr. W. Shearer (chairman) said that unofficial advices indicated that the Chenderoh power station (27,000 kW) was practically intact and was at present affording a moderate supply for military and other requirements; the Malim Nawar station (30,000 kW) was available as standby, but to what extent could not yet be ascertained; while the Batu Gajah station (22,000 kW) had been practically dismantled by the Japanese, three sets aggregating 17,000 kW having been removed to sites outside the company's area. He paid a tribute to the late Captain Henry Dane, the company's general manager, who died in a prisoner-of-war camp at Tokyo, and said that they had heard only recently of the death, in similar circumstances, of one of the company's youngest engineers, Mr. J. C. Bruce, who was serving with Captain Dane.

Heenan & Froude, Ltd.—Referring to the activities of the company's "S" department at the annual meeting, Mr. Alan P. Good (chairman) said that at the beginning of the war the company took a licence from the Dynamic Corporation of Kenosha for the manufacture of that concern's eddy-current type of engine testing equipment for all parts of the world other than the United States and Canada. This type of equipment was slowly superseding the Heenan hydraulic brake. Some years before the war the company acquired certain patents for the manufacture of wire and strip forming machines, a class of equipment which had previously been almost entirely imported either

from Germany or America. The range had been very considerably developed and the company was now inundated with inquiries.

S. Smith & Sons (England), Ltd., have declared a final dividend of 10½ per cent. on the preferred ordinary shares, again making 17½ per cent. for the year, and the dividend of 37½ per cent. on the deferred shares is again at the same rate. The net profit for the year ended August 4th last rose from £103,579 to £116,568.

Telephone Rentals, Ltd., has declared an interim dividend of 4 per cent. (same).

New Companies

Monmore Conduits, Ltd.—Private company. Registered December 7th. Capital, £10,000. Objects: To carry on the business of steel rollers, manufacturers of electric conduit tubes, etc. Subscribers: Margery Rookcroft, 35, Lawley Street, Birmingham, 4, and Doris M. Lewin, 18, Lily Road, South Yardley, Birmingham, 26. Registered office: Jubilee Works, Charles Street, Short Heath, near Wolverhampton.

Etherington's Electrical Services, Ltd.—Private company. Registered December 3rd. Capital, £2,000. Objects: To carry on the business of electrical contractors, manufacturers of, and dealers in, radio equipment, etc. Directors: S. G. J. Etherington, 35, Wolsey Road, Godalming, and J. M. Dowson, The Poplars, Pershore, Worcs. Registered office: 65a, High Street, Godalming, Surrey.

Raidel Services, Ltd.—Private company. Registered December 5th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, all kinds of transformers, electrical and wireless instruments and apparatus, etc. Directors: C. G. Warren, 11, Spa Hill, Upper Norwood, S.E.19, and two others. Registered office: 49, Lower Addiscombe Road, Croydon.

Light & Sound Industries, Ltd.—Private company. Registered December 13th. Capital, £5,000. Objects: To acquire the business of an electrical engineer and contractor, carried on by Frederick N. Ings at 29a, The Triangle, Bournemouth, and to carry on business of electrical, radio and mechanical engineers, etc. Subscribers: Mrs. Ada V. Kien and F. N. Ings, 4, Bradbourne Road, Bournemouth. Registered office: 29a, The Triangle, Bournemouth.

Electrical Products & Trading Co. (London), Ltd.—Private company. Registered December 13th. Capital, £100. Objects: To carry on the business of electrical and radio engineers and contractors, etc. Directors: H. Finn, 17, Newcombe Park, N.W.7, and Hyman Bilsky, 26, Sandringham Road, N.22. Registered offices: 56-58, Clerkenwell Road, E.C.1.

Berkshire Radioelectric Services (Newbury), Ltd.—Private company. Registered November 23rd. Capital, £2,000. Objects: To carry on the business of manufacturers, repairers, maintenance contractors, and installers of radio

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components, electrical apparatus, accessories and television, electrical wiring and apparatus, etc. Directors: J. Bach, The Bungalow, Spring Copse, Hermitage, near Newbury; Mrs. J. M. Sanders, Peewit Farm, Wickham Heath, near Newbury, and A. W. Sanders, 11, Tinker Lane, Crookes, Sheffield, 10 (directors of Kempston Electrical Co., Ltd.). Registered office: 21, Oxford Street, Newbury.

Reliance Vacuum Cleaner Service (Ilford), Ltd.—Private company. Registered November 14th. Capital, £3,000. Objects: To carry on the business of manufacturers, repairers and servicers of, agents for, and dealers in, domestic, household and general electrical and other equipment and appliances, including washing and cleaning machines, wringers, refrigerators, etc. Directors: G. MacDonald, 333, Aldborough Road, Seven Kings, and two others. Registered office: 152/4, Broadway, Bexley Heath, Kent.

Kays Instrument Co., Ltd.—Private company. Registered November 14th. Capital, £1,000. Objects: To carry on the business of manufacturers of, agents for, and dealers in, scientific instruments and apparatus, engineering products, electrical and radio apparatus, etc. Directors: A. T. Painter (permanent), 80, Elmstead Gardens, Worcester Park, and E. P. Mahoney, 7, Spruce Hill Road, Walthamstow, E.17. Registered office: 2a, Cannhall Road, Leytonstone, E.

Harris & Boddy, Ltd.—Private company. Registered November 30th. Capital, £2,500. Objects: To carry on the business of electrical and radio contractors, manufacturers of, and dealers in, cinema projection apparatus, etc. Directors: C. F. Harris, 13, Whitefriars Drive, Harrow Weald, Middlesex (permanent), and J. L. Ellsworth, 11, Rusland Road, Harrow. Solicitors: Guscott Fowler & Cox, Kingston-on-Thames.

Arthur Moore, Ltd.—Private company. Registered November 3rd. Capital, £5,000. Objects: To carry on the business of wholesale dealers in, and exporters and importers of, radio, electrical and mechanical apparatus and components, etc. Directors: D. D. Rothschild, address not stated, and three others. Registered office: 3, Chase Side, Southgate, N.14.

Electron Wireless Co., Ltd.—Private company. Registered November 6th. Capital, £1,000. Objects: To carry on the business of manufacturers and distributors of, and dealers in, wireless and television sets, etc. Directors: T. J. Favell, 46, Mayfield Avenue, N.12, and H. A. J. Hoodless, 106, Sydney Road, N.8. Registered office: 208, Seven Sisters Road, N.4.

Martin Franklin, Ltd.—Private company. Registered November 12th. Capital, £100. Objects: To carry on the business of electrical, radio and television engineers and retailers, etc. First directors: M. Franklin and Mrs. Alice Franklin, 24, Mapesbury Road, N.W.2. Secretary: Mrs. L. A. Smith, 41, Walm Lane, N.W.2.

Lubins (Portsmouth), Ltd.—Private company. Registered November 30th. Capital, £1,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical, radio, sound recording and television apparatus and supplies, etc. Directors: W. R. Wiseman,

St. Lawrence, Wood Street, Guildford, and Mrs. Violet Y. C. Lubin, 37, Military Road, Hilsa, Portsmouth. Registered office: South-down Building, North End Junction, Portsmouth.

G. Pilkington, Ltd.—Private company. Registered November 30th. Capital, £2,000. Objects: To carry on the business of electrical engineers and contractors, manufacturers of, and dealers in, radio and television apparatus, etc. Directors: G. Pilkington and Frances Pilkington, both of 29, Broadway, Blackpool, and H. Pilkington, Masfield Road, Droylsden, Manchester. Registered office: 29, Broadway, Blackpool.

Electrical Services (Duns), Ltd.—Private company. Registered in Edinburgh November 27th. Capital, £1,000. Objects: To carry on the business of lighting, heating and ventilating engineers and suppliers of, or dealers in, radio and electrical equipment and accessories, etc. Directors: G. Luke, Cheviotview, Duns, and two others. Registered office: 28, Castle Street, Duns.

Grubb & Whiteside, Ltd.—Private company. Registered November 14th. Capital, £2,000. Objects: To carry on the business of electrical engineers, wireless service agents, etc. Permanent directors: J. Whiteside, 11a, Hawthorne Road, Torrisholme, Morecambe (managing director), and three others. Registered office: Sylvester Street Works, Lancaster.

Cornelius Electronic Instruments, Ltd.—Private company. Registered November 22nd. Capital, £2,500. Objects: To carry on the business of manufacturers of, and dealers in, electrical, radio and electronic instruments, scientific, medical, industrial and household equipment, etc. J. R. Cornelius, 90, Broadway, Coventry, is the first director. Registered office: 90, Broadway, Coventry.

Silent Salesman, Ltd.—Private company. Registered November 21st. Capital, £3,000. Objects: To acquire the business of an inventor and manufacturer of neon lighting and other luminous signs, etc., carried on by J. L. Kelway, at 1, Pipe Lane, Bristol, as the "Silent Salesman." J. L. Kelway, 32, Halsbury Road, Westbury Park, Bristol, is permanent managing director. Registered offices: 1, Pipe Lane, Bristol.

Brindle & Kirby (Electrical & Radio Engineers), Ltd.—Private company. Registered November 28th. Capital, £1,000. Objects: To carry on the business of electrical and radio engineers and stockists, etc. Directors: N. Brindle, 470, Bury New Road, Prestwich, Manchester, and C. F. Cross, 38, Gardner Road, Prestwich, Manchester.

Scottish Heat and Vacuum, Ltd.—Private company. Registered in Edinburgh, November 16th. Capital, £2,500. Objects: To carry on the business of manufacturers and/or sellers of electric heaters and heating utensils, etc. First directors: J. W. Nicol, "Corwhan," Dalhousie Street, Carnoustie, and three others. Registered office: 11, Barrack Street, Dundee.

Bankruptcies

M. F. R. Plowman, 67, Cambridge Street, Stafford, electrical engineer.—Receiving order made December 14th.

STOCKS AND SHARES

THE present year, which has included VE and VJ Days, and also the return of the Labour Party to effective power, cannot fail to stand out very prominently in history for the eventful character of its happenings. The Stock Exchange has shared to the full in the result of peace conditions. Business throughout the period has run on reasonably active lines. Every now and then the markets fell into the doldrums, but this phase never lasted long, weight of money being the important factor in re-energising prices and business alike.

Electricity Supply Shares

Prices of shares, ordinary and preference, in the Home electricity supply group mostly show falls; the reason is purely political. Publication of accounts, permitted as a sequel to the victory in Europe, showed the undertakings to have made substantial progress during the war years, and proprietors were thus confirmed in the confidence they entertained as to the stability of their investments. When the Labour Party came into power, one of their early announcements related to nationalisation of the industry, and prices promptly fell. How the London companies' shares have changed, this group shows:—

Ordinary	Dec. 31st 1944		Now		Rise or Fall
	s.	d.	s.	d.	
City of London	30	0	27	6	- 2 6
County of London	43	0	38	0	- 5 0
London Assoc. Elec.	26	0	27	0	+ 1 0
Metropolitan	43	0	40	0	- 3 0
Northmet Power	41	0	37	6	- 3 6
South London	30	0	29	0	- 1 0

Prices of ordinary shares in the Scottish and provincial supply undertakings have followed a similar course. Representative examples are:—

Ordinary	Dec. 31st 1944		Now		Fall
	s.	d.	s.	d.	
Bournemouth & Poole	62	6	59	0	3 6
Clyde Valley	42	0	39	6	2 6
Edmundsons	31	0	26	0	5 0
Elec. Dis. Yorks.	45	6	40	0	4 6
Lancs. Light & Power	37	0	32	6	4 6
Midland Counties	41	6	37	6	4 0
Midland Elec.	44	0	40	6	3 6
North Eastern Power	34	6	31	6	3 0
Northampton	50	0	46	6	3 6
Scottish Power	40	6	35	0	5 6
Yorkshire Elec.	43	0	39	6	3 6

Preference Shares on Offer

As an example of depressed preference shares, Yorkshire Electric Power 6 per cents. may be instanced as being now offered at 25s., to yield 4.8 per cent. Earlier this year, the shares cost as much as 32s. 6d. Edmundsons 6 per cent. have come down from 32s. 3d. to 23s. 9d. and now give £5 1s. per cent. on the money. North-Eastern Electric 7 per cent. preference shares, which can be bought for

26s. to yield well over 5 per cent., have fallen more than 10s. this year. Northmet Power 4 per cents. are 21s. 3d. and pay 3½ per cent. on the money. The price has dropped only 1s. 6d. this year. On Midland Counties 4½ per cent. preference at 22s. the yield is under 4 per cent., and this year's depreciation 1s. 9d. Metropolitan Electric Supply 4½ per cents. are 22s. 9d. and the yield nearly 4 per cent. Depreciation of the order illustrated in the case of the heavier shares reflects what might be termed an ultra-cautious view of nationalisation terms.

Communication Stocks

The market in communication stocks and shares has for its main feature a good rise in Cable & Wireless ordinary and a smaller fall in the preference. The Government has announced its intention of taking over a portion of the combine, but no details have yet been made public. International Telephone & Telegraph shares advanced on steady buying from America. Here are some of the changes:—

Stock or Share	Dec. 31st 1944	Now	Rise or Fall
Anglo-Amer. pf.	124	128½	+ 4½
Cable & Wireless pf.	118	110	- 8
Cable & Wireless ord.	85	103	+ 18
Great Northern	28	32½	+ 4½
Inter. Tel. & Tel.	23	37	+ 14
Marconi Marine	35s. 6d.	32s. 3d.	- 3s. 3d.

E.M.I. Conversion Problems

The chairman of Electric & Musical Industries, Ltd., gave at the recent meeting an impressive idea of the company's many-sided contribution to war production, and of the formidable problems connected with reconversion to normal business. He enlarged on the reference made previously in the annual report of a new application of science and engineering to some of the company's branches, but gave nothing away as to its exact nature. He was confident of their ability to keep well to the fore in the television field. The price of the shares has gone back to 33s. 6d.

Cossor Development

Reports about negotiations in progress between A. C. Cossor and an American electrical concern had been current for some months before last week's announcement of their conclusion. News of the intention to form a new £500,000 subsidiary under Cossor's control proved to have been discounted in the market. A rise to 47s. was followed by a reaction to 43s. 6d. This was ascribed in part to the intimation that no new financing is expected at present. There had been a fairly widespread expectation that shareholders would have the opportunity of subscribing fresh capital for the development of radar for peacetime purposes. Formation of the new subsidiary, it is pointed out, is subject to the approval of the Capital Issues Committee.

Early Salad Crops

A Useful Off-peak Load

THE food value of salad crops, particularly at a time when vitamin deficiencies are common, is undisputed. While the position is satisfactory in summer, there is an acute shortage of supplies during the spring, which is the period when the greatest need exists.

Lettuces are the easiest crop to grow and will thrive with only a small amount of heat, provided a closed frame is used in a light position. The lettuces can be successfully intercropped with carrots which will follow on after the lettuces have been pulled. Experiments have shown that, not only in Southern England, but as far north as Edinburgh, lettuces can be made to mature satisfactorily by the end of March by using a standard soil-heating cable in conjunction with an ordinary garden frame, and the simplicity of installation and low initial cost place this method within the province of the amateur gardener. In fact, provided there is uninterrupted south light and sufficient depth of soil can be provided, the crops can be grown in a concrete yard. The lettuces are normally ready at the end of March, when the heating is switched off to prevent the plants "bolting" and thus extend the period over which they can be pulled. The carrot crop follows about a month later.

Approximate Cost

The first question to be considered is that of cost. Neglecting the cost of the garden frame, which, incidentally, should be heat insulated all round by packing, the total cost per lettuce works out at 3d. per plant with electricity at $\frac{3}{4}$ d. per kWh. In computing this cost it is assumed that a standard 6 ft. by 4 ft. garden frame is used, containing 48 plants, and no thermostat is considered necessary. Consumption is in the neighbourhood of 90 kWh during the three months of growth, and the heating cable, which costs just over a pound, can be expected to have a life of five years if not damaged by mishandling. The use of a transformer and bare wire will increase the initial cost, but since the transformer will last many years the annual cost will not be much, if any, greater. The cost of providing a supply as far as the frame can be averaged at 2s. per yd. for materials only.

It will be appreciated that with early spring lettuces being retailed at from 9d. to 1s. 3d. each a considerable saving can be made by the amateur gardener and a useful profit made by the small commercial grower.

Where unobstructed south light can be obtained the frame can be constructed within a few yards of the house. This will simplify

By A. D. Johnson wiring and at the same time afford a certain amount of protection against frost. Three-core cable, preferably carried on poles out of reach, should be used so that the transformer casing and cable sheath can be earthed. Where any distance has to be traversed the cable will have to conform with local regulations and be of a more permanent nature. In both cases the supply should be obtained from an independently fused circuit.

The standard cable is in a 25-ft. length loaded at 125 W, which is suitable for an 8 ft. by 6 ft. frame. Lengths of 100 and 150 ft. loaded at 470 and 700 W respectively are also available for larger installations. The cable should be laid about 6 in. below the eventual surface of the soil as evenly as possible so that at no position are the cable lengths nearer than 7 in. to one another. A layer of sand will tend to improve heat distribution, and if a one-inch layer of soil is placed over the cable and followed by a layer of small mesh wire netting an additional safeguard is provided against accidental mechanical damage. It is important that the cable, once laid, should not be moved the following year, and care must therefore be taken when changing the soil.

When a transformer is used, it should be fitted inside the frame so as to utilise its heat losses and the connections between the iron wire, which is laid in the same way as the heating cable, made just above soil level, either transformer tails or 7/064 cable being used for the connection.

A weatherproof totally enclosed transformer should be used, but if this is not available and an open type transformer has to be employed, care must be taken to ensure that it is mounted above the soil level and protected against the ingress of water. In some instances it may be better to mount the transformer outside the frame in an enclosed but ventilated box.

Operation

It is not proposed here to deal with the cultivation angle, but certain important factors must be borne in mind. The ideal arrangement is to prepare the bed in November and allow it to settle with the lights on, to encourage weed seeds to grow. These can then be removed easily. A week or two before planting the lettuce in January, the frame should be left open and well soaked with water. Two days before planting it should be closed and the heating left on. Carrot seed should then be sown, followed by lettuce plants spaced 7 in. apart. In both

instances a good forcing variety must be used.

During growth, unless there is undue drainage, no further watering should be required until March, and the lights should not be moved unnecessarily. Heating should be switched on then every night for 8 or 9 hours until the crop is ready—usually about the end of March. After this no heating should be given or the plants will "bolt."

The recommended 125-W loading enables the heat to be switched on overnight: a higher loading than 5 W per sq. ft. would prove difficult to operate without a thermostat and would be dangerous to crops if accidentally left on all day.

Although the actual consumption in the

case of a small single-frame installation may amount to only 30 kWh per month, its simplicity of operation and installation should make possible its wide application, especially in these days of keen interest in gardening and home grown salads. From the supply undertaking's point of view, if a sufficient number of installations are running, it offers an attractive off-peak load on a par with water heating, and no doubt a progressive undertaking would apply the same tariff. The idea also lends itself to an interesting window exhibit in showrooms, particularly if the undertaking can co-operate with amateur growers to provide demonstration frames.

Municipal Reports

Watford

THERE was a surplus of £17,152 on the past year's operations of the Watford Electricity Department, against £236 in 1934-44. Gross revenue was £427,481 (£385,923) and working expenses amounted to £351,820 (£329,736). Sales aggregated 109.0 million kWh (100.1 million), the increase being divided fairly equally between power and other supplies. The net average price obtained was 0.89d. (0.87d.) but "Norwich" tariff consumers paid an average of only 0.55d. which coincides with the figure for 1939-40 and the borough electrical engineer (Mr. A. W. Barham) points out that this is in striking contrast to the present day costs of other items in the domestic budget.

The output of the undertaking's generating plant last year dropped from 32.4 million kWh to 15.5 million, two turbines remaining out of commission throughout the year despite the engineer's endeavours to obtain some priority for their repair. The maximum load on the undertaking (32,350 kW against 27,650 kW in 1943-44) occurred at 9.30 a.m. on December 28th, 1944, and the maximum day's output on January 26th, 1945.

Leyton

In spite of a decrease of 1,062 in the number of consumers during 1944-45, due to flying bomb and rocket attacks, the quantity of electricity sold by the Leyton undertaking—37.5 million kWh—represents an increase of approximately 12 per cent. on the previous year, although owing to the effect of continuous meter reading the increase of 8½ per cent. in kWh purchased is a better criterion of the rate of growth. The average cost per kWh sold of 1.369d. was the lowest during the war years, which the borough electrical engineer and manager (Mr. A. E. Morgan) ascribes in part to improved wartime economy in working and reduction in capital charges. The average price received (1.568d.) was also lower than for a number of years past. Total revenue amounted

to £252,447 (£234,561) and working expenses were £185,995 (£174,786). After adding bank interest, etc., and providing £34,520 (£32,129) for loan charges and £18,000 (£10,000) for income tax there was a net profit of £15,467 (£21,837). Contributions to capital outlay take £2,326 (£785) and rate contribution £3,639 (£4,031).

During the year a supply was provided to a hundred emergency hutsments at Whipps Cross. They were wired and fitted with cookers and wash boilers by the Ministry of Works and the undertaking supplied water heaters, irons and fires at an inclusive hire charge of 8d. a week, tenants obtaining their electricity at a fixed charge of about 9d. a week, collected with the rent, and a running charge of ½d. per kWh (plus 15 per cent.) collected through a slot meter. Another development was the introduction of a new two-part domestic "all purpose" tariff.

Southampton

The borough electrical engineer of Southampton (Mr. W. G. Turner) reports that the total quantity of electricity sold in 1944-45 including bulk supplies of 18.7 million kWh (against 16.6 million in 1943-44) was 134.1 million kWh, an increase of nearly 10 per cent. There was a small decline in power sales but substantial increases were recorded in other categories, which the engineer states was partly due to the demands of the various Services and the return of evacuees. Income amounted to £663,501 (against £579,815) and working expenditure was £564,846 (£482,875). After adding certain refunds of £6,583 (£677) and providing for £75,580 (£79,534) interest and redemption charges, and £8,141 (£11,868) special expenditure, there was a net surplus of £21,545 (£6,905).

A total of 156.1 million kWh was sent out from the power station (against 158.2 million), the thermal efficiency being 16.83 (17.37) per cent. Coal cost 49s. 10½d. a ton (compared with 21s. 6½d. in 1940) and the quality was poor.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

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

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

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

Hull.—January 31st. Corporation. One electrically driven pump with switchgear and collecting pipes. (See this issue.)

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

Poplar.—January 28th. Borough Council. Three 6-panel 11,000 V metalclad switchgear units. (See this issue.)

Rochdale.—January 16th. Electricity Department. Quarterly and prepayment meters and transformers. (December 21st.)

Sheffield.—January 28th. Electricity Department. One 14-panel auxiliary switchboard. (December 21st.)

Eleven 600-kVA double-wound auxiliary transformers. (See this issue.)

Southend-on-Sea.—January 1st. Town Council. Electric heating installation at Westcliff School for Boys. Borough electrical engineer and manager, Electricity Works, London Road.

February 1st. Electricity Department. One 800-kW alternator. (December 21st.)

Weston-super-Mare.—December 31st. Town Council. Electric wiring in connection with the reinstatement of the Winter Gardens Pavilion. Borough engineer, Town Hall.

Orders Placed

Hackney.—Electricity Committee. Recommended. Six 500-kVA distribution transformers (£2,676).—Hackbridge Electric Construction Co.

Manchester.—Health Committee. Accepted. Electric heating installation in school rooms and at Memorial Home.—F. H. Wheeler & Co.

Housing Committee. Accepted. Electrical installation, Miles Platting flats.—H. C. Taylor & Co.

Middlesex.—Health Committee. Accepted. Fluorescent lighting, Shenley Hospital (about £300).—B.T.H. Co.

St. Pancras.—Contracts and Stores Committee. Accepted. Five hundred 5-A single-phase meters (£1 15s. 3d. each).—Ferranti. Fifty 3-pint chromium plated kettles (£128).—Hotpoint.

Southport.—Lighting Committee. Accepted. 100 fluted steel lamp pillars (£14 2s. 8d. each).—Stewarts & Lloyds.

West Hartlepool.—Corporation. Accepted. Two trolley-bus chassis.—Transport Vehicles (Daimler).

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.—Houses (60), at Bankhead; County Architect's Office, 22, Union Terrace.

Aberferry.—Permanent houses (36), Crumlin, for U.D.C.; A. G. Jones, surveyor, Council Offices.

Ashington.—Houses (54), for U.D.C.; W. Leech (Builders), Ltd., Newcastle-on-Tyne.

Batley.—Houses (66), Healey Lane site; T. Mossop, borough surveyor, Municipal Buildings.

Beaconsfield.—Permanent houses (20), Maxwell & Ronald Roads, for U.D.C.; J. H. Crosby, surveyor, Council Hall, Penn Road.

Birmingham.—Houses (82), Upton Warren; S. I. King & Co., surveyors, 29, Clarence Street.

Bishop Auckland.—Houses (150); U.D.C. surveyor.

Bolton.—Houses (22), Withins Way and Winchester Way; G. H. Pearce & Son.

Brighton.—Houses (65), Council estates (£70,234); Building & Public Works Construction Co., Ltd.

Buckley.—Permanent houses (59), site at Bistre-Buckley, for U.D.C.; R. Lloyd Roberts, architect, Wrexham Street, Mold.

Carlisle.—Houses (80), Wigton estate; J. Laing & Son, Ltd.

Chester.—Houses (60), Clough's estate, for U.D.C.; H. Jones, surveyor, Council Offices, Connah's Quay.

Cleator, Moor (Cumberland).—Houses (68), Cleator Moor and Frizington; North-Eastern Housing Association, Northumberland Road, Newcastle-on-Tyne.

Crayford.—Houses (40), Heath Road, for U.D.C.; F. Turner, surveyor, Municipal Buildings.

Darlington.—Factory, Aycliffe, for Bakelite, Ltd.; W. Pearson & Son, builders, Stranton, West Hartlepool.

Dartford.—Houses (22), Oaklands Road; J. Franklin & Co. (Erith), Ltd.

Dorchester.—Houses (22), Ackerman Road (£24,546); C. P. Unwin & Sons, Ltd.

Dundee.—Reconstruction scheme, Gourdie Farm, for Corporation (£30,000); city architect.

East Barnet.—Houses (118), for U.D.C.; C. M. Barnes, surveyor, Town Hall, Station Road, New Barnet.

East Grinstead.—Houses (80), Stone Quarry estate, Holtze Road, for U.D.C.; A. W. Kenyon, architect, 15, Adeline Place, Bedford Square, London, W.C.1.

Enfield.—Permanent houses (74), Hoe Lane site, for U.D.C.; F. Lee, surveyor, 7, Little Park Gardens.

Eye (Suffolk).—Houses (40), Victoria Hill site; J. A. Armstrong, town clerk.

Falkland (Fife).—Houses (48), for Town Council; A. D. Haxton, architect, 5, Scoonie Place, Leven.

Fareham.—Houses (70), Fareham and Warsash, for U.D.C.; H. T. Privett, surveyor, Council Offices, Westbury Manor.

Felling (Co. Durham).—Bottling factory for Archibald, Rower & Co., Ltd.; E. M. Lawson, architect, Barras Buildings, Newcastle-on-Tyne.

Printing works for the C.W.S., Ltd., at Pelaw; C.W.S. Architects' Department, 90, Westmoreland Road, Newcastle-on-Tyne.

Fleetwood.—Houses (54), Homestead estate; borough engineer.

Frimley and Camberley.—Houses (32), for U.D.C.; R. H. Porteous, surveyor, Municipal Buildings, Camberley.

Gatehouse of Fleet.—Permanent houses (56), for Town Council; M. Purdon Smith, architect, 33, Castle Street, Dumfries.

Gateshead.—Administrative unit, Queen Elizabeth Hospital (£36,000); Hadden & Hillman, Ltd., builders, New Bridge Street, Newcastle-on-Tyne.

Farm building additions, Mental Hospital (£2,700); J. F. Dickman, builder, Newbiggin, Northumberland.

Houses (90), Blue Quarries site; J. Clark & Son, builders, New Seaham.

Additions, South Shore Road, for British Ropes, Ltd.; J. Milne & Son, builders, Coatsworth Road.

Factory addition, Team Valley estate, for the Tyneside Safety Glass Co., Ltd.; J. H. Napper, architect, 52, Eldon Square, Newcastle-on-Tyne.

Glasgow.—Factory, Muirend Avenue; Robert Kay & Co.

School cookery centre, Yorkhill; city engineer.

Gosforth (Northumberland).—Houses (50); U.D.C. surveyor.

Guildford.—Permanent houses (110); borough engineer.

Hanbury.—Dairy, Goosehill Farm; Col. E. C. L. Bearcroft, Mere Hall, Droitwich.

Hove.—Houses (58), Knoll estate (£63,492); Building & Public Works Construction Co., Ltd., Swindon.

Huddersfield.—Temporary school accommodation at Deighton (£6,000); borough engineer.

Kidsgrove.—Permanent houses (36), Banbury Street, Butt Lane, for U.D.C.; Wood, Goldstraw & Yorath, architects, Station Road, Tunstall, Stoke-on-Trent.

Lewes.—Permanent houses (40), Landport estate; C. T. Butler, borough surveyor.

Littlehampton.—Houses (72), and bungalows, Hill Road site, for U.D.C.; J. A. Young, surveyor, Manor House.

Liverpool.—Dining hall and kitchen, Speke county school for Education Committee; L. H. Keay, city architect, Blackburn Chambers, Dale Street.

Long Eaton.—Houses (166), Tamworth Road estate, for U.D.C.; H. Raven, engineer, Town Hall.

Luton.—Houses (265), Hart Hill estate; borough engineer.

Marlow.—Houses (26), for U.D.C.; C. K. Smith, surveyor, Council Offices.

Melksham.—Houses (36), for U.D.C.; D. H. McKershar, architect, Town Hall.

Monifieth (Angus).—Houses (36); town clerk.

Newport (I. o. W.).—Houses (20), Melbourne Park estate (£24,542); I. o. W. Building Trades Employers' Federation.

Northallerton.—Houses (43), for U.D.C.; S. F. Esland, clerk, 72, High Street.

North Riding.—Establishment of school dental service throughout the area (£130,000); county architect, County Hall, Northallerton.

Oakengates.—Houses (60), on several sites, for U.D.C.; M. S. Lee, Council Offices, Stafford Road.

Redcar.—Houses (36), for Town Council; R. Hilton, borough surveyor.

Southborough.—Permanent houses (100), Manor Road site, for U.D.C.; Howes & Jackman, architects, 1, Verulam Buildings, Gray's Inn, London, W.C.1.

Spenborough.—Permanent houses (54), Windy Bank estate, for U.D.C.; surveyor, Town Hall, Cleckheaton.

Stourbridge.—Houses (140), Rufford estate; G. N. Maynard, borough surveyor, Town Hall.

Sunderland.—Houses (186), Springwell Farm estate; L. W. Evans, Ltd., builders.

Swinton.—Houses (32), Thornfield Drive and Gorsefield Drive; Central Estates (Swinton), Ltd., builders, 51, Shaftesbury Road.

Tadcaster.—Houses (40), Oxton Lane, for R.D.C.; Needham & Thorp, architects, 3, Duncombe Place, York.

Tamworth.—Permanent houses (48), Fazeley Road, H. F. Bruce Smith, borough engineer, Municipal Offices.

Thornaby-on-Tees.—Factory, for Crosthwaite, Ltd. (£15,000); W. Pearson & Son, builders, Stranton, West Hartlepool.

Tipton.—Houses (£67,320), Denbigh estate, Horseley Heath; Asphalt & Public Works, Ltd., contractors, Congreve Street, Birmingham.

Tiverton.—Houses (113), Westex South; H. S. W. Stone & Partners, architects, Lloyds Bank Chambers, 7, Fore Street, Taunton.

Tow Law (Co. Durham).—Houses (50), for North Eastern Housing Association; J. W. Hanson & Son, Eldon Square, Newcastle-on-Tyne.

Tunbridge Wells.—Houses (114); H. P. Bishop, borough engineer, Town Hall.

Tynemouth.—Additions, Tynemouth Infectious Diseases Hospital (£21,500); borough engineer, 19, Howard Street, North Shields.

Houses, West Chirton (520) and Broadway, Cullercoats (188); borough engineer.

Warrington.—Central kitchen, Arpley Street, for Education Committee; D. Cooper, Ltd., builders, Clarence Street.

West Hartlepool.—Factory for Educational Supplies Association; W. Pearson & Son, contractors, Stranton.

Wigton (Cumberland).—Houses (63), for North-Eastern Housing Association; Stephen Mann, architect.

Worcester.—Permanent houses (88), Tolladine No. 4 estate; city engineer, 22, Bridge Street.



FAMOUS HYDRO-ELECTRIC STATIONS.

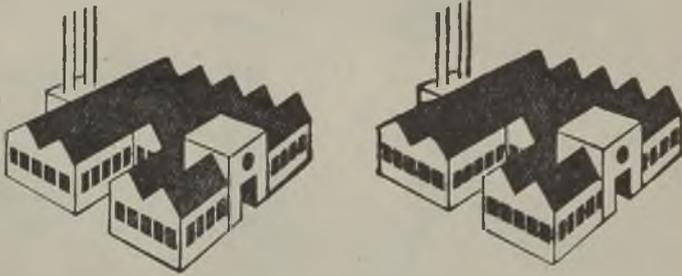
This remarkable aerial photograph shows the complete working area taken over for the spectacular construction of the mighty Grand Coulee Dam, one of America's finest, in the state of Washington. Mason City lies in the left foreground and the Government town on the right. The dam has an ultimate capacity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



MEASUREMENT LIMITED

Electricity and Water Meters of Quality

TERMINAL HOUSE, LOWER BELGRAVE ST., LONDON, S.W.1



one of these factories is out-of-date

ITS PLANT IS first-class, its workers skilled and willing, its management capable—but its lighting is wrong. All the good work, the new machinery, the careful executive control, operate in extremes of light and shadow, trying to the eyes and nerves, slowing up output . . . In the other factory, OSRAM Fluorescent Lamps provide a cool, shadowless light that is the next best thing to daylight itself—restful, diffused, evenly distributed. And economical, too! The 80-watt OSRAM Fluorescent Lamp gives three times as much light as a tungsten lamp for the same amount of current. No wonder records are broken in Factory No. 2 while it is always a struggle to keep abreast in Factory No. 1.

Stocks available at all G.E.C. Branches

Osram

FLUORESCENT
LAMPS

DAYLIGHT and WARM WHITE



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. 7 words) per insertion, minimum 2 lines 4/-, or for display advertisements 30/- per inch, with a minimum of one inch. Where the advertisement includes a Box Number this counts as six words and there is an additional charge of 6d. for postage of replies.

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

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

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES, TENDERS, ETC.

SHEFFIELD CORPORATION ELECTRICITY DEPT.

Contract No. 707

THE Electricity Committee are prepared to receive tenders for the supply and delivery of the under-mentioned Transformers:—

ELEVEN 600-kVA Double-wound Self-cooled Generating Station Auxiliary Transformers.

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

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

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

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

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

JOHN R. STRUTHERS,
General Manager and Engineer.

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

3769

METROPOLITAN BOROUGH OF POPLAR

Tenders for E.H.T. Switchgear

THE Council of the above-named Borough invites tenders for the manufacture, testing and delivery to site of Three 6-panel E.H.T. Metalclad Switchgear Units (11,000 volt) for static substations.

Specifications and Forms of Tender may be obtained on application to the undersigned, on payment of a deposit of one guinea in the form of a cheque made payable to the Poplar Borough Council, which amount will be refunded on receipt of a bona fide tender not subsequently withdrawn.

Sealed tender (in the envelope provided), endorsed "Tender for E.H.T. Switchgear," must be delivered to the undersigned at the Poplar Town Hall, Bow Road, E.3, not later than 6 p.m. on Monday, 28th January, 1946.

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

S. A. HAMILTON,
Town Clerk.

Poplar Town Hall,
Bow Road, London, E.3.
December, 1945.

3774

CITY AND COUNTY OF KINGSTON-UPON-HULL

East Hull Main Drainage—Pumping Plant

THE Corporation is prepared to receive tenders for the supply and installation of one Electrically-driven Pump capable of pumping 1,600 cu. ft. per minute and one Electrically-driven Pump capable of pumping 6,400 cu. ft. per minute, together with switchgear and collecting pipes.

Drawings and Contract Documents may be obtained from the City Engineer, Guildhall, Kingston-upon-Hull, on payment of 2s., which will be refunded on receipt of a bona fide tender.

Tenders, enclosed in plain sealed packages, endorsed "East Hull Main Drainage Pumping Plant," are to be addressed to the Chairman of the Works Committee and delivered at the Town Clerk's office not later than 9.30 a.m., Thursday, the 31st January, 1946.

The acceptance of the tender will be subject to the observance by the Contractor of the Corporation Fair Wages and Local Labour Clauses.

The Corporation does not bind itself to accept the lowest or any tender. 8759

SITUATIONS VACANT

COUNTY BOROUGH OF PRESTON

Electricity Undertaking

A PPLICATIONS are invited for the following positions at the Ribble Generating Station from suitably qualified engineers:—

ASSISTANT SHIFT CHARGE ENGINEER: Applicants must be experienced in the operation and maintenance of high pressure plant in a modern power station. Salary and conditions of employment in accordance with the National Joint Board Schedule, Grade 8a, Class J, at present £439 per annum.

CONTROL ENGINEER (Shift Duties): Applicants must have had previous experience in the duties appertaining to the operation of an E.H.T. Control Room in a modern Power Station, and possess suitable technical qualifications. Salary and conditions of employment in accordance with the National Joint Board Schedule, Grade 9, Class J, at present £382 per annum.

TWO BOILER HOUSE ENGINEERS (Shift Duties): Applicants must have had technical and practical training in mechanical engineering, and considerable experience in the operation and maintenance of high pressure water tube boilers and ancillary plant of modern design. Salary and conditions of employment in accordance with the National Joint Board Schedule, Grade 9, Class J, at present £382 per annum.

All the above appointments will be subject to the provisions of the Local Government Superannuation Act, 1937, and persons appointed will be required to pass a medical examination.

Applications, stating age and giving full particulars of technical qualifications, training and experience, accompanied by not more than three testimonials, and appropriately endorsed, either "Assistant Shift Charge Engineer," "Control Engineer" or "Boiler House Engineer," must be received by the undersigned not later than Saturday, the 5th January, 1946.

G. A. ROBERTSON,

40 and 41, Lune St.,
Preston.
14th December, 1945.

Borough Electrical Engineer.

3787

CITY OF MANCHESTER

Electricity Department

A PPLICATIONS are invited for appointments on the staff of the Electricity Department as follows:—

TWO COMBUSTION ENGINEERS FOR SHIFT DUTIES: Applicants must have had previous experience in power station operation and in efficient combustion of low grade fuel in water tube boilers fitted with mechanical stokers; must have served a workshop apprenticeship or equivalent, and have technical qualifications equivalent to Higher National Certificate in electrical or mechanical engineering. Age about 30. Salary in accordance with Class K, Grade 8b, of the N.J.B. Schedule, £439 per annum.

FOUR JUNIOR ENGINEERS FOR TRAINING IN POWER STATION OPERATION: Applicants must have served an apprenticeship in engineering, and have technical qualifications equivalent to the Higher National Certificate in electrical and mechanical engineering. Previous experience in power station work not essential. Must be prepared to do shift work if required. Age between 20 and 30. Salary in accordance with Class J, Grade 10b, of the N.J.B. Schedule, £283 per annum.

The appointments will be subject to the City Council Superannuation Scheme, and the successful applicants will be required to pass a medical examination.

Applications, giving full particulars of age, technical training and experience, together with copies of recent testimonials, must be endorsed "Combustion Engineer" or "Junior Engineer" and addressed to Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, not later than 10 a.m. on Friday, 4th January, 1946.

Canvassing, directly or indirectly, will disqualify.

PHILIP B. DINGLE.

Town Hall, Manchester, 2. Town Clerk.
December, 1945. 3784

COUNTY BOROUGH OF HUDDERSFIELD

Electricity Department

Mains Staff

A PPLICATIONS are invited for the following positions on the Staff of the Mains Department, in accordance with the National Joint Board's Schedule.

Candidates must have had experience in the operation of a high voltage system and be conversant with the erection and maintenance of E.H.T. and L.T. overhead lines, underground cables and static substations. Preference will be given to those having technical qualifications.

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

Applications, appropriately endorsed on the envelope, should give age, education, details of training, experience and technical qualifications, and be accompanied by copies of recent testimonials, and should be addressed to the undersigned not later than the 9th January, 1946.

- (A) Mains Assistant, Grade 8a/1, Class G, £393 p.a.
(B) Substation Assistant, Grade 8b/1, Class G, £366 p.a.
(C) Mains Foreman, at a Standing Weekly Wage of £5 5s., plus £1 4s. war bonus at present.

F. A. ELLIS, M.I.Mech.E., M.I.E.E.,
M.Inst.F., Borough Electrical Engineer
and Manager.

Market Street, Huddersfield. 3786

SCOTTISH SOUTHERN ELECTRIC SUPPLY CO. LTD.

Wiring Department—Manager

A PPLICATIONS are invited for the position of Manager of the Company's Wiring Department at Berwick-on-Tweed.

Applicants should have sound experience of domestic, farm and small power installations, and should be capable of taking full charge, doing their own estimating, supervising, ordering materials, etc.

The position is a permanent one and has good prospects. Applications should state experience, age and salary required.

W. S. SAWTELL, M.I.E.E.,
General Manager.

Galashiels, December, 1945. 3743

METROPOLITAN BOROUGH OF FULHAM

Electricity Department

A PPLICATIONS in writing are invited for the following positions at the Council's Base Load Generating Station, Townmead Road, Fulham, in Class L of the National Joint Board Schedule, at the commencing annual salaries indicated.

- (a) Chief Chemist, Grade 8, £567.
(b) Junior Technical Engineer, Grade 10, £382 4s.
(c) Combustion Engineer, Grade 8a, £529 4s.
(d) Three Assistant Planning Engineers, Grade 9a, £421 1s.

Applicants for positions (a), (b) and (c) must be under 45 years of age, and for position (d) under 40 years of age.

Applications are also invited for the position of female Canteen Supervisor (Temporary) in Grade 11 of the Council's service, with a commencing salary of £210 per annum, rising by annual increments of £15 to £255 per annum, plus cost of living bonus, which at present is 18s. 6d. per week. Applicants must not be more than 35 years of age.

Forms of application and general conditions of the appointments may be obtained by sending a stamped addressed foolscap envelope to the undersigned, to whom completed applications must be returned to arrive not later than 12 noon on Monday, January 14th, 1946.

No further application is necessary from those who applied as the result of a previous similar advertisement as those applications will still stand.

CYRIL F. THATCHER.

Town Hall, Fulham, S.W.6. Town Clerk.
14th December, 1945. 3765

COUNTY BOROUGH OF WOLVERHAMPTON

Electricity Department

Appointment of Female Senior Demonstrator

A PPLICATIONS are invited for the above appointment at a salary of £240 per annum, rising to £270, plus war bonus, at present 18s. 6d. per week.

Candidates must have had a good general education and hold a recognised Diploma in Domestic Science and possess a thorough knowledge of the use of electrical domestic appliances; possession of the E.A.W. Electrical Housecraft Diploma will be an advantage. They must be competent to arrange and conduct Lecture Demonstrations and advise consumers on Kitchen Planning and the selection and use of electrical appliances.

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

Applications to the Borough Electrical Engineer, 83, Darlington Street, Wolverhampton, containing full details of the candidate's experience, should be received not later than first post on the 14th January, 1946, endorsed "Senior Demonstrator."

J. BROCK ALLON,

Town Hall, Wolverhampton. Town Clerk. 3760

MILFORD HAVEN URBAN DISTRICT COUNCIL

Electricity Undertaking

Appointment of Distribution Superintendent

A PPLICATIONS are invited for the above permanent appointment. Candidates must possess a technical qualification equivalent to I.E.E. Graduateship standard and have had a good all-round experience in the distribution and utilisation of electricity, including the survey and design of O.H. E.H.T. lines; substations; cable laying; change-over. The salary will be in accordance with Grade 3, Class B, of the N.J.B. Schedule, at present £457 for the first two years, £471 for the third and fourth years, and £485 subsequently.

Applications, giving age, details of training and experience, present position held, accompanied by copies of two testimonials, should be delivered to the undersigned not later than Friday, January 11th. Preference will be given to Servicemen.

A. J. DALTON,

Town Hall, Milford Haven, Pembro. Electrical Engineer and Manager.
14th December, 1945. 3747

COUNTY BOROUGH OF WIGAN

Appointment of Electrical Engineer and Manager

APPPLICATIONS are invited for the position of Electrical Engineer and Manager at a salary in accordance with the scale set out in the agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers, dated 9th July, 1941. In accordance with clause 10 of such agreement the salary for the first year will be 85% of the full salary and for the second year 92½% thereof; the full salary being payable in the third and subsequent years.

The present unit assessment of the Corporation's Electricity Undertaking is 50,000,000.

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

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

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

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

WILLIAM HENRY TYRER,

Town Clerk.

Town Clerk's Office,

Municipal Buildings,

Library Street, Wigan.

14th December, 1945.

3716

COUNTY BOROUGH OF ST. HELENS

Electricity Department

Appointment of Development Assistant
(Consumers' Department)

APPPLICATIONS are invited for the above position with salary and conditions in accordance with Grade 8b, Class G, of the National Joint Board's Schedule, at present £366 per annum.

Candidates must be experienced in the application of electricity to heating problems in the commercial and industrial fields, including space heating, heavy duty cooking, industrial heating, etc., and must be Graduate Members of the Institution of Electrical Engineers or possess equivalent qualifications.

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

Applications, accompanied by copies of not more than three testimonials, must be made on the form obtainable from the address given below and be received not later than 14th January, 1946, endorsed "Development Assistant."

P. BREGAZZI, A.M.I.E.E.,

Electrical Engineer and Manager.

Electricity Works,

Carlton Street,

St. Helens, Lancashire.

3746

SCOTTISH SOUTHERN ELECTRIC SUPPLY CO. LTD.

Distribution Superintendent

APPPLICATIONS are invited for the position of Distribution Superintendent with charge of substations. Applicants should possess a sound knowledge and experience of the control and distribution of electricity in urban and extensive rural areas, and be capable of designing and supervising the erection of all electric lines and plant required for a system operating at various voltages up to 33 kV.

The commencing salary will be £560 per annum.

The successful candidate will be required to contribute to the Company's Superannuation Scheme.

W. S. SAWTELL, M.I.E.E.,

General Manager.

Galashiels,

December, 1945.

3744

ASSISTANT Foreman for armature winding and repair shop, F.H.P. Small but rapidly expanding manufacturers of high grade electro-mechanical equipment. Will train suitable applicant for eventual foremanship. A ground work of winding necessary. Must be strict disciplinarian, but only one untried of hard work and who really wants to progress need apply. W.1 area.—Box 3791, c/o The Electrical Review.

BOROUGH OF LYME REGIS

Electrical Clerk of Works

APPPLICATIONS are invited from experienced Electrical Engineers for the position of Clerk of Works, to supervise the whole of the work necessitated by the Change-over of Electricity Supply in the Borough (population 3,000) from Direct to Alternating Current.

The work will include the paying under contract of a new E.H.T. and L.T. network of cables, the equipping of transformer substations and the alteration or replacement of unsuitable consumers' apparatus.

The person appointed may afterwards be considered for the position of Borough Electrical Engineer when the change-over work has been satisfactorily completed.

Commencing salary £350 per annum.

Applications, stating age and previous experience, and accompanied by copies of not more than three recent testimonials, enclosed in envelopes endorsed "Clerk of Works," must be delivered to me, the undersigned, not later than 7th January, 1946.

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

G. ATTERBURY,

Town Clerk.

Town Clerk's Office,

Lyme Regis.

10th December, 1945.

3754

COUNTY BOROUGH OF WALLASEY

Electricity Department

Appointment of Deputy Borough Electrical Engineer
and Manager

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

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

EMRYS EVANS, Town Clerk.

December, 1945.

3713

ARMATURE Winders for all types of A.C. and D.C. rewinds. Good conditions and permanency to right men.—Write—Box 3771, c/o The Electrical Review.

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

CHARGEHAND Engineer required for shift work by industrial undertaking in West Midlands, Lancashire boilers and reciprocating engines generating A.C. Permanent post with pension. Salary £300 to £350. State age and experience. Men due for early release can apply.—Box 3675, c/o The Electrical Review.

CHIEF Designer required for motor department of progressive electrical manufacturing company in London district. Experience in commutator motor design an advantage. Replies will be treated in strictest confidence. State age, education, experience and salary required.—Box 3794, c/o The Electrical Review.

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

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

DESIGNER required for 35,000-volt switchgear. State age, experience and salary required to—Box 3734, c/o The Electrical Review.

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

DRAUGHTSMEN required by South London firm of electrical and mechanical engineers, preferably with experience of small switchgear, motors and generators. Write giving full particulars of experience and qualifications, together with age and salary required. to—Box 3755, c/o The Electrical Review.

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

DRAUGHTSMEN required with good experience in machine design and plant installation. A knowledge of Bakelite moulds an advantage. Reply, stating age, experience and salary required, to—Box 3789, c/o The Electrical Review.

ELECTRIC Traction Engineers (Two) required by Hongkong Tramways Ltd. Practical experience in overhead equipment mains and trackwork essential. Substation experience would be additional qualification. One required as Assistant Engineer at equivalent of £800 p.a., the other as Junior Assistant Engineer at £600 p.a., both receiving house allowance in addition. Apply, stating age, training, qualifications and experience, to—Matheson & Co. Ltd., 3, Lombard Street, London, E.C.3. 3792

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

ELECTRICAL Fitters for servicing all types of electrical plant under maintenance contract; also Wiremen and Mates used to good class industrial wiring installations. Write—Box 3772, c/o The Electrical Review. 3772

ELECTRICAL Research Engineer with research experience and practical knowledge of fractional horsepower motors required by Walsall manufacturers. Please write giving full details of experience and salary required.—Box 3762, c/o The Electrical Review.

ELECTRICIAN required for installation work. Apply in writing or call—Freeman Electrical Co., 253, Whitechapel Road, London, E.1. 3763

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

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

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

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

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

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

ESTIMATING Engineer required by a firm of electrical contractors in London. Only men who have had experience in the preparation of estimates for all classes of contracting and able to submit own schemes need apply. State salary required, experience, and when available.—Box 3778, c/o The Electrical Review.

EXPERIENCED Electricians and Overhead Linesmen required by the East Anglian Electrical Supply Co. Ltd., Finborough Hall, Stowmarket, Suffolk. 3785

EXPERIENCED Specialist Draughtsmen urgently required for switchgear and transformer depts. of well-known electrical engineers, South-East London. Fullest details of experience must be given, together with age, salary required and whether free to move. Applications to—Box 3781, c/o The Electrical Review.

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

FOREMAN Mechanic required for repair and test of small industrial petrol engines. Electrical experience an advantage.—Box 3745, c/o The Electrical Review.

HIVAC Ltd. invite applications from young Radio Valve Technicians with experience in all branches of receiving valve production. The post offered will be a staff appointment and will ultimately be pensionable. Write to—The Manager, Hivac Ltd., Greenhill Crescent, Harrow-on-the-Hill, Middx. 3752

HIVAC Ltd. invite applications for the position of Senior Valve Development Engineer. Applicants should have had extensive experience in the design and production of receiving valves and their applications. The possession of academic qualifications will be considered an advantage. The post is pensionable under the company's pension scheme. The salary offered will be commensurate with the applicant's experience and qualifications. Replies will be treated in the strictest confidence and should be addressed to—The Manager, Hivac Ltd., Greenhill Crescent, Harrow-on-the-Hill, Middx. 3751

JUNIOR Shift, for small station, steam, diesel and bulk supply, A.C. and D.C. generation and switching. N.J.B. conditions and salary, Class B, Grade 8b, at present £277 p.a. No special form of application. Application, with full particulars of experience, age, m. or s., and two recent testimonials, by noon on Monday, 14th January, 1946, to the Clerk, Horsham Urban District Council, Park House, Horsham, Sussex. Mark the envelope "Junior Shift." 3749

KERRY'S (Great Britain) Ltd. have vacancies at their branches at London, Sheffield, Leicester, Oxford and Ipswich for Radio Service Engineers, also Wireless and Electrical Representatives. Applicants must write, giving full particulars of past experience, to—C. A. N. Kerry's (Great Britain) Ltd., Watton Rd., High St., Stratford, E.15. 3780

LADY Book-keeper required, also Invoice Clerk, both with knowledge of typing. No Saturdays. Apply to—The Overseas Engineering Co. Ltd., 200, Bishopsgate, E.C.2. 3741

LARGE public works contractors require Linesman Electrician and Power Electrician for plant depots in London area, and for construction sites throughout the country. Must be willing to travel. London rate paid. Apply—Box 3779, c/o The Electrical Review.

MAINTENANCE Electrician required for dairy. Knowledge of electric vehicles an advantage. Apply—C. F. Simmons & Sons Ltd., Waterworks Rd., Eastbourne. 8152

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

MANUFACTURING Electrical Engineers required experienced Sales Manager. Applications only considered from first-class men capable of substantial earnings.—Box 82, c/o The Electrical Review.

PLANNING Engineer required to take charge of motor planning section of progressive electrical engineering concern in London district. Experience of commutator motor manufacturing essential. Reply stating age, experience and salary required.—Box 3795, c/o The Electrical Review.

SENIOR Testers, London electricity meter manufacturers. Experience in testing of polyphase, M.D.I.'s, preparation meters essential. State age, experience and salary required.—Box 3761, c/o The Electrical Review.

STORES Assistant required mainly to handle goods inwards section dealing with cinematograph electrical and radio equipment. Write stating age, experience, salary required—RCA Photophone Ltd., Belgrove House, Belgrove Street, King's Cross, W.C.1. 3770

TELEPHONE Repairers and Installers required, with experience inter-com. systems.—Box 3756, c/o The Electrical Review.

THE Institute of the Plastics Industry, Windsor House, Victoria Street, S.W.1, invites written applications for the position of Managing Secretary to the Institute. Applicants should state qualifications, experience, age and salary required. 3739

TIME and Motion Study Engineer required for motor department of progressive electrical engineering concern in London district. Experience in motor winding essential. Reply giving full particulars of age, experience and salary required.—Box 3793, c/o The Electrical Review.

TRAVELLERS calling on retail electrical trade, and stores required to market electric Iron on commission, all areas.—Box 3753, c/o The Electrical Review.

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

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

WORKING Storekeeper, experienced, required by wholesale electrical firm, capable of controlling small staff, viz., packers, etc.; must be thoroughly conversant with the wholesale electrical trade. Write—Secretary, British Central Electrical Co. Ltd., 6 & 8, Rosebery Avenue, London, E.C.1. 3773

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

YOUNG Draughtsman required by heating engineers in Slough district. Expanding business and good prospects. Applications from serving members of H.M. Forces due for early release welcomed. Apply, stating age, experience and salary required, to Box 3740, c/o The Electrical Review.

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

YOUNG lady required to act as Secretary of newly formed company of electrical and mechanical engineers in Doncaster. Duties to include organisation of office routine; knowledge of accountancy and P.A.Y.E. system essential. Reply giving details of education, experience and salary required.—Box 8141, c/o The Electrical Review.

YOUNG man required for London area to act as Representative of electrical manufacturers. Will also be required to undertake other duties in connection with buying and office routine. Write, stating age, experience and salary required.—Box 3788, c/o The Electrical Review.

YOUNG Technical Men for Electricity Meter work. Opportunities occur in single and polyphase testing, and also for Technical Assistants. There are excellent opportunities of advancement for suitable men. Reply stating age, experience and salary required.—Box 3768, 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.

COUNTY Borough of Halifax—Assistant Mains Engineer; Johnson & Phillips Ltd.—General Sales Manager. All applicants are thanked.

SITUATIONS WANTED

FOR THE ATTENTION OF CONTROL GEAR MANUFACTURERS

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

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

Prospects more important than initial remuneration. Release obtainable.—Box 8129, c/o The Electrical Review.

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

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

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

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

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

A DVERTISER (32), sound experience all branches works and commercial administration, seeks post with small radio/electrical firm anxious to expand output. Outside London for preference. Box 8147, c/o The Electrical Review.

B UYER and Stock Controller (36) wishes to change place of employment. Experienced in handling all light electrical engineering supplies, materials and components, and with good technical and practical background and process knowledge. Apply—Box 8160, c/o The Electrical Review.

B UYER M.P.O.A., seeks position with concern manufacturing engineering and electrical equipment. Fully experienced in buying and modern stock control methods, and stores routine etc., salary required £500 p.a. Available Jan. 1st. 1946.—Box 8113, c/o The Electrical Review.

C LASS A leave: Electrician, 12 yrs' varied experience, maintenance, repairs, A.C./D.C., refrigerators, lifts, signs, aircraft, perm. position required.—Box 8086, c/o The Electrical Review.

D OMESTIC Appliance, Cooker and Thermostat Engineer wishes to contact firm with view to position Works, Production or Sales Manager on demob. within 6 months. Would consider certain Colonies or Dominions under agreement.—Box 8098, c/o The Electrical Review.

E LECTRICAL and Refrigeration Engineer, A.M.I.E.E., seeks responsible post where general electrical and refrigeration experience, household and commercial, coupled with five years' army engineering and workshop control experience, are suitable qualifications. London area preferred.—Box 8150, c/o The Electrical Review.

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

E LECTRICAL Engineer, experienced in factory installation and maintenance of electrical equipment, A.C. and D.C., including high frequency heating, resistance furnaces and electronic control of welders, etc., desires change. Salary required from £600 to £700 per annum according to the electrical capacity of plant. Age 45 years. Technical training Regent Street Polytechnic. Over 30 years' experience.—Box 8143, c/o The Electrical Review.

E LECTRICAL Engineer (27), officer R.A.F., Grad I.E.E., City and Guilds finals radio communication, 5 years industrial and domestic electrical installation, knowledge of electronic applications to industry, 6 years R.A.F., set servicing, ground transmitting and receiving stations installation. Confidently undertake staff management and handling of technical correspondence. Release January, start immediately. Plenty of force and initiative, hard worker. Desires progressive position in manufacturing, development or distribution.—Box 8151, c/o The Electrical Review.

E LEC. Engineer (29), released Forces, with experience supervising, operation, maintenance and repair, requires position Southern England.—Box 8153, c/o The Electrical Review.

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

E LECTRICAL Engineering Draughtsman will produce dimensioned drawings from sketches, and also cloth tracings. Prompt service, fully experienced.—Box 8145, c/o The Electrical Review.

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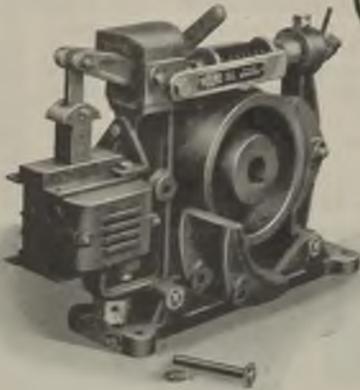
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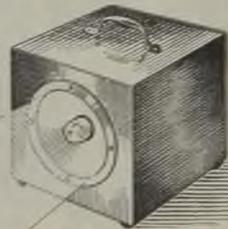
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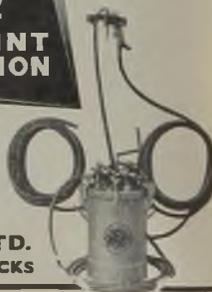


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COMBINATION

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Longsight, Manchester 12.

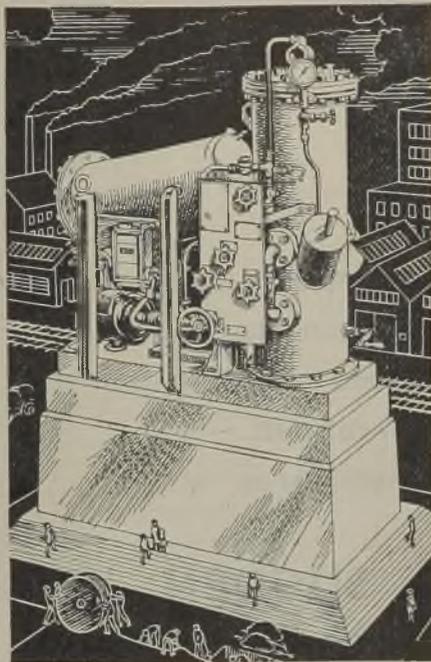
London : 34 Victoria Street, S.W.1

The advertisement features a central image of a multi-core cable with a dark, textured jacket and several individual conductors visible at the end. To the left of the cable is a circular terminal or connector. A tag is attached to the cable, and a speech bubble-like shape contains the product name. A small text box at the bottom right provides technical details.

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MULTI-CORE CABLES

Made by
AERIALITE
LIMITED
Manufacturers of
"ASHTON" CABLES,
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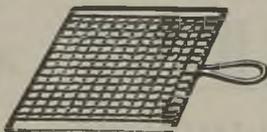
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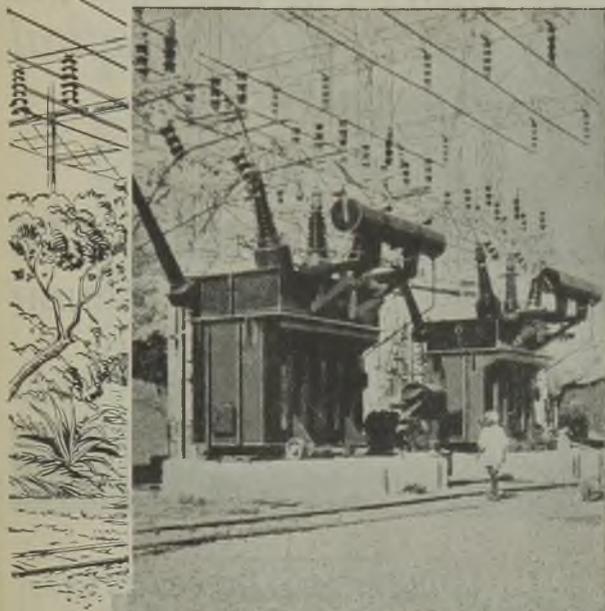
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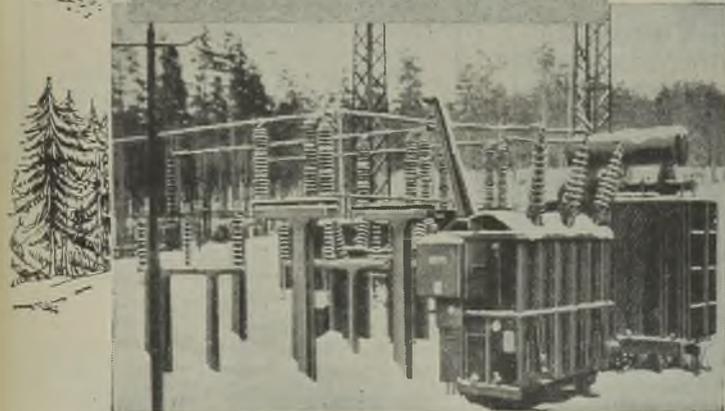
D. WALTER & CO. LTD. Actual Manufacturers
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TELEPHONE: HOP 3651

-All the world over



Left: A "Metrovick" 110 kV 3-phase outdoor transformer at a power station in Madras.



Left: A "Metrovick" 11,000 kVA outdoor transformer installed in Finland.

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METROPOLITAN Vickers

ELECTRICAL CO. LTD.

TRAFFORD PARK ... MANCHESTER 17.

EA/403

Light aids production

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THE NEW CHARGING SYSTEM

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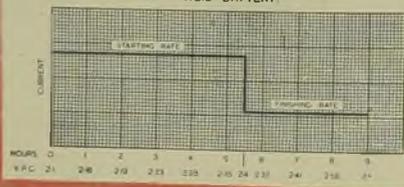
The Davenset Fluxomatic System has provided the answer.

Without manual control, a constant pre-determined current is maintained against a rising battery voltage.

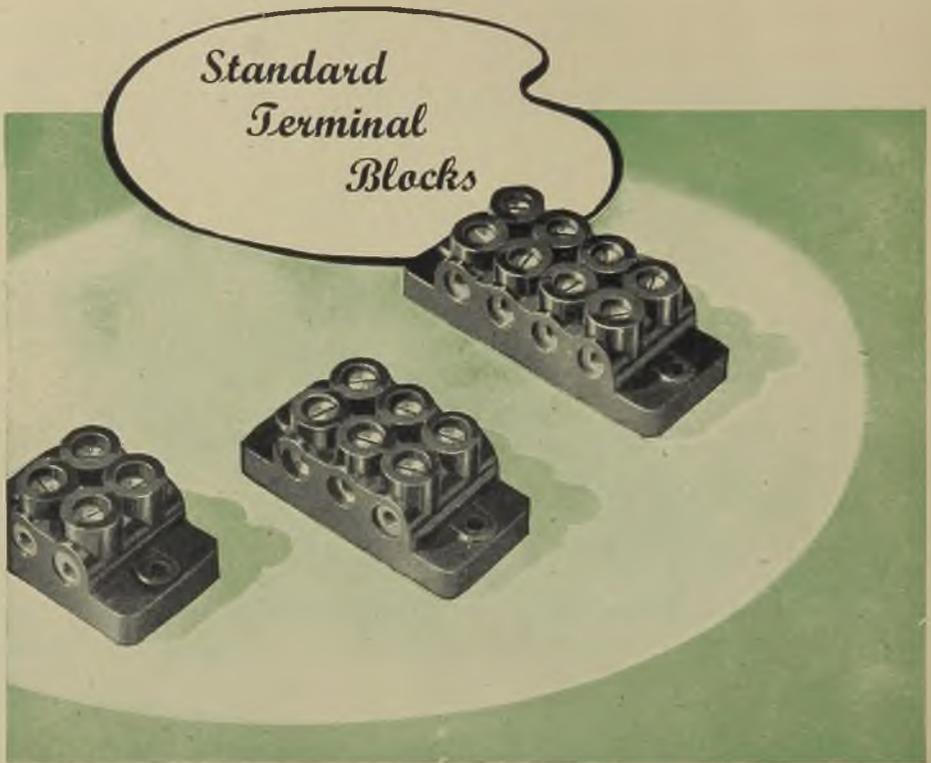
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generally 11 men for them. All had to wa



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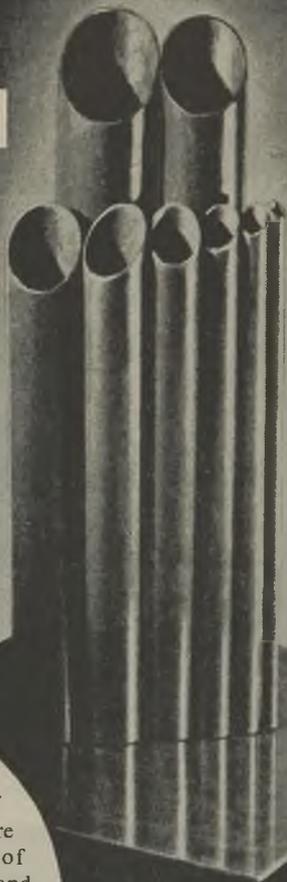
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Paxolin is the registered trade name for our laminated products of the phenolic class which are made in a wide variety of grades in Sheets, Rods, Tubes and Cylinders. Complete details, including technical data, information regarding the grade most suitable for any particular purpose and instructions for machining are obtainable from the manufacturers.

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Makers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA, PAXOLIN (Synthetic-resin laminated sheets, rods, tubes and cylinders). High-voltage Bushings and Terminals for indoor and outdoor use. Empire Varnished Insulating Cloths and Tapes and all other forms of Electrical Insulation. Suppliers of Vulcanised Fibre, Leatheroid, Presspahn, etc. Distributors of Micoflex-Duratube Sleeveings, Micoflex-Durasteeve (plastic covered flexible metal conduit) and Kenutuf Injection Mouldings (P.V.C.).

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WE have completed many large distribution schemes in these areas for Government Departments, Supply and Industrial Undertakings,



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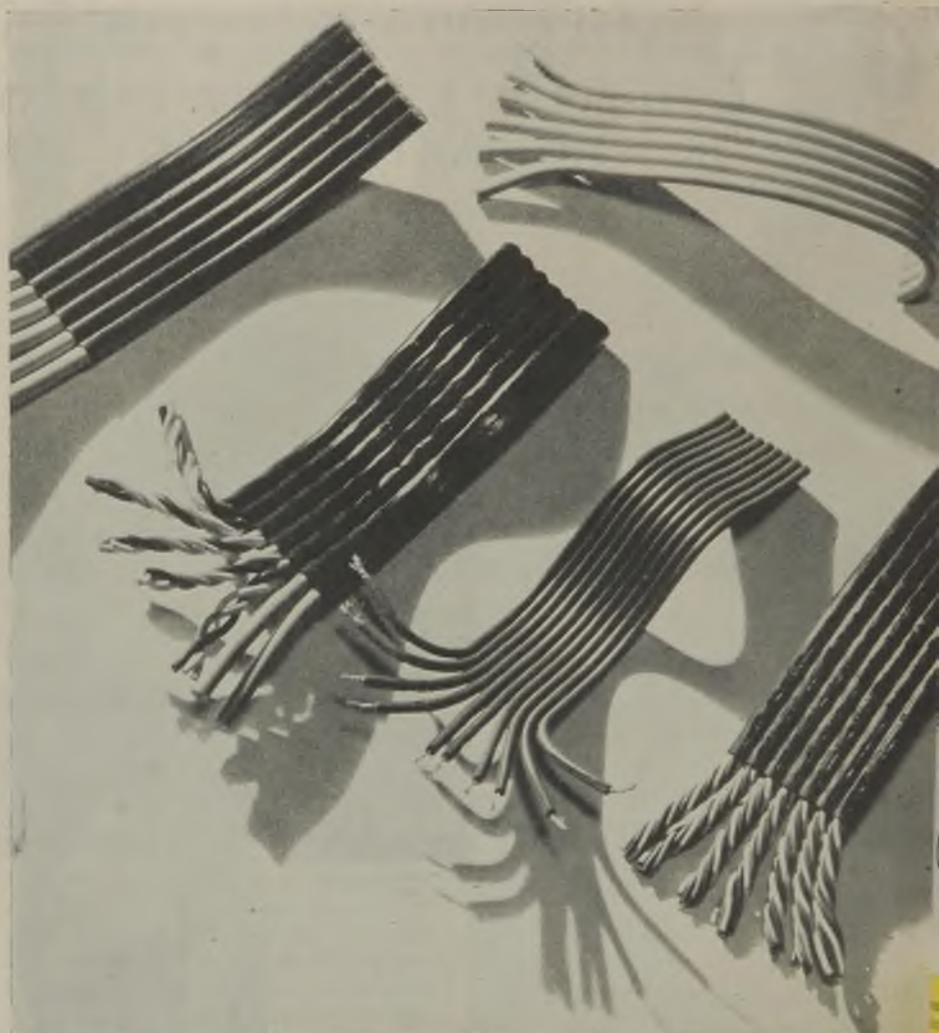
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Area Representative:
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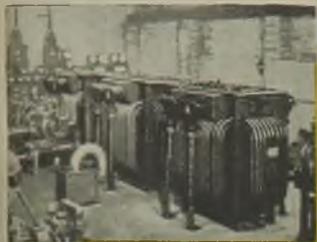
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*polyvinyl chloride compositions for
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P.W.16



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Illustrated below : (1) 4,000 kVA naturally cooled transformer, one of two supplying University of London ; (2) Typical large electric furnace transformer with water cooled, forced oil circulation and remote operated ratio control ; (3) Hackbridge mining type transformer complete with switchgear ; (4) Self-contained transformer substation unit ; (5) Variable-voltage transformer for salt bath operation ; (6) Hackbridge mining type transformer.



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FLUORESCENT (DAYLIGHT OR WARM-WHITE) LIGHTING

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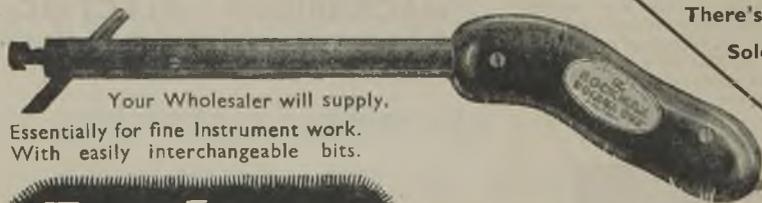
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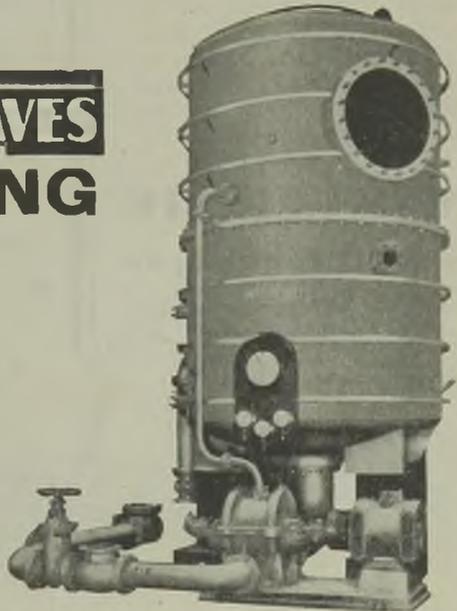
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AD 41 O

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Established 1896

"A H" Type Toggle Switch in ACTUAL SIZE!



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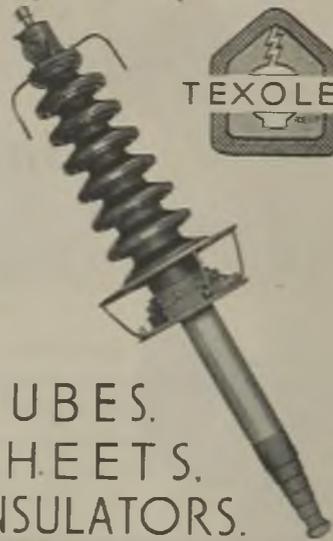
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MONMER FOUNDRY LTD.
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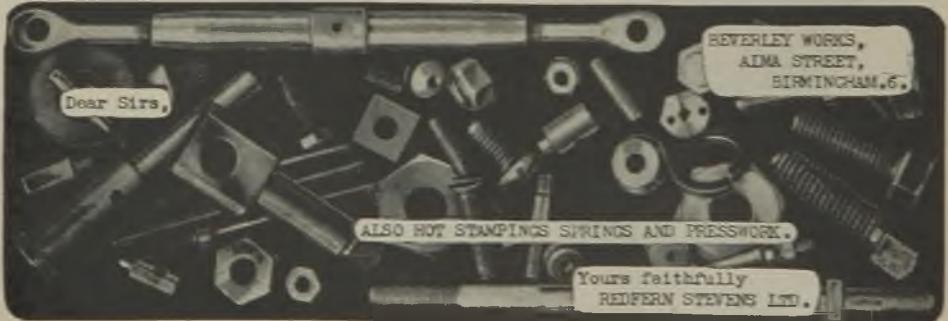
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Yours faithfully
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frames and cases are all just

sheet metal fabricated to

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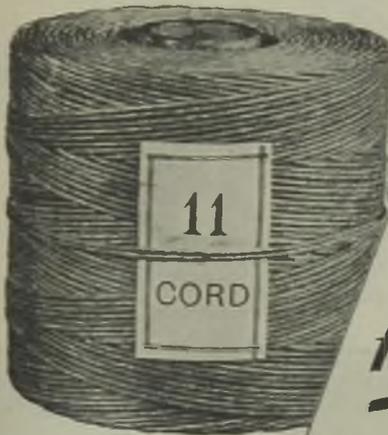
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Specification, on 2-oz. cops.

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For **AUXILIARY STEAM
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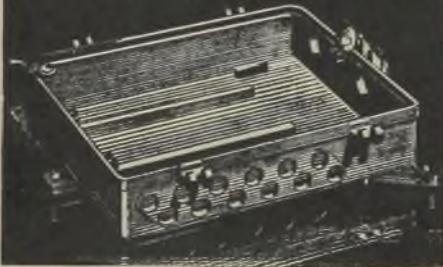
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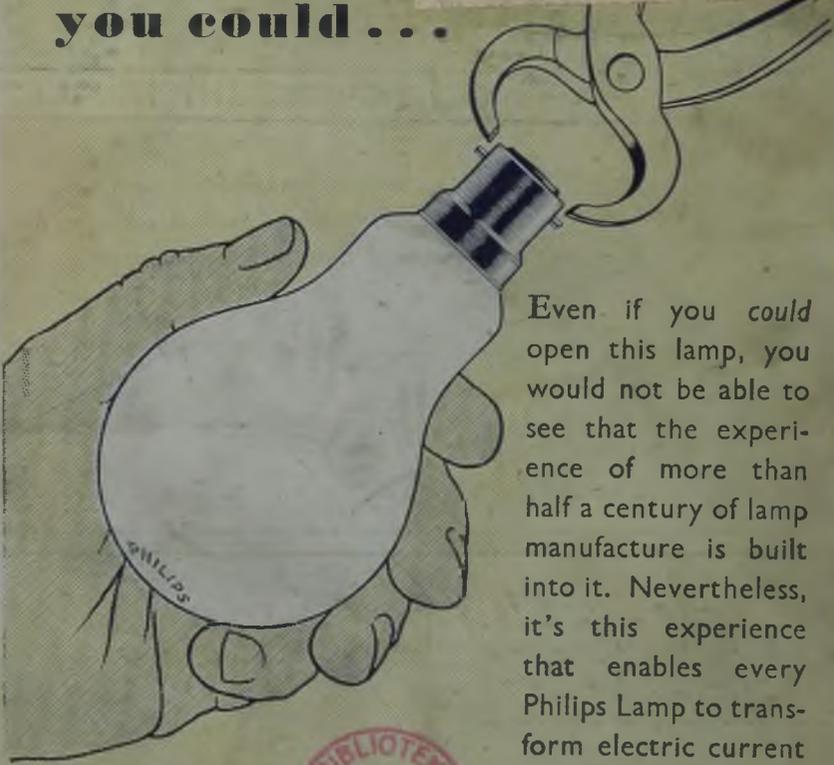
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