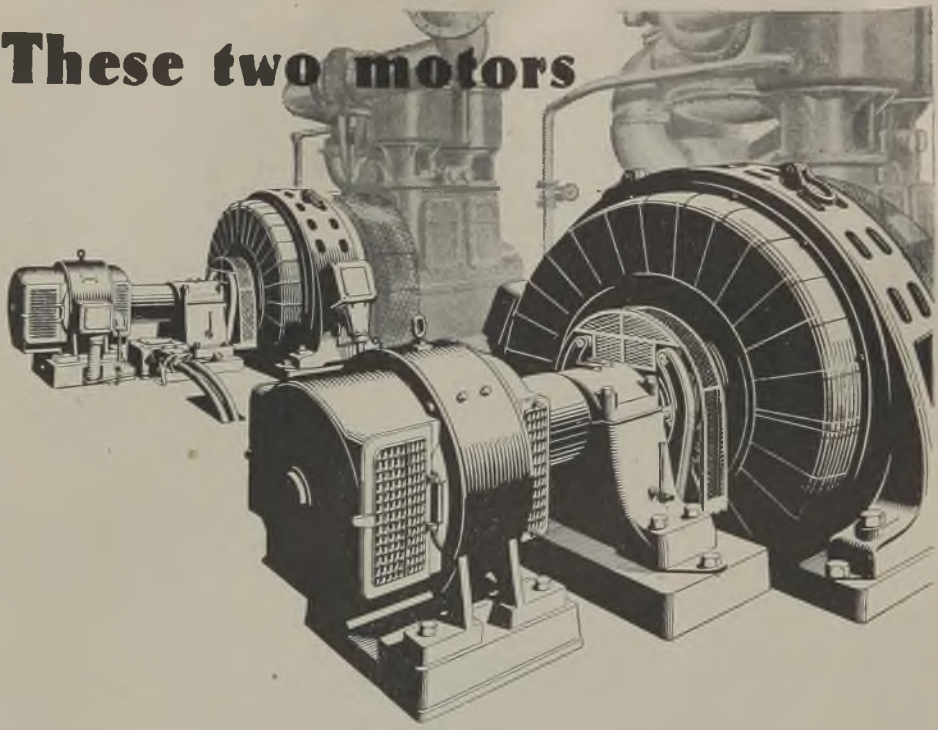
ELECTRICAL REVIEW

FOUNDED 1872

Vol. CXXXVII. No. 3528 JULY 6, 1945 9d. WEEKLY

These two motors



saved £500 a year by P.F. correction.

Two needs existed in a large works. First, equipment was required to maintain the overall power factor at an economical figure. Second, motors were required to drive two large compressors. By ordering two 560 H.P. Crompton Auto-Synchronous Motors both needs were satisfied. The motors provide highly efficient constant speed drives. At the same time they maintain an overall maximum demand of approximately 1,800 kW at a power factor of ·985 lagging. They saved £500 a year on the maximum kVA demand over what it would have been with ordinary induction motors without p.f. correction.

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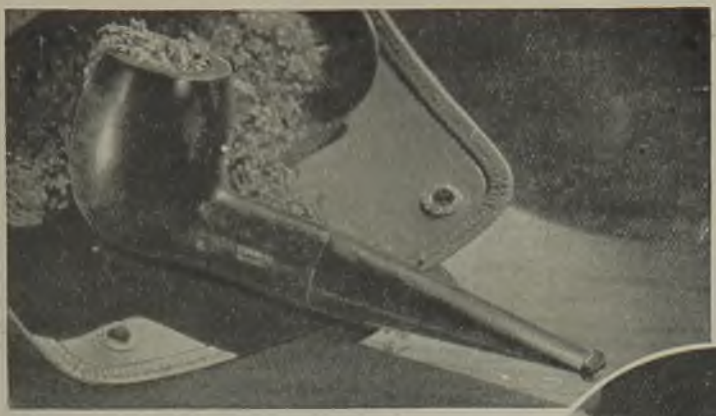
ELECTRA HOUSE, VICTORIA EMBANKMENT, LONDON, W.C.2 *and Branches*



That DIFFERENCE is in DETAIL

IT may be true that "all great things are simple." But all simple things are not necessarily great. And to those who design and install electrical accessories, simplicity, for its own sake, is seldom a virtue. A simple accessory can have all the rustic crudeness of the old-time cherry-wood, revealing in its stark lines a rough workmanship and a poverty of idea. That, however, is not the simplicity for which we strive. Our aim has always been to perfect each product so that it shall be complete in every detail. We feel some sort of pride, in fact, that our products are simple. But such a feeling is not prompted by what we have been able to leave out. It springs rather from the knowledge of what we have been able to put in.

Crabtree 5-Amp. 3-Pin Plug and Shielded Socket-Outlet.

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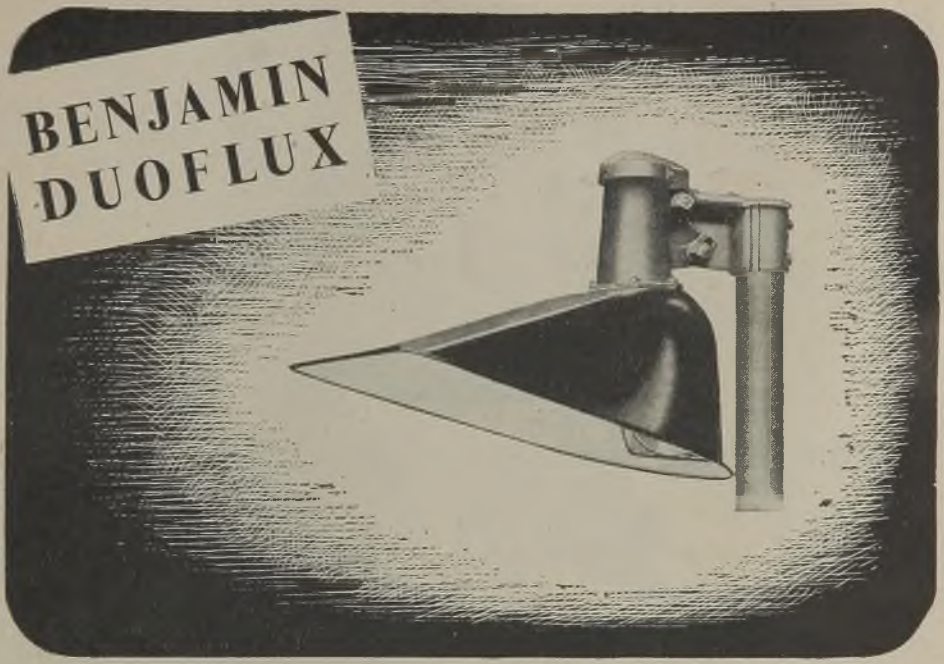
A · NAME · SYNONYMOUS · WITH · PROGRESS · IN · ACCESSORIES · AND · SWITCHGEAR

"Crabtree" (Registered) *C.227/27. Advt. of J. A. Crabtree & Co. Ltd., Walsall, England.*



The logical way of lighting all sorts of outdoor areas is by the provision of a flood of light from high above. The Duoflux, mounted 25 or more feet above the ground on a pole or wall, spreads the light over the area in front of it, with the supplementary reflector at the back adding punch to the beam. No light is wasted upwards, and the fittings being placed at the side no obstruction is caused by inconvenient poles.

The Duoflux consists of a Crysteel Porcelain enamelled reflector on a diecast neck. An adjustable bracket piece is available in types to suit pole top fixing or for clamping round a pole, with sufficient adjustment to enable the light to be directed in the required way. A specular reflector behind the lamp adds a beam to the general spread of light from the main reflector. They are available in types to suit E.D. or Filament lamps.

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The Benjamin Electric Ltd., Brantwood Works, Tottenham, London, N.17

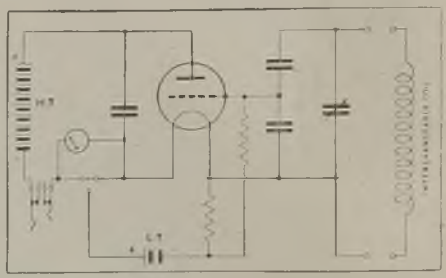
Telegrams : "Benjalect, Southtot, London." Telephone : Tottenham 5252 (5 lines)

A COMPACT AND PRECISE WAVEMETER FOR USE IN ALL CLIMATES

EVERY ship and shore radio station must have, as an essential part of its equipment, a wavemeter that is absolutely reliable under all conditions.

The Rediffusion 605A Wavemeter has been constructed to have a discrimination of 0.1 per cent. over a range of frequencies from 100 to 43,000 kilocycles (3,000 to 7 meters). This range is covered by using eight interchangeable coils, which are carried in a separate case and are used in conjunction with a graph card made out for each individual coil. Tuning is by means of a variable condenser.

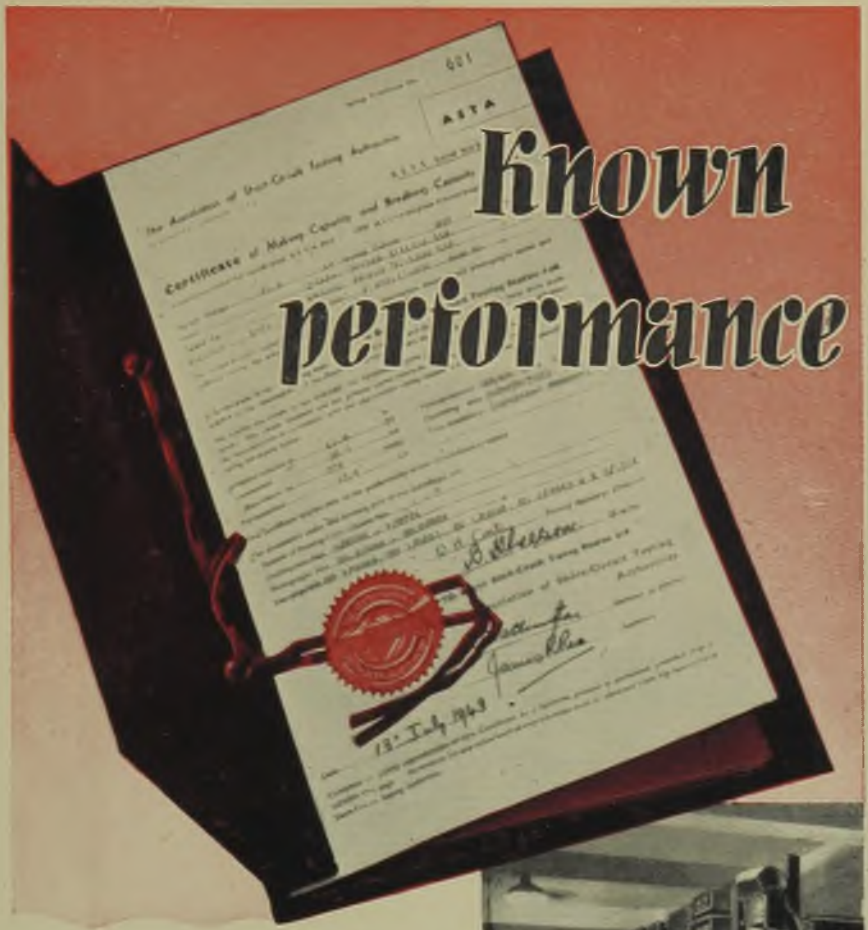
The 605A Wavemeter is normally used for frequency measurement of a transmitting station, and as a standard by which to tune a transmitter output. It can also be used to indicate the resonance of modulated carrier waves, and to indicate the functioning of a very low-power radiating circuit.



CIRCUIT OF THE REDIFFUSION 605A WAVEMETER

The wavemeter unit is light and compact, weighing only $7\frac{1}{2}$ pounds, and is 5" x 8" x 8". The construction throughout has been designed to resist severe variations of climate in most parts of the world. The eight coils are carried in a case of similar size weighing 4 pounds. In use the coils are attached to two terminals placed on the side of the wavemeter.

This instrument is available now. Further details can be sent on request.



Ellison high voltage truck switchgear complies with B.S. No. 116, Part 1, 1937, is proved by test for thermal rating and mechanical endurance and carries A.S.T.A. certificates for making and breaking capacities.

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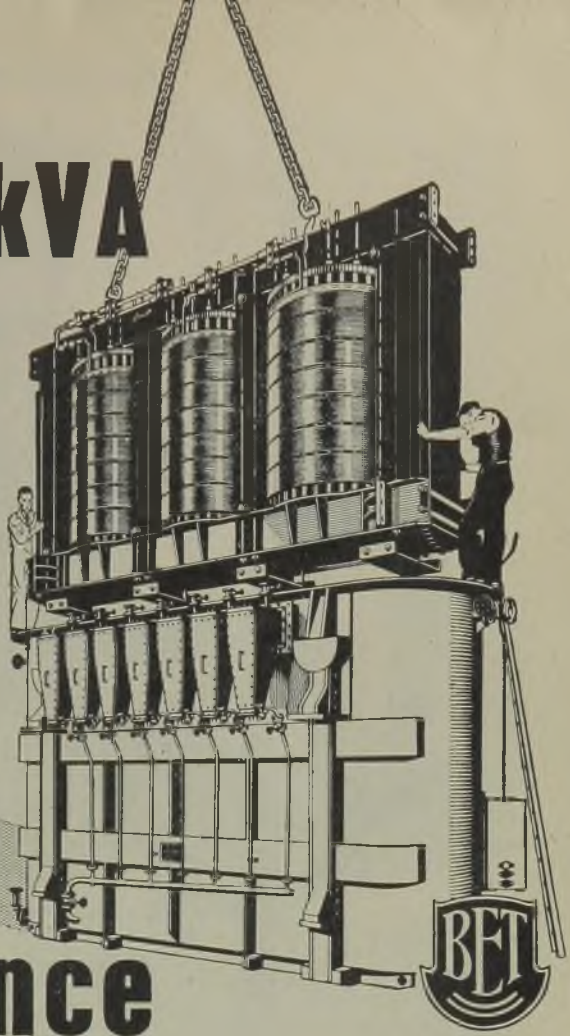
LIMITED
BIRMINGHAM 22B ENGLAND

501

62,500 kVA of B.E.T. Experience



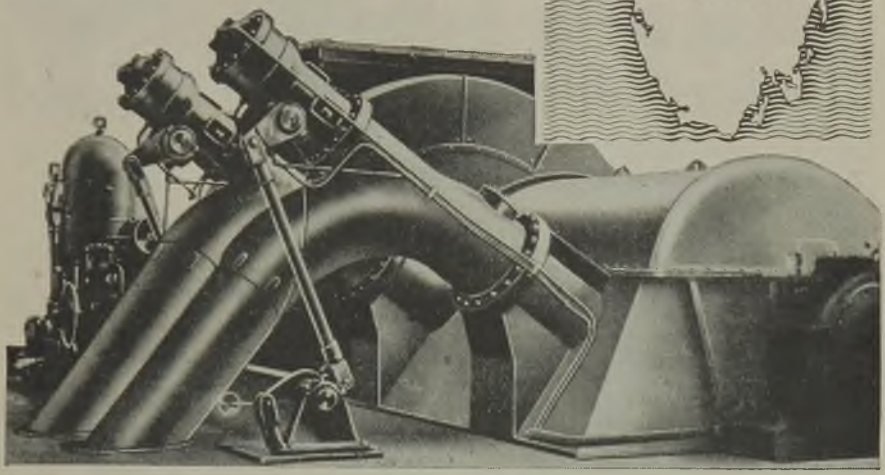
This B.E.T. 62,500 kVA Transformer is going into its tank to give years of service. Its duty will be a responsible one but it goes out with the confidence of its makers. B.E.T. have specialised in transformers for 47 years. There is nothing in transformer construction for which B.E.T. experience does not provide an answer. This experience is at your service.

The
British Electric Transformer
Company Limited
In association with CROMPTON PARKINSON LIMITED

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

Tasmania thanks

"English Electric" Workers AND The Merchant Navy



"English Electric" water turbine driven alternator sets as installed at Tarraleah and Waddamana power stations, Tasmania

IN THE REPORT issued by the Hydro-Electric Commission of Tasmania for 1943/44, under the heading "Power Production," the following passage appears.

"That Great Britain was able to build for us and to deliver to Tasmania these large turbo-generators . . . . whilst fighting for her existence . . . . is an achievement which we propose to record on each machine. . . . . Thus these historic units will remain as lasting symbols of the indomitable courage and solidarity of the Empire. . . . ."

WHEREVER there is a power plant problem "English Electric" research workers, designers and engineers have the knowledge, experience and resources to provide the answer.

THE ENGLISH ELECTRIC COMPANY LIMITED

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E E.1

Keep your eye on the WATER

Expert advice for water users

Pumping and conveying water to where you want it take a lot of power (and much fuel and money). Water is even more precious if it has been heated or purified in your works.

How to make the best use possible of your water supply is told in these handy booklets:

FUEL ECONOMY BY WATER SAVING (*Bulletin No.* 31)

This is a survey of the economies (many of them substantial) that are possible in water supply for boiler feed, drinking and washing, process and cooling. It tells you, too, how to clean water mains and plant, and how to keep them clean.

WATER TREATMENT (*Bulletin No.* 39)

The correct treatment of water, whether for boiler feed, cooling or process is a matter for the specialist. This Bulletin surveys the whole field and describes briefly the methods available for overcoming your difficulties.

BLOW-DOWN (*Bulletin No.* 35)

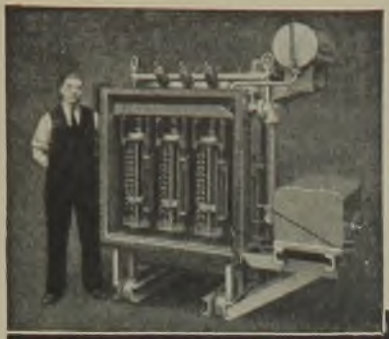
Too often the blowing down of boilers is merely a matter of routine, bearing no relation to need. Excessive or insufficient blow-down are both serious fuel wasters. This Bulletin tells you why, when and how much to blow down.

THE UNORTHODOX USE OF ECONOMISERS (*Bulletin No.* 30)

This Bulletin shows how to obtain the maximum results from your feed-water economiser. Some of the suggestions may be new to you, e.g., the use of a condemned plant for process water heating or as an air heater.

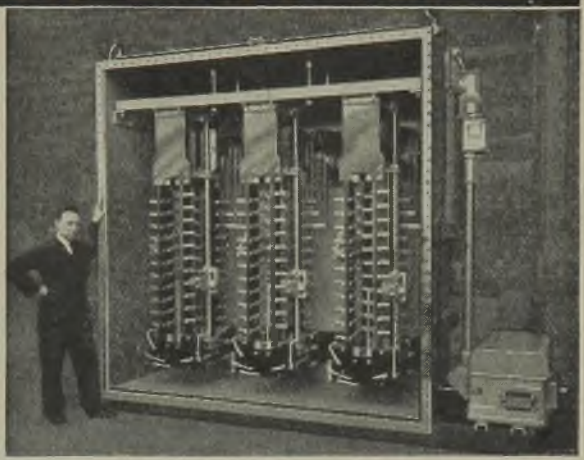
A SOUND ANSWER to practically every problem of fuel economy is quickly found in these Fuel Efficiency Bulletins. Keep a list of their titles handy; then you can turn up at once the particular Bulletin you need. The Bulletins are free from your Regional Office of the Ministry of Fuel and Power.

ISSUED BY THE MINISTRY OF FUEL AND POWER



ON LOAD TAP CHANGERS

SMALL OR LARGE



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ELECTRICAL REVIEW

July 6, 1945

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVII. No. 3528. JULY 6, 1945 9d. WEEKLY

Back to Normal

A Concession with Some "Ifs"

ANY relaxation of wartime restrictions is to be welcomed—even when advantage cannot be taken of it. Of this nature is the decision of the Ministry of Fuel and Power, communicated to electricity supply undertakings by the Electricity Commissioners, that normal electrical development may be resumed.

It is only here and there that the concession will make any immediate difference, for the special cases to which the affording of new or additional supplies was permitted still take first place. It is only when these are satisfied, and there is still labour and material to spare that the wants of other consumers or would-be consumers can be met.

Building Restrictions

Apart from this deterrent there are one or two other matters to be considered. The raising of loans is still subject to Treasury control, but this will affect only the larger schemes for assisted wiring and hire and hire-purchase of equipment. A possibly more likely handicap is the limitation imposed by the Ministry of Works on building and civil engineering work, under which head electrical installations fall. In London and S.E. England a limit of £10 in any one year has been fixed (apart from an allowance for maintenance and repairs) and this is to be extended to the whole of the country in August. It must be remembered that the limit applies to all classes of building and civil engineering work and that electrical work will have to take its place with the rest.

Before the war it was possible to secure some sort of domestic installation for £10 but something more than this will be necessary with more advanced ideas of electrical convenience and considerably higher costs. It remains to be seen whether the necessary licences will be granted : up to £100 the matter is in the hands of the local authorities.

Those who secure temporary houses will be the fortunate ones ; their installations will be included in the plans. Others will not find it so easy unless they happen to be in areas where there is not much rural or industrial work waiting to be done or war damage to be made good. They should also live on the routes of existing mains if they expect early attention.

Labour is the principal limiting factor, but as war contracts fall off and the need for new factories and extensions ends the demand for electricians' services will decline, probably rapidly, and they will be free for other work. There are also about 25,000 members of the Electrical Trades Union in the Forces many of whom will return to the electrical contracting industry.

Equipment Available

Materials, the other direction in which there are shortages, were the subject of a recent survey by the Ministry of Works and other Government Departments. As we reported last week, this showed that, in general, electrical installation equipment (with the exception of conduit) could be produced in sufficient quantities to meet all probable requirements. Electric cookers, which are generally the first requirement,

were said to be scarce (and the same applied to gas cookers) but it was apparently possible to obtain all the water heaters, wash-boilers and fires needed. Nevertheless it looks as though the "ordinary" consumer will have to possess his soul in patience for a little time yet. But, to adopt the language of some wartime advertisements, he will be glad he waited.

Cable Merger Approved

THE important scheme for the amalgamation of the businesses of Callender's and British Insulated Cables was approved by large majorities at meetings of the shareholders of both companies last week. The new merger company—British Insulated Callender's Cables, Ltd.—has already been registered; it will have an initial issued capital of over £11 million allocated to the stockholders of the two companies and Callender's Trust, Ltd., in proportion to the market value of their holdings. Two principal advantages which are expected to arise from the combination are a strengthened export position and stability of employment for the companies' workers.

Supply in Thanet

LONG-TERM discussions of the future of electricity supply in the area of the Isle of Thanet Electric Supply Co., Ltd., have culminated in an application by the Margate and Broadstairs local authorities for a Special Order empowering them to acquire the company's undertaking in their own and adjacent areas. In 1936 the authorities agreed to postpone their purchase rights until December 31st, 1945, but they declined to agree to further postponement and in January last the Electricity Commissioners consented to the authorities giving six months notice of their intention to purchase the company's undertaking. The case is of interest as it marks a departure from the wartime rule of suspension of purchase rights.

The E.I.B.A.'s Work

ONCE again the annual report of the Electrical Industries Benevolent Association stresses the sympathetic treatment accorded to the cases which come to its notice. "As cold as charity" certainly has no application to the E.I.B.A. which looks upon such cases as misfortunes of fellow electrical men and women to be dealt with in a family spirit. Instead of applying a "means test," the voluntary workers for the Association discover in what practical ways they can help the unfortunate members of the industry. It is felt that the operations of the E.I.B.A. are not yet sufficiently widely known and all subscribers are asked to remedy this by bringing to their employees' notice the publicity material which they receive from time to time. The Association's reserve funds have now reached £100,000 which is satisfactory but not excessive in view of anticipated future demands which may possibly include the provision of homes for aged electrical people.

Wind Power

INTERMITTENCY of output and small individual capacity of isolated wind generators have hitherto prevented their contributing appreciably to public electricity supply. Developments referred to on another page, however, appear to foreshadow the construction of units large enough for interconnection with other types of power station with a view to securing stability, provided wind velocities of about 20 M.P.H. can be counted on. Short periods of wind deficiency may be less serious than is a seasonal lack of water in the case of a hydro-electric station. Reservoirs too small to guard against the effects of drought would suffice to smooth out fluctuations in wind power, so that a combination of the two resources might correct to some extent the shortcomings of each.

International Standards

AN early example of the value of the right kind of standardisation was provided about a century ago when Whitworth's views regarding the losses incurred in the use of a number of kinds of screw threads began to be accepted. National standardisation is not always enough, as has been shown by serious delays and waste of man power in the production and upkeep of war material manufactured and used in common by the Allies. Differences in screw-thread standards as between Great Britain and the United States alone have, the Ministry of Production estimates, already added at least £25 million to the cost of the war to date and are likely to hinder post-war collaboration. Much is hoped from the further conference to be held in Washington next autumn.

Widespread Distribution

The Scheme of the Ayrshire Electricity Board

The 33-kV double-circuit line from Kilmarnock to Girvan has A-pole supports of home-grown Scots fir

AFTER spending a few days studying the developments of the Ayrshire Electricity Board, by the courtesy of Mr. William C. Bexon, chief engineer and manager, our outstanding impression of the Board's distribution system is that if it were to be laid down to-day to meet present conditions it would be very much the same despite the fact that it has been developed in a rather piecemeal fashion with the industrial progress and growth of load during the past thirty years or so. A feature of the area of about 1,150 sq. miles covered, *i.e.*, the whole of Ayrshire, is the rather scattered nature of industry, but certain areas can be cited as representing industrial concentrations and therefore load centres, which are served directly by the primary transmission lines of the Board.

In an attempt to illustrate this relationship between the industrial concentrations and the primary lines as they exist to-day, we have superimposed a sketch, roughly geographical, of the lines on a map indicating the concentration areas. The conclusion will be drawn that the industrial-concentration areas coincide closely with the concentration of burghs and built-up areas, but it must be borne in mind that many of the built-up areas have been created with the development of industry during the period in which the distribution system has grown to its present shape and size, and often the industries have developed as the result of the availability of electricity supply. One cannot, however, dismiss the relationship we have drawn without appreciation of the foresight shown by the responsible engineers in the earlier days of the piecemeal development by which it can be claimed that over the years the system has been gradually built up to a *design*, a point of as much concern to the load builder as it is to the distribution engineer.

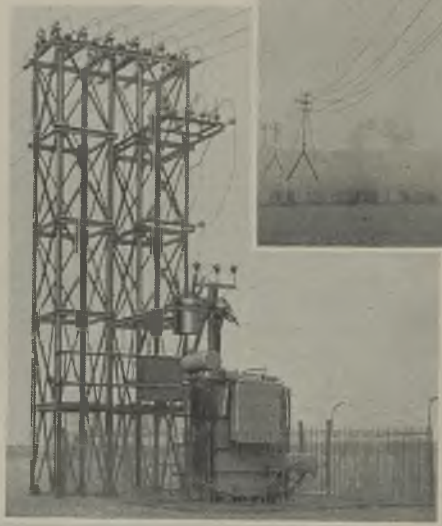
We shall show, however, that the distribution story does not end with an account of major lines serving concentration areas. Ayrshire is a noted agricultural county, and practically the whole of it outside the concentration areas, and a good deal within them, is intensely worked by "those of the land" who have not been neglected by the load builders, with the result that subsidiary lines exist everywhere to meet their requirements, all fitting into the major design. Rural industries mingle with these agricultural activities too.

There are two sources of incoming supply

There are two sources of incoming supply in the area; one (shown) is the grid substation at Ardrossan on the coast towards the north of the area

The 33-kV line is fed from a step-up substation near the Kilmarnock power station in which are installed two 5,000-kVA transformers

in the area. One is the Board's 85,000-kW generating station at Kilmarnock which operates in conjunction with an adjacent grid substation, and the other is another



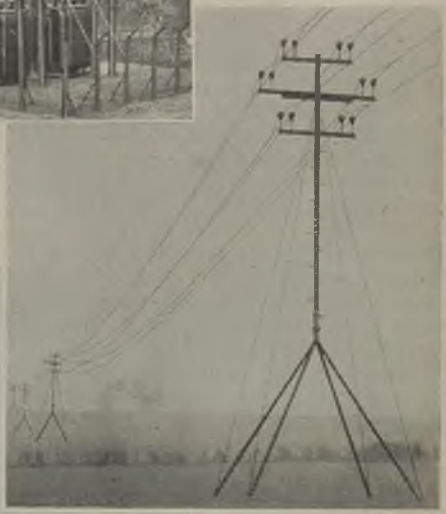
The Kilmaurs section tower and substation is equipped with ground-operated section switches and a 22-kV/11-kV transformer serving the area networks

grid substation at Ardrossan on the coast towards the north of the area. These two grid substations are, of course, connected to the grid system

The isolating tower at Glengarnock is a feature of the Kilmarnock-Glengarnock line and is the primary splitting up point for the area

outside the area in question, but Ardrossan is used for "importation" only.

Probably, however, a greater influence on

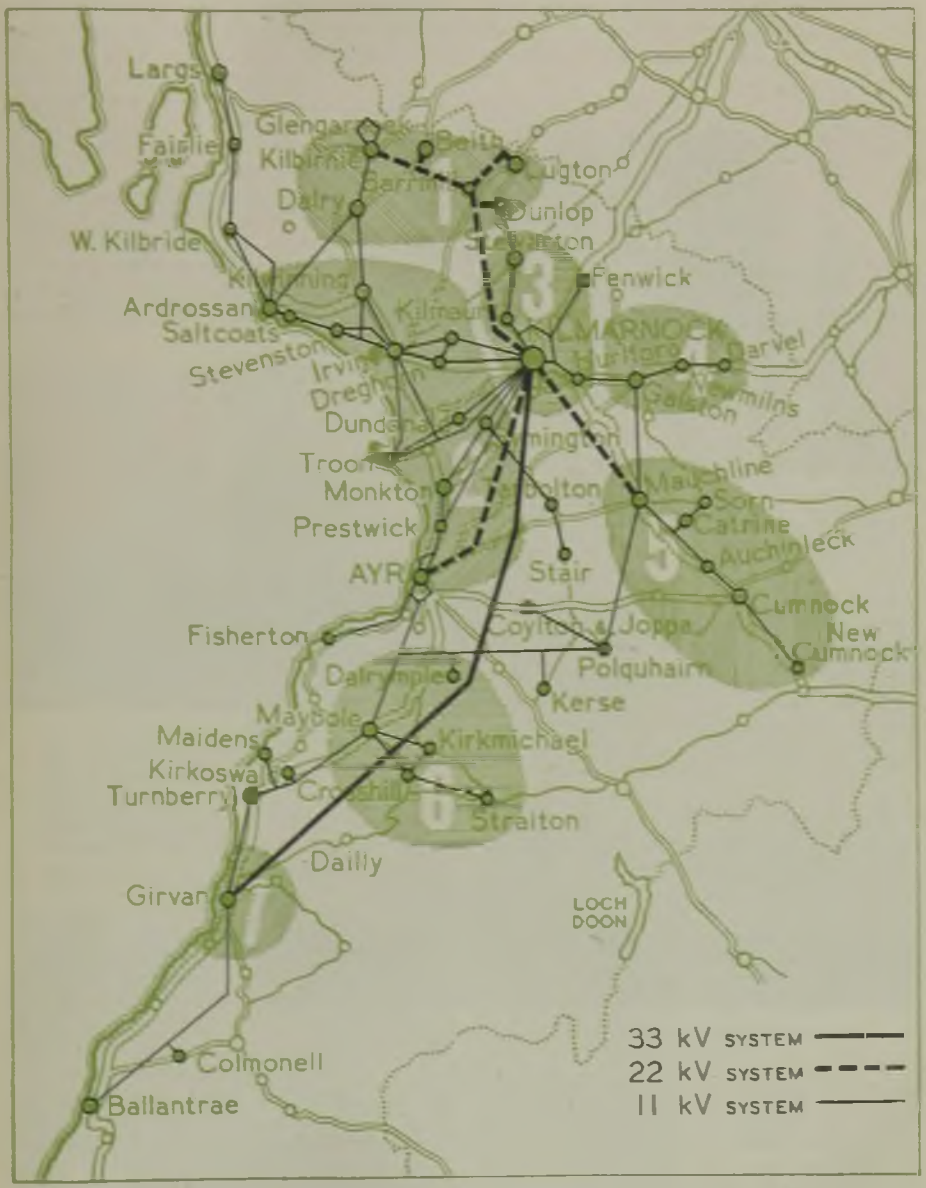


The establishment of 22-kV lines was the logical development compatible with load growth and technical progress; "Kay" tower supports are used; note duplicate insulators for special crossing at Kilmaurs

the distribution scheme under review is the link at 132 kV between the two points, *i.e.*, Kilmarnock and Ardrossan. To cite a few examples of the relationship we are trying to express, firstly there is No. 1 area (the numbering

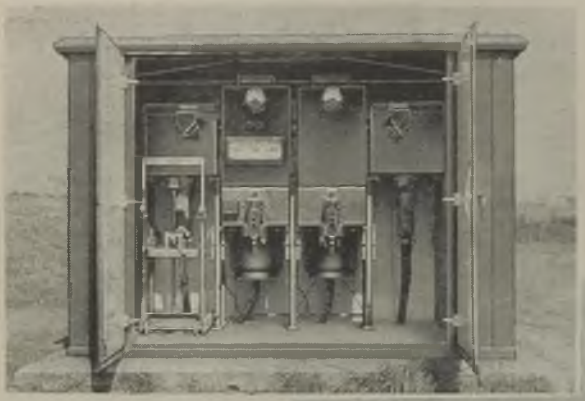
is our own purely for convenience in presenting this article) roughly at the north corner of the county and bordering on Renfrewshire

in which the following industries are responsible for a concentration of load : iron and steel, linen thread, fishing nets, cotton, potteries, leather, furniture and lime. This area is served by a 22-kV double-circuit line from Kilmarnock to Kilbirnie and Glengarnock, and there is a spur on this line from a point about a quarter of its length from the far end to Lugton in the same area.



Map showing primary transmission lines and industrial concentration areas (with acknowledgments to "Geographia")

The following industries are active in No. 2 area, which is roughly the central coastal district : coal, bauxite, concrete pipes, foundries, chemical, glass-bottle, shipbuilding, textile, quarrying, airport (Prestwick), and woollen and leather goods. This area is served by a 22-kV double-circuit line from Kilmarnock to Ayr, a double-circuit 11-kV line from Kilmarnock to Ardrossan *via* Irvine, a single-circuit 11-kV line from Kilmarnock to Troon, and an 11-kV single-circuit line from Troon to Irvine. There are also in this area the following underground feeders which are not shown on the map: one cable from Kilmarnock to Stevenston, one from Kilmarnock to Ardrossan, two from Kilmarnock to Ayr, and one from Kilmarnock to Prestwick. No. 3 area is the central one of Kilmarnock and its environs, with extensions to the north to include Kilmaurs, Stewarton, Fenwick and Dunlop. It produces boots and shoes, hydraulic equipment, locomotives, machinery for a variety of industries, foundry castings, pottery and woollen goods. All the major lines from the supply source at Kilmarnock radiate through this area, and much of the load is therefore provided for by spur lines from the major feeders. For instance, on the 11-kV line to Irvine, there are loops at the villages of Dreghorn, Springside and Crosshouse to the west, while at Kilmaurs to the north there is a take-off from the 22-kV line to Kilbirnie.



Secondary substation at Knockinlaw supplied at 3·3 kV from a primary "sub" and serving the locality at low voltage

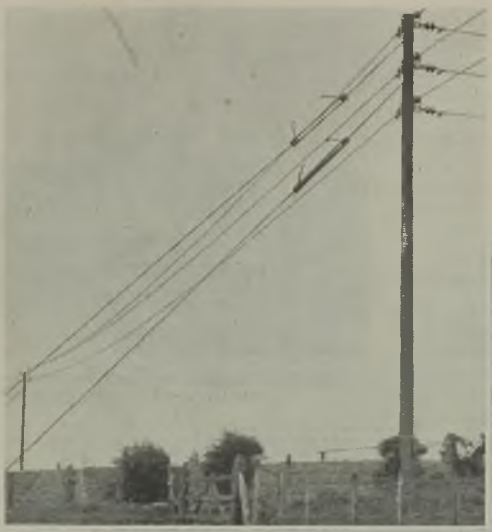
A good example of five-wire vertical-formation low-voltage distribution is that at Fenwick

An exception to the general 11-kV line construction scheme is the double-circuit line from West Kilbride to Largs which has steel lattice masts

Kilmarnock Burgh is also ringed by an 11-kV feeder taking in the Bonnyton, Knockinlaw, Bishopfield and Blackwood areas.

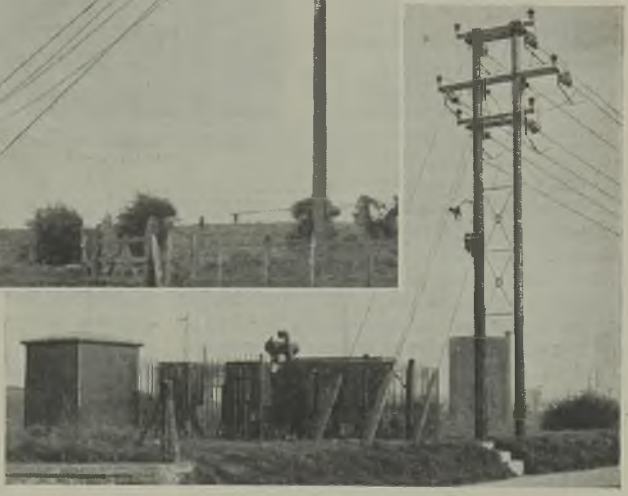
In No. 4 area one has no difficulty in tracing the production of foundry castings and fireclay goods and, in particular, lace. And to serve this there is a single-circuit 11-kV line from Kilmarnock to Galston and a double-circuit 11-kV line extending from Galston to Darvel. From Mauchline in the next area to the south

another single-circuit 11-kV line links with Galston and forms a ring main with the double-circuit 22-kV line to Mauchline. This line to Mauchline is the principal supply circuit for No. 5 area which is almost entirely covered by the Ayrshire coalfield which exercises a great influence on other industries, including textiles.



Advantage is taken of the relaxed Regulations of the Electricity Commissioners which permit the absence of earthing; "compensation" is provided by special stay-wire insulators

Other feeders serving the area are a double-circuit 11-kV line which is tapped from a similar line running from Ayr southwards and extends to Mauchline *via* Polquhairn, so as to form a ring main with the 22-kV lines to Ayr and Mauchline. There is another double-circuit 11-kV line through this area from Mauchline to New Cumnock. No. 6 area to the south is also dominated by the coalfield, while the leather and boot and shoe industries are prominently placed in it, and there are some residential areas to the south amid some of Ayrshire's beauty spots. The 11-kV section of the Kilmarnock, Ayr, Mauchline ring-main already referred to largely serves this area, but the double-circuit 11-kV line running south from Ayr to Girvan by way of Maybole serves the south of the area as well by means of a small ring main from Maybole to Crosshill, Kirkmichael and Maybole. We have already referred to the double-circuit 11-kV line serving Girvan in the south from Ayr, while a wartime development to meet a chemical - industry demand in the area is a double-circuit 33-kV line from Kilmarnock.



The substation at Girvan is typical of the substations supplying small Scottish burghs

Residential area substation at Largs designed to preserve the amenities of the district

Of course, outside these major areas which we have depicted as having a close relationship with the distribution scheme design are other lesser concentrated areas, but there is no point in going beyond the limit we have set ourselves, except perhaps to

mention the essentially residential area and the seaside resort of Largs in the north which are provided for by means of an 11-kV double-circuit line from Ardrossan.

There is no need to discuss in detail the construction of the various types of lines, because in the main standard equipment and methods have been used, but an outline of their types and mention of features *en route* will add interest and dovetail the lines into the scheme as a whole. The 33-kV double-circuit line to Girvan has already been referred to as mainly a wartime development. It has 0·10-sq. in. stranded copper conductors mounted on creosoted A-pole supports of home-grown Scots fir. The route length is about 30 miles and no underground cable whatever is employed. By means of ground-operated section switches the line has been divided into six sections. Difficulties were encountered during construction in obtaining suitable materials and labour owing to the war and because the line had to be erected over some of the best agricultural land in the country and in parts of the county where access was difficult, being at an altitude of 800 ft. to 1,000 ft. above sea level and remote from the beaten track. The line is fed from a step-up substation near the Kilmarnock power station, in which are installed two 5,000-kVA transformers having a ratio of 22 kV to 33 kV.

"Buckeye" digger engaged in cable laying operations for a 0·1 sq. in. 11-kV feeder from Girvan to Dailly

The establishment of 22-kV lines throughout the system was the logical development some years back compatible with load growth and technical progress. The lines consist of single No. 0 SWG hard-drawn copper conductors on "Kay" tower supports. They are double-circuit throughout. The duplicate insulator scheme at the road crossing poles at Kilmaurs is a point of interest, as is the Kilmaurs section tower and substation, which comprises a steel tower supporting ground-operated air-break section switches, and a step-down transformer of 2,000-kVA capacity, with a ratio of 22,000/11,000 V, which is used to feed into the area 11-kV feeder network. The substation equipment which can be served by either circuit of the double-circuit line by means of a change-over air-break switch, is used mainly over winter peak periods.

The isolating tower at Glengarnock is another feature of the Kilmarnock-Glengarnock line in that it is the primary splitting-up point for the area and includes a 22- to 11-kV step-down distribution substation. The only underground cable used on the 22-kV lines is that at rail and road crossings and where the route runs through

An excellent scheme to preserve local amenities is the low-voltage distribution at Straiton; special cable under the eaves of the buildings

built-up areas. The grid substation at Kilmarnock is linked up with the 22-kV system and the 22-kV circuit-breakers controlling the individual feeders are supplied *via* reactors from 22-kV group feeder circuit-breakers installed with the power station extensions during the war years.

The initiation of the 11-kV system was the result of the extension of the area of supply outside the burgh of Kilmarnock to various other burghs and large consumers in the county area. The lines then consisted of single three-wire circuits made up of No. 0 SWG hard-drawn copper conductors mounted on creosoted Norwegian red-fir poles. The first consumer in the county to be supplied in this way was the Hillhouse Quarry Co., near Troon. These lines were gradually extended over the years as the supply area grew and as the work of the load builders produced results.

Cable Networks

An exception to the construction scheme described is the 11-kV double-circuit line from West Kilbride to Largs which has 0·1-sq. in. conductors carried by steel lattice masts. The grid substation at Ardrossan by which the incoming supply to the area is supplemented is linked with the 11-kV system, and an indoor substation at this burgh has a direct connection at 11 kV from the grid substation. This indoor substation is representative of supply sources to the fairly large burghs and built-up areas where the consumers are mainly served from underground networks. The 11-kV overhead system was reinforced by underground cables in the built-up areas to the west and in particular where there are opportunities to pick up consumers *en route*. The cables are all three-core p.i. and armoured equipment, laid direct in the ground and they vary in size from 0·25 sq. in. in the case of the Kilmarnock to Prestwick feeder, to 0·15 sq. in. in the case of the two Kilmarnock to Ayr feeders. In the major transmission scheme described above every opportunity is taken to establish ring mains or double-circuit or multiple-feeder schemes, some of which we have already referred to, while others are shown on the map of the system.

There is a good deal of secondary distribution throughout the area at 3·3 kV, and this scheme really has its roots in the burgh of Kilmarnock where the 3·3-kV three-phase, 50-cycle system represented the first breakaway from the initial DC scheme and was established to serve a rotary substation for supplying DC and individual consumers by way of step-down transformers. The scheme also prevails in a good many residential and shopping areas throughout the county, mainly on account of the lack of suitable sites for larger 11- or 22-kV substations in which extensive automatic switchgear would be required.

The usual plan is to establish a kiosk substation which is supplied at the secondary voltage from a primary substation equipped with a transformer with a ratio of either 22 kV or 11 kV to 3·3 kV. These kiosk substations have capacities from 100 kVA to 250 kVA, and a good example is the one at Knockinlaw in the north section of the Kilmarnock district, which houses h.v. and l.v. switchgear and transformers for local l.v. distribution. The 3·3-kV overhead distribution lines are of simple construction with 0·1 sq. in. h.d. copper conductors mounted on single fir poles.

In a general way the bulk of the distribution substations can be classified by reference to their service. We have already cited the indoor substation at Ardrossan as typical of the larger burgh or built-up area substations, and the substation at Girvan may be taken as representing a typical means of supplying the small Scottish burghs. It is fed from the 11-kV lines from Ayr and controlled on the 11-kV side by automatic switchgear. It has two primary 11- to 3·3-kV transformers which serve a ring main in the town in which are linked three local distribution substations for stepping down to the underground-network voltage of 415/240. The substation also controls an 11-kV spur line to Ballantrae 11 miles further south.

Area Substations

The substation at Mauchline is representative of those supplying an area, as against a burgh or built-up district. It is fed from two 22-kV feeders and has a capacity of 8,000 kVA in two transformers, fitted with automatic on-load tap-changing equipment, with a ratio of 22 kV to 11 kV. The 11-kV side serves the district county area while an 11-kV to 415-kV transformer serves for local distribution.

An example of a substation for an individual consumer is that at Blackwood & Morton's carpet factory, Kilmarnock, which is equipped for 11-kV ring-main control, with a 500-kVA transformer and a factory service l.v. control unit.

The pole-mounted transformer is popular

for affording supplies to individual consumers or small areas in the rural districts, particularly farms. We cannot recall seeing a residential area substation built expressly to preserve the amenities of the district which better merges into its surroundings than one at Largs.

The Royal Burgh of Ayr originally had its own power station, but following the formation of the Ayrshire Electricity Board 22-kV overhead feeders were erected between Kilmarnock and the Ayr power station. Control switchgear and transformers were installed and a high-voltage feeder and low-voltage three-phase distributor system laid in the town and a change over from DC to AC was carried out. Thereafter all steam plant was scrapped and the site thus became the main centre for the control of all feeders radiating from Ayr south, east and north, and for the local distribution. There are incoming supplies at both 11 kV and 22 kV, and outgoing at 11 kV to the south and east. These circuits operate both ways—into and out of Ayr. Distribution schemes throughout the town at 11 kV, 3·3 kV and 415 V are all fed from this substation. The transformers are housed in the old condenser basement and the switchgear is mounted on the old control galleries. It is the general practice of the Board to adopt underground distribution systems within the burghs and urban areas generally, and overhead distribution in the rural areas.

Underground Rural Supplies

In dealing with rural supplies at h.v. the special rural cable now permissible under the relaxed Regulations of the Electricity Commissioners is extensively used. It consists of three-core 0·016-sq. in. p.i., l.c., served, but unarmoured cable, trenched in the normal way and covered with marker tiles. It is used particularly in areas to be developed by town planning, or in places where overhead lines would spoil the local amenities. Its cost compares favourably with that of overhead lines, and it has the advantage of overcoming wayleave difficulties. Associated with this development is the overhead-line scheme now permitted under the Regulations without earthing arrangements. "Compensation" for the absence of earthing equipment is provided by stay-wire insulators, each consisting of two wood slats about 5 ft. 6 in. long with arcing horns and porcelain strain insulators. On the l.v. side standard underground cables of from 0·075 sq. in. to 0·20 sq. in. are used and buried normally, while overhead l.v. distribution is usually in five-wire vertical formation with 0·1, 0·125 and 0·15 sq. in. conductors. A good example is that at Fenwick.

The Board's engineers speak very favourably of the work of the "Buckeye" digger which we saw trenching for cable-laying on a new run from Girvan to Dailly, about eight miles, for 0·1 sq. in. 3-core, 11-kV, l.c. p.i. d.s.a. cable. It is a petrol-engine-driven machine, operating on the dredger principle and running on caterpillar tracks. The dredger buckets throw the soil from the trench on to a short endless conveyor disposed normally to the line of operation and projecting at each side. The trench is about 2 ft. 6 in. deep in this case, but it can be varied up to 8 ft. 6 in. deep. The width of the trench can be varied from 13 in. to 2 ft. 6 in. A normal trenching speed is about a mile in eight hours. About forty different speeds are available to both the crawler and the conveyor by means of a comprehensive series of gears.

An excellent scheme to preserve local amenities is the l.v. distribution at Straiton, where "Wethertex" is seen under the eaves of the picturesque buildings. In order to afford supplies to the outlying areas of Muirkirk and Dalmellington which lie some distance from the main transmission lines, opportunities have been taken to obtain "incoming" supplies from the local colliery generating stations. Electricity is purchased by the Board from the colliery owners and is distributed throughout the isolated areas by the Board's lines. Metering is effected at the colliery power stations. The supply in each case is 415-V, three-phase, four-wire.

Administration System

Much of the construction work throughout the system is done by direct labour, and generally all new construction is conducted from headquarters. It is often expedient, however, for some of the smaller work to be carried out by the superintendent responsible for the district concerned. There are four districts, and in each case the superintendent is responsible to the distribution engineer for the maintenance of that part of the system within his area and for ordinary service connections, etc.

We are indebted to Mr. William C. Bexon, under whose direction the whole of the distribution system has been designed and developed, for facilities to study the system, and to members of his senior staff, for help in obtaining the above information.

Overhead-Line Charts—II

Load-Carrying Capacity and Voltage Drop

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

THE basic considerations governing the construction of voltage-drop charts have been discussed.* On most lines, it is the voltage drop which limits the load-carrying capacity, but if the line is very short, or if the load has a high or a leading power factor, care should always be taken to verify that the maximum current-carrying capacity of the conductor itself is not exceeded, even although the voltage drop may be small.

Current Limits

The current limit of the conductor is usually determined by the temperature rise (under specified conditions of wind and ambient temperature) which will result in the maximum permissible sag. The large changes which occur in temperature rise owing to changes in wind velocity and solar radiation make it difficult to specify precise limits for the current-carrying capacity of conductors. Approximate figures for the conductor sizes under consideration are, however, given in Table 2.

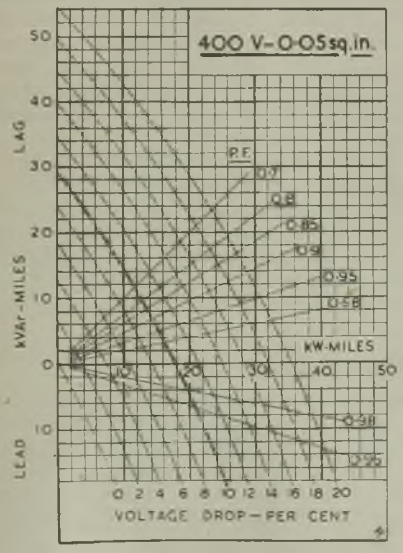


Fig. 4.—400 V line with 0.05 sq. in. copper conductors

* The first article of this series was published in the *Electrical Review* of June 22nd (p. 893).

These figures are based on a conductor temperature rise of 30 deg. C, an ambient temperature of 20 deg. C, a wind velocity of two miles per hour and maximum solar radiation in this country. Very similar values are obtained for still air, and no solar radiation. If a higher temperature rise than 30 deg. C is permissible, the currents may be increased in proportion to the square roots of the temperature rises. Thus, for a rise of 50 deg. C, the figures in the table should be multiplied by 1·3.

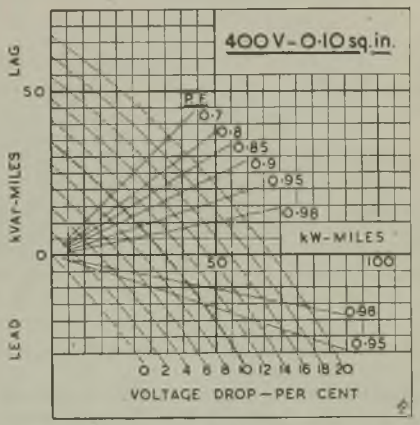


Fig. 5.—400 V line with 0.10 sq. in. copper conductors

The conductor material affects the temperature rise to some extent. Steel-cored aluminium conductors, with two layers of aluminium strands, have a current rating about 10 per cent. higher than that of the equivalent copper conductors. With steel-cored aluminium conductors having a single layer of aluminium strands, the increase in AC resistance compensates for the increased surface area of the aluminium conductor, and the current rating may be slightly less than that of the equivalent

Table 2.—Currents for 30 deg. C. Temperature Rise

Equivalent copper, sq. in.	Amperes
0·05	150
0·075	200
0·10	250
0·15	350
0·175	400
0·20	450
0·30	550
0·40	650

copper conductor. Such considerations are, however, of little importance in practice, and the figures given in the table may be used for copper, cadmium-copper, and steel-cored aluminium conductors.

Fortunately, peak loads seldom occur when the air temperature is high, and troubles due to the overheating of conductors are rare. Joint failures due to overheating, particularly in the case of steel-cored aluminium lines, are not uncommon, however, and care should be taken to ensure that the joints are at least equivalent to the conductors in current-carrying capacity.

It is hoped that with the aid of the previous introductory article the reader will be able to extract the maximum information from the charts and solve almost at a glance practically any overhead line voltage-drop problem.

Charts for lines operated at 400 V are given herewith. Those for higher voltages will appear in due course. These charts may be used without serious error for lines up to 100 miles in length. Longer lines will be considered more fully in a later article.

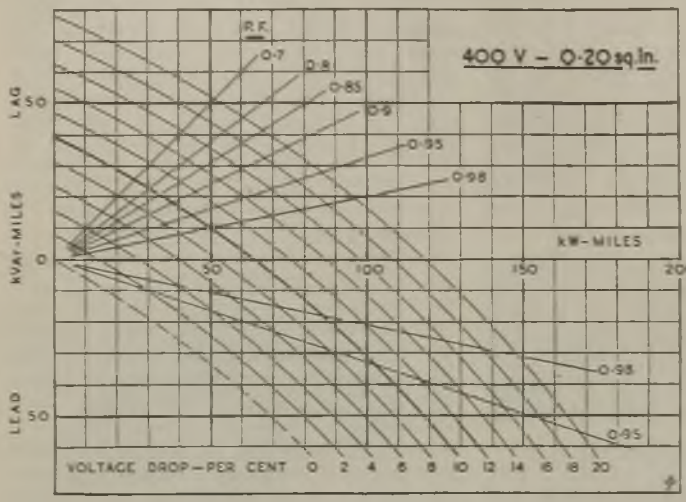


Fig. 6.—400 V line with 0.20 sq. in. copper conductors

Example 1

(a) *A 3-phase, 0·1 sq. in., low-voltage distribution line is 1 mile long, and supplies a motor load of 25 kW at a voltage of 400 V between phases and a power factor of 0·7 lagging. What is the sending-end voltage?*

The transmitted load is 25 kW-miles as the line is 1 mile long, and reference to Fig. 5 shows that the voltage drop due to this load at a power factor of 0·7 lagging is 14 per cent. The sending-end voltage is therefore 456 V.

(b) *What is the effect of installing a 20-kVA static condenser at the receiving end?*

It is clear from Fig. 5 that the addition (in the leading direction) of 20 kVAR-miles will increase the power factor to 0·98 lagging, and will reduce the voltage drop in the line from 14 per cent. to 8·5 per cent.

I.M.E.A. in the North-West

THE annual meeting of the North-West England and North Wales Centre of the Incorporated Municipal Electrical Association at Liverpool on June 26th was preceded by a luncheon given by the Liverpool Electric Power and Lighting Committee. Alderman A. Critchley, chairman of the Committee presided and referred in a speech to the statement of the power companies that 60 per cent. of the municipal electricity supply authorities had raised their charges during the war. He said that only a few of the 350 municipal authorities had increased their prices while 40 per cent. of the company undertakings had done so.

Alderman Sir William Walker (president, I.M.E.A.) referred to the importance of Liverpool in the national grid and said that by producing power at a reasonable cost electricity suppliers would enable British industries to work off the gigantic burden of debt which the war had placed upon them.

The Lord Mayor of Liverpool (Lord Sefton) paid a tribute to the part played in the development of electricity supply by the Association throughout the country and he was supported in this by Councillor J. J. Sloan, vice-chairman of the Liverpool Electric Power and Lighting Committee.

Mr. J. Eccles, city electrical engineer, said that it was the Association's duty to see that the rights of local authorities in the sphere of electricity supply were maintained and to ensure that a cheap and abundant supply was made available to other industries. A vote of thanks to the Electric Power and Lighting Committee was moved by Mr. W. P. Lilwall, immediate past-president.

CORRESPONDENCE

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

" All-electric "

MAY I make a plea for greater care in the use of the phrase " all-electric "? In its correct sense it denotes the use of electricity for all purposes, to the exclusion of any other medium. But only too often houses are described as " all-electric " when it is meant to convey that no gas is laid on, regardless of how many coal fires may be provided.

For instance, it is reported that " the Stoke Newington B.C. has asked its Housing Committee to consider the erection of a number of houses . . . with no provision for coal fires, thus making them an experimental type of ' all-electric house.' " This is clear. But more often one reads paragraphs of the following type: " Felling (Co. Durham)—All-electric Houses—The Urban District Council is to build 55 all-electric houses at . . ." Here it is left to the imagination to decide what is meant; most likely it denotes " no gas," with plenty of coal fires.

What is needed is a term to express the fact that in a house or housing estate no gas is laid on. " All-electric," however, should be left to its proper province.

London, W.2. P. SCHILLER.

Is Retrogression Economical?

I AM enclosing for your attention, a cutting from a leading newspaper the text of which appears to be paradoxical as it reports the proposed conversion of street lighting at Sunbury and Ashford Common from electricity to gas. It is difficult in these times of rapid development to imagine the choice of gas for a new installation, but to convert from electricity to gas is, in my estimation, alarming.

Apparently gas is so economical that its installation, maintenance and fuel costs can compete against an established electrical installation. Surely there must be something wrong somewhere; is it the incompetence of the electrical industry as a whole or an individual? Such a state of affairs is ridiculous and I would appreciate the comments of your readers.

This selection of gas against electric lighting for public use, if taken just on comparative lumen values, appears hard to believe, but when taking into account the various types of lighting the electrical industry can give the public it is inconceivable. I feel that the decision, to revert from the twentieth century to the nineteenth has been made without any regard to efficiency or economy.

Feltham, Mx. K. C. DERRICK, Student I.E.E.

The Domestic Consumer

IN the beginning of his article Capt. J. M. Donaldson in your issue of June 29th expressed very fairly the feelings of the average consumer about complicated and varying charges for electricity. The result was, alas! only one more system added to the list. Every engineer has his own ideas on the subject and it is time that the tariff-making mania ceased.

Why is electricity so different from every other commodity bought by the man in the street, not even excepting gas, that the highest mathematical brains must be employed to decide how much he shall pay per unit? The secret is largely the " promotional " rate mentioned by your contributor. We must encourage consumers to use more, and for longer hours. Do all these fancy rates produce that apparently much desired result? I say definitely: " No."

A factory or a domestic consumer uses electricity when it is most needed, and not otherwise, as it costs money. The fantastic floor space, blocks, rateable value, and other charges make no difference to the average tenant's use of electricity. If he needs heat, he will certainly use it regardless of the consequent expense.

It seems to me that Capt. Donaldson confuses two distinct things. One is the cost of producing in country districts as compared with urban districts; the other, " promotional " charges to encourage the long-hour use of lots of electricity. While it is right to charge more where capital charges caused by long lines are heavier, this does not justify giving a town consumer choice of several ways of paying for what he uses. He, the town user, should pay per unit the *market* price, which is regulated in the same way as the price of potatoes or butter, with no other trimmings

such as floor space, size of rooms, lamps installed, rateable value, maximum demand and what not.

If the slightest proof were forthcoming that all these fancy charges had any effect in producing low peaks and steady twenty-four hour loads, then one uniform charge and one only to that end should be instituted, but all that happens is the consumer uses what he wants and when he wants it. The undertaking supplies the power as and when it is demanded. But, owing to his wise choice of rates, one consumer, *after he has used it* in the way he chose at the time, pays less than another who had not studied such complex problems and chose the wrong rate for his particular habits. Moreover, the multitudes of poorer consumers to whom we boast we are introducing the conveniences of civilisation hitherto only within reach of the rich, are paying the highest rates. They are, in fact, paying for the large number of cheap rate units kindly supplied by benevolent undertakings to factories and large domestic consumers with corresponding incomes.

W.E.B.

REGARDING Capt. J. M. Donaldson's constructive article in your issue of June 29th, I also am of the opinion that only one system of charging should be the rule. When the grid was first mooted great things were promised such as cheap electricity for all, etc. Although the grid has been in commission for many years, what is the position? Consumers in some populous areas still have to pay anything from 6d. to 1s. per kWh for lighting; and electric heating, cooking, etc., are quite out of the question.

In the writer's business area, which is served by the Glasgow Corporation, electricity is a small item in one's oncost and the electricity undertaking has done exceedingly well for its consumers. At my home address I am not quite so fortunate as my supply has to be purchased from a private company at a higher rate than that of the Glasgow Corporation, although my home is only a stone's throw from the latter's area. I can sympathise with the layman who cannot possibly be convinced as to the reason for such variations.

There is certainly something wrong with the numerous methods of charging for electricity and if we are to get domestic consumers properly electrically minded, standardisation of price and drastic reductions in cost in all populous areas are necessary.

Glasgow, E.2. ALEX. MILNE, SENR.

Portable Electric Tools

WITH reference to Mr. R. Bennett's letter in your issue of June 29th, the use of 25 V as a standard for portable tools, is, in my opinion, not justified from a safety point of view, nor do I think that it would be practicable.

Although by rewinding with the appropriate number of turns of heavier gauge wire, the standard 230-V universal tool can be converted for a 25-V circuit, the commutator, brush-gear and brushes, which having been designed to carry say, 1 A at 230 V, will, at 25 V, need to deal with 9 A. A number of brushes rely on contact with the box brush-holder only, and even brushes fitted with a copper flexible lead would not carry the heavier current.

Pre-war switches for portable tools were reasonably good, considering that they were designed to be housed in the minimum space, but even these would not stand up to many "stalls." Switches now obtainable are often very far from satisfactory, and a robust type capable of dealing with the increased current could not be stowed away in the recess already provided.

I have found, from long experience with all types of portable electric tools, that for safety and trouble-free service there is very little to complain about with 110-V three-phase, 200-cycle tools fed from a frequency changer. I know of no case of an operator receiving a serious shock.

Many large engineering firms and most car manufacturers use portable tools of this type. I know of one car firm which up to the outbreak of war had used them for more than seven years, and their electrical engineer stated that they had very little trouble—chiefly the renewal of ball races—and that the cost of spares had averaged 2s. 5d. per tool per annum.

Yeovil. CYRIL J. BENNETT, A.M.I.E.E.,
Electrical Engineer,
Westland Aircraft, Ltd.

Jute Cables

CONTRARY to expectations, jute-insulated cables have continued to be called for and they are still referred to in the I.E.E. Wiring Rules. Therefore a new specification (B.S. 1216-1945) has been issued, dealing with sizes, resistances, voltage tests and the identification of cores, but it is not concerned with the composition, quality, or durability of the insulating material. The document is obtainable (price 2s.) from the British Standards Institution, 28 Victoria Street, London, S.W.1.

PERSONAL and SOCIAL

News of Men and Women of the Industry

Crompton Centenary Dinner.—To mark the centenary of the birth of Colonel R. E. B. Crompton, C.B., the Association of Old Cromptonians is holding a dinner at the Connaught Rooms on Wednesday, September 26th. The hon. secretary of the Association would be grateful if Old Cromptonians wishing to be present would communicate with him at Electra House, Victoria Embankment, W.C.2.

Wing Commander C. E. Verity, technical engineer to the London Power Company, who was seconded to the R.A.F. in 1941, was awarded the O.B.E. in the recent Birthday Honours List.

Major C. V. Wattenbach, M.C., who has received the M.B.E., is a director of Dictograph Telephones, Ltd. He is at present serving with H.M. Forces.

Mr. J. W. Noble (Manchester) has been elected chairman of the Association of Supervising Electrical Engineers and **Mr. J. D. Griffiths** (Birmingham), vice-chairman. **Mr. J. J. Smith,** M.I.E.E. (London) has been re-elected hon. treasurer. Messrs. **W. S. Gearing** and **G. H. Parker** have resigned from the Council and the vacancies have been filled by **Messrs. A. E. Poole** (Wolverhampton) and **J. J. Wilson** (Liverpool).

Mr. J. W. Noble

Mr. Noble is chief engineer to John Lewis, Ltd., Manchester. His Association activities include sixteen years service as district representative for Lancashire, Cheshire, North Wales and Isle of Man. Mr. Griffiths is supervising engineer with Reynolds & Bradwell, Birmingham; he was the first secretary, and is immediate past-chairman, of the Birmingham branch and represents the Association on the City and Guilds Installation Advisory Committee.

Lieut.-Colonel R. M'Creary, M.C., general manager of Belfast Transport Department, will resume his duties with that Department on August 1st. Lieut.-Colonel M'Creary served in the 1914–18 War, and in the present war was mentioned in despatches and decorated for his services in the Royal Engineers.

Lieut.-Colonel N. R. Elliott until recently 163 C.R.E. Power to 21st Army Group, has been promoted colonel and appointed Deputy Director of Works, 21st Army Group, with effect from April last. Colonel Elliott has also been elected chairman of the Isle of Thanet Electric Supply Company, of which he has been a director for some years. He hopes to be back in civilian life in about five weeks' time.

Mr. J. N. Stephens, who has been re-elected president of the Electrical Industries Benevolent Association for a second year, has been working for the Association for twenty-two years, for the last seventeen of which he had been a member of its governing body. He had occupied the position of chairman of the Court for six years, and had been chairman of the Relief Committee for many years before that.

Mr. J. N. Stephens

Mr. A. A. Rowse, chairman of Venner Time Switches, Ltd., and S. G. Brown, Ltd., has been appointed honorary consultant and adviser to the Director of the Admiralty Compass Department.

Mr. J. A. Hunn has retired from the board of Laurence, Scott & Electromotors, Ltd., and his position as director in charge of marine sales will be taken by **Mr. R. Clarke.** Arising out of the new appointment, **Mr. J. Fitzgerald** becomes chief engineer, Switch Works, and **Mr. J. Affleck** takes charge of marine sales at the London office, where **Mr. C. Jones** remains in charge of industrial sales. Two further changes, not connected with the foregoing, are the appointment of **Mr. P. Webb** as chief of the A.C. Estimating Department, in succession to **Mr. A. Cook,** who after a very long period of service with the company (and before the amalgamation, with Electromotors, Ltd.), hopes to be a little freer from the stress of commercial work as technical assistant to **Mr. P. A. Mossay,** the director in charge of electrical development.

Mr. R. Clarke

Mr. Hunn, the retiring director, has been with the company for forty-eight years. He was apprenticed to the company and gained his technical training at Finsbury. In the early days of the application of electric power to ships' auxiliaries he was in charge of some of the pioneer work on battleships of the "Dreadnought" class. He has been closely associated

with the development of the company's marine electrical business and his service in the R.N.V.R. during 1914-19, when he attained the rank of commander and was awarded the O.B.E., was of great practical value. But for the volume of important Admiralty work in hand he would have retired earlier. He will continue to be closely associated with the company. Mr. Hunn suffered the loss of his only son in the "Thetis" disaster.

Mr. R. Clarke, the new director, was also apprenticed to Laurence, Scott, in 1912, and with short intervals in the army in 1914-19 and with the B.T.H. Co. on h.v. switchgear design, has been with the company ever since. He has had considerable experience in the design and manufacture of marine and industrial control gear and was appointed chief engineer to the Switchgear Department in 1939. During the war, in addition to a great deal of development work on special control gear, he has been responsible for the building and equipment of a branch factory in which 90 per cent. of the employees are unskilled women, many of them out-workers—an experiment which has proved very successful.

The first meeting of the Social and Sports Club of Bruce Peebles & Co., Ltd., since the start of the war was held on June 23rd. The meeting was well attended and a most pleasant

Mrs. Rodger presenting prizes at the Bruce Peebles sports meeting

afternoon was spent by the employees with their families and friends. Among the guests were the company's chairman, Dr. James Watt; Mr. George M. Cowan, director; Mr. J. W. Rodger, managing director, and Mrs. Rodger; Mr. William H. Morton, director, and Mrs. Morton. There was a full programme and the events were well contested. In addressing the gathering Mr. Rodger commented on the high standard of performance in the many and varied events, and congratulated the members of the organising committee on the success of its efforts. At the close of the sports, Mrs. Rodger presented the prizes.

On June 19th a visit was paid to the works of Sangamo Weston, Ltd., by a number of members of the Southern Divisional Meter Engineers' Group of the E.P.E.A.

At the annual meeting of the Electrical Wholesalers' Federation on June 20th, the vacancy on the Council, caused by the retirement of **Mr. T. Woods** (Downes & Davies, Liverpool) was filled by the election of **Mr. S. Whitlam** (Hallamshire Electric Co., Ltd., Sheffield).

Mr. M. A. Fiennes has resigned from the Brush Electrical Engineering Co. to take up the post of managing director of the Davy & United Engineering Co., Sheffield. He will be leaving the Brush organisation on July 31st. As from August 1st **Mr. D. B. Hoseason,** M.I.Mech.E., M.I.E.E., will be the director responsible for the turbine division of the company, while still maintaining responsibility for the electrical division.

Captain R. C. Petter, M.I.Mech.E., M.I.Mar.E. has resigned from the board of Associated British Engineering, Ltd.

Mr. H. J. Cox, who has retired from the position of assistant distribution engineer to the Birmingham Electric Supply Department after forty-three years' service has been presented with an illuminated address. Mr. Cox is a former chairman of the Midland Section of the Electrical Power Engineers' Association.

Ald. W. E. Sowter, M.B.E., chairman of the Bedford Electricity Committee, has been elected chairman of the South-East and East England Centre of the Incorporated Municipal Electrical Association for the ensuing year. He is the first local authority representative to be appointed to the office.

The Marquis of Reading and **Mr. G. Bradlaw** have been elected directors of the Palestine Electric Corporation, Ltd., and **Mr. James de Rothschild** has rejoined the board after relinquishing the position of Joint Parliamentary Secretary to the Ministry of Supply.

I.E.E. Premiums.—The Council of the Institution of Electrical Engineers has made the following award of premiums for papers read during the 1944-45 session or accepted for publication:—

Group A. *Kelvin Premium:* Mr. G. F. Shotter; *John Hopkinson Premium:* Mr. R. J. Halsey, B.Sc. (Eng.). Group B. *Non-Section Premiums:* Mr. H. Frohlich (Ayrton), Mr. G. A. Juhlin (Llewelyn B. Atkinson) and Mr. R. Pohl, D.Eng. (Extra). *Installations Section Premiums:* Mr. R. O. Ackerley (Crompton), Mr. R. T. Lythall (Swan) and Mr. L. S. Atkinson (Extra). *Measurements Section Premiums:* Messrs. L. Hartshorn, D.Sc. and W. Wilson, B.Sc. (Silvanus Thompson), Mr. D. J. Desmond, M.Sc. (Mather) and Mr. H. J. Josephs (Extra). *Radio Section Premiums:* Prof. Willis Jackson, D.Sc. and Mr. J. S. A. Forsyth, B.Sc. (Duddell), Mr. K. R. Sturley, Ph.D. (Ambrose Fleming) and Mr. D. G. Fink (Extra). *Transmission Section Premiums:* Mr. D. B. Irving, B.Sc. (Eng.)

(Sebastian de Ferranti), Messrs. W. Kidd and E. M. S. McWhirter (John Snell), Messrs. R. C. Hatton and J. McCombe, Ph.D. (Extra) and Mr. J. L. Carr, M.Sc. (Extra). Group C. *Fahie Premium*: Messrs. R. B. Armstrong, B.Sc., and J. A. Smale, B.Sc. *Paris Exhibition, 1881, Premium*: Messrs. L. J. C. Connoll, B.Sc., O. W. Humphreys, B.Sc., and J. L. Rycroft B.Sc. *Overseas Premium* (for senior members): Mr. R. H. Paul, M.A. *Students' Premiums* (value £10): Mr. W. M. Butler, Mr. G. B. Downham, Mr. J. R. Hanchett, Lieut. L. B. Knowles, R.N.V.R., and Mr. J. Willis. *Students' Premiums* (value £5): Messrs. J. Banks, M.Eng., H. Burton, B.Eng., T. E. Calverley, B.Sc., J. B. Higham, B.Sc., A. C. Robb, B.Eng., and W. B. Robertshaw.

Mr. H. Shorland, B.Sc.(Eng.), has been elected chairman of the London Students Section of the Institution of Electrical Engineers for the 1945-46 session, with **Mr. R. G. F. Stefanelli** as vice-chairman. The secretary is **Mr. R. V. Darton,** B.Sc.(Eng.), 27, Church Rise, Forest Hill, S.E.23, and the hon. assistant secretary **Mr. G. S. H. Mogford.**

Mr. S. E. Goodall, whose portrait we reproduce, has been appointed deputy chief engineer to W. T. Henley's Telegraph Works Co., Ltd. Details of Mr. Goodall's career were published in our last issue.

Mr. S. E. Goodall

Mr. J. W. Lapthorn has been appointed manager of Henley's Order Department as from June 1st. He joined the company as a junior in the Stock Room (later re-named Order Department) in 1899 and in 1909 he was appointed chief assistant. Mr. Lapthorn has thus served in the same department throughout his forty-six years' service with Henley's.

Mr. Stanley W. Bowler has returned to Richards & Bright, consulting engineers, from the Directorate of Instrument and Aircraft Equipment Production, Ministry of Aircraft Production.

Mr. H. Osborne, mains superintendent in the Dover electricity undertaking, who recently announced his intention to resign, has now asked for permission to withdraw his resignation.

Mr. J. T. Masterton, who has been joint general manager of Brown Brothers, Ltd., since 1937 and general sales manager since 1938, has been appointed to the board of the company. Mr. Masterton joined Thomson & Brown Brothers, Ltd., in 1920, in Edinburgh, and was subsequently appointed assistant branch manager at Leeds, later becoming manager at Dundee. In 1930 he was appointed manager of the newly opened branch at Liverpool and four years later joined the head office staff in London, where he was responsible for the supervision of the company's many branches. He will continue to act as joint general manager in conjunction with Mr. W. G. Pavitt. Consequent on Mr. Masterton's appointment, **Mr. G. Tiffen,** who has been with Brown Brothers since 1919 and has acted as assistant sales manager for a number of years, has been appointed sales manager.

A " Bring and Buy Sale " is being held by the E.A.W. London Branch at the headquarters, 20, Regent Street, on July 12th, at 2.30 p.m., the proceeds to be devoted to the " Caroline Haslett Trust." Friends will be welcomed and gifts or donations gratefully received.

M. Georges Claude, the seventy-four-year-old inventor of neon lighting, has been sentenced to imprisonment for life by the French Court of Justice for treason. He was alleged to have been the inventor of the flying bomb but he denied this.

The North of Scotland Hydro-Electric Board is advertising for an assistant commercial engineer.

Obituary

Major C. E. S. Phillips, whose death occurred on June 17th at the age of seventy-four, was one of the earliest workers in the field of X-rays and was responsible for many developments in the construction of tubes. For his work in this direction during the 1914-18 war he was awarded the O.B.E. He was one of the founders of the Institute of Physics and was honorary treasurer of the Institute for many years. In 1930-31 he was president of the British Institute of Radiology. He was also honorary secretary of the Royal Institution for about sixteen years. Major Phillips was the son of Samuel Phillips one of the founders of Johnson & Phillips.

Mr. A. F. B. Andrew.—The death occurred on June 22nd of Mr. A. F. B. Andrew, who was with the London and Home Counties J.E.A. (Twickenham District) and formerly in the chief engineer's department. He was fifty-one years of age.

Wills.—The late **Sir Henry Herbert Couzens,** formerly chief electrical engineer at West Ham and Hampstead and later president of the Brazilian Traction, Light & Power Co., left estate valued at £140,033.

Mr. G. Keith, chairman and managing director of Keith Blackman, Ltd., left £155,024, with net personalty £151,217.

The late **Sir Duncan Wilson,** formerly Chief Inspector of Factories, left £50,194.

Wind Power

Plans for 7,500-kW Units

OPERATING experience with the 1,000-kW experimental wind turbine on Grandpa's Knob, Vermont, has led the U.S. Federal Power Commission, it is stated in *Power*, to consider designs for units up to 7,500 kW on towers up to 475 ft. high but with a much broader base than in the earlier design. The unit at Grandpa's Knob. which is on a 110-ft. tower and is claimed to be the first wind-power generator to be connected to a commercial supply system—the Central Vermont Public Service Corporation—was placed in commission in October, 1941, and its salient features were described in the *Electrical Review*. It ran for about 16 months when a bearing failed and could not be renewed owing to war priorities. It was restarted on March 3rd last but on March 26th one of the 65-ft. blades, weighing about 7 tons broke. The unit is to be rebuilt. So far it has run for 838 hr. and has generated 360,000 kWh.

The layout of the 7,500-kW set includes twin-wheel propellers mounted at opposite ends of a 200-ft. rotating bridge and driving a single 1,200-V DC generator with speed range of from full value to 40 per cent. The DC power is transformed to AC by a twelve-phase rotary convertor and the voltage is transformed to 66,000 for feeding into the undertaking's transmission system. The electrical equipment and auxiliaries are installed in a generating room at the centre of the bridge. With a maximum wheel speed of 42·75 RPM and a maximum wind velocity of 34 MPH, the delivered output was 7,700 kW. The generator was designed for average wind velocities of 23 to 25 MPH, which is comparable with the Grandpa's Knob design. A second design has been prepared for average velocities of 18 to 21 MPH with a rated capacity of 6,500 kW at 28 MPH. Overall construction costs per kW for ten units erected on two or three sites are estimated at $68 for the 7,500-kW size and $75 for the 6,500-kW size.

Fuel and Power Organisation

A NEW 17-page pamphlet issued by Fabian Publications, Ltd., "Fuel and Power" (Research Series No. 93, 6d.) deals with the organisation and control of electricity, gas, coal and oil in relation to the pre-war position, wartime controls and post-war policy. Allowing for its avowed political predilections, the pamphlet is moderate in tone and objective as to facts. It contains no reference to diversity of tariffs regarding which such strange misconceptions have been shown in some quarters recently.

Mention is made of the fact that, although electricity supply undertakings have been faced with rising costs, especially coal costs, during the war, their increased power loads have, in the main, carried these, and they have not advanced their charges much. It might have been added that prices per kWh have been subject to regulation by the Electricity Commissioners. The reason that electricity has been especially handicapped by increases in the cost per ton is, of course, that these are of the flat-rate kind and take no account of the heat value of the fuel, which is lower than that required generally in other industries.

Whatever the future organisation of the mining industry may be, the case for linking it up with electricity supply is not convincingly worked out. Better evidence is offered of the need for a reduction in the number of independent undertakings, though it is admitted that the largest units need not be the most efficient. Referring to the McGowan Report, it is stated that no distributors were willing to sacrifice autonomy in the interests of efficiency and that for this reason alone distribution should be administered by new *ad hoc* regional bodies (the members of which would be chosen by the central Government) under a national co-ordinating authority of the C.E.B. or B.B.C. type. All selected stations, it is recommended, should become the property of the Central Electricity Board, but their present owners should receive a guarantee that their supplies would not cost more than they did previously.

Thanet Joint Board

NOTICE has been given by the Margate Corporation and the Broadstairs and St. Peter's U.D.C. of their intention to apply to the Electricity Commissioners for a Special Order empowering them to purchase the undertaking of the Isle of Thanet Electric Supply Co., Ltd., in the borough of Margate, the Broadstairs and St. Peter's urban district and parts of the borough of Ramsgate and the parish of Acol (Kent). It is proposed to constitute a joint board to exercise powers under the Electricity (Supply) Acts and the Special Order.

Copies of the draft Order are obtainable (at 2s. each) from the Town Clerk of Margate, the Clerk to the U.D.C., or from Sharpe, Pritchard & Co., Parliamentary agents, Palace Chambers, Bridge Street, Westminster, S.W.1. Any objections to the Order must be sent to the Electricity Commissioners on or before July 30th, copies being sent to the local authorities concerned or their Parliamentary agents.

Diamond Tools and Gauges

Following the closing of the Diamond Tool Advisory Centre, the Council of the Gauge & Tool Makers' Association has established a new section for manufacturers of diamond tools and gauges. The section has eight members and the chairman is Mr. E. Van Moppes (L. M. Van Moppes & Sons). Membership is open to manufacturers of shaped diamond tools, diamond indenters, lens drills, glaziers' diamonds, and diamond gauges.

E.I.B.A. Report

Reserve Reaches £100,000

THE two highlights of the annual general meeting of the Electrical Industries Benevolent Association, which was held on Friday last, were that the reserve funds of the Association had reached the £100,000 mark, and that a special committee had been appointed to examine to what extent there was a need for homes for aged people associated with the electrical industry.

In his speech introducing the report and accounts Mr. J. N. Stephens, who was appointed president for a second year, said that the amount paid out in relief in 1944 was the all-time record of £10,803, which was practically four times the comparable figure for ten years ago. It was most gratifying that, in spite of this, there was a sufficient surplus to have brought the reserve up to six figures, and it was very fitting that this should have occurred in the year which included the fortieth " birthday " of the Association. These and still bigger reserves, however, were necessary to ensure the continuation of the E.I.B.A. work should there be a serious post-war slump in which calls on the funds might greatly increase at a time when subscriptions might possibly be seriously reduced.

It would have been understandable, after nearly six years of extreme difficulties, if the Association had been faced with a deficit; that E.I.B.A. was in a much better financial position than this, and was able to lay plans for the future, resulted from the stalwart way in which old and new helpers had assisted it, and in this connection Mr. Stephens paid particular tribute to Mr. E. E. Hoadley, Mr. P. V. Hunter and Mr. E. E. Sharp, the three who had immediately preceded him in office.

To exemplify what was being done Mr. Stephens read a letter of appreciation from a professional man of over sixty who, with his wife, was seriously injured in a raid, whose savings were exhausted, and who was receiving the princely pension in respect of his wife and himself of 8s. a week for their injuries.

Mr. Stephens emphasised the last paragraph of the report, which read: " The greatest art of all has been said to be the art of living. It has also been said to be the art of giving. Surely these two statements are complementary for we are only living to the extent that we give, whether it be in money, time, service, or cheerful inspiration."

Mr. L. C. Penwill proposed Mr. Stephens's re-election as president, outlining his long service with the Association. Mr. W. J. Jones was appointed as a new member of the Court, Mr. L. C. Penwill was re-elected chairman of the Court, Mr. L. C. Sharp, vice-chairman and Mr. J. Y. Fletcher, honorary treasurer.

E.D.A. Activities

New Members

SEVEN new members have enrolled in the Electrical Development Association during the first six months of this year. They are, in order of enrolment, Bolsover U.D.C., Keighley Corporation, Felixstowe U.D.C., Huddersfield Corporation, Macclesfield Corporation, Loughborough Corporation and the West Gloucestershire Power Co., Ltd.

Representation at Conferences

The Council of E.D.A. has appointed Mr. V. W. Dale, the general manager and secretary, and Mr. J. I. Bernard as the Association's delegates to the conference of the Association of Public Lighting Engineers. Mr. Dale will also represent the Association at the conference of the National Chamber of Trade. He has been nominated to serve on the Building Industries National Council.

Electric Kitchens

On Monday last the Association's exhibition of four all-electric kitchens for low-cost homes was opened at Rossleigh's Showrooms, 14-16, Shandwick Place, Edinburgh, where it is to remain for four weeks (until July 28th) instead of the usual three. From Edinburgh the exhibition will go to Newcastle-on-Tyne where it will be on view from September 10th to 29th, and thence to Sheffield from November 12th to December 1st. It was originally agreed that Birmingham should be the venue in the Central England area, but it has now been decided that Wolverhampton shall stage the exhibition instead, from January 21st to February 9th, 1946.

Despite the fact that the VE holidays curtailed the time it was open to the public, the exhibition at Cardiff was very successful, being visited by over 21,000 people.

" Women and Electricity " Exhibition

The E.D.A. Council has decided to organise an electrical exhibition in the Dorland Hall, London, during October. The exhibition, which will coincide with the twenty-first birthday celebrations of the E.A.W., will probably be called " Women and Electricity." It will describe electrical development over the past twenty-one years, the part that women and electricity played in our war effort, and the great service that electricity has to offer women in peacetime in the home, in industry and as a career.

Views on the News

Reflections on Current Topics

THE recent I.M.E.A. report announced the dissolution of that wartime hybrid the Joint Gas and Electricity Committee. Adversity makes strange bedfellows but when conditions improve they invariably seek separate quarters. I suppose that the Electricity Commissioners' note to electricity supply undertakings signifies another step towards the parting of the ways, especially as the gas undertakings have had a similar letter from the Ministry of Fuel and Power. Nothing is said regarding changes from electricity to gas and *vice versa* which were forbidden for the period of the war, but I think that the letters implicitly permit the resumption of such changes when they become possible. The Ministry, with whom the idea originated, seems to be resigned to the fact that some people are so perverse as to wish to exercise a choice and sometimes change their minds.

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From conversations with various members of the public I have gained the impression that much of the talk of big differences in domestic tariffs is due to the statutory obligation on an undertaking to quote a flat-rate alternative to a two-part tariff. This flat rate, normally adopted by a consumer requiring a few lights only, is compared with the "unit" charge paid by someone else in another area (the standing charge being forgotten), even though the undertaking criticised itself offers favourable terms for extended use. This kind of criticism could be avoided by repealing the statutory flat-rate requirement or by the general adoption of a variable-block tariff.

* * *

I was asked the other day whether a landlord was entitled to retail electricity to tenants of a block of flats at 2d. a unit more than he paid for it. It is not the first time that this has cropped up and it seems to be one of those rare matters which has gone on for a long time without its legality being properly tested. Any action would seem to lie with the supply authority : if that authority knows about it and does not object the tenants can do nothing about it short of refusing to use electricity (or gas if it comes to that, for the legislation in the matter originated with gas).

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Apparently something of the kind was anticipated when the Gasworks (Clauses) Act of 1847 was drawn up. Section 18 of this Act provides that: "Every person who shall lay or cause to be laid any pipe to communicate with any pipe belonging to the undertakers without their consent . . . or shall supply any other person with any part of the gas supplied to him by the undertakers, shall forfeit to the undertakers the sum of five pounds for every such offence, and also the sum of forty shillings for every day such pipe shall so remain . . . or such supply furnished." Moreover, "the undertakers may take off the gas from the house and premises so offending." These provisions were embodied, with the necessary modifications, in the Electric Lighting (Clauses) Act, 1899. It will be seen that if a tenant complains he stands to lose his supply altogether, to say nothing of incurring the landlord's odium.

* * *

Although Russia must be credited with many remarkable achievements some reports from that country have to be treated with reserve. We have heard a lot about the Baba traction system which, while no doubt founded on some kind of fact, has some of the attributes of the "Arabian Nights" tales with which the name is also associated. Now the *Evening News*, quoting Moscow Radio, says that a woman academician in Moscow has worked out a method of reviving electric shock victims by the application of high-frequency current at between 2,000 and 5,000 V. Experiments of this kind were carried out in the United States some years ago, but my recollection is that the business was so risky that they were dropped. The attendant hazards are so great that such a method would require a good deal of "working out."

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Commendable optimism is displayed by the Hong Kong Electric Co. in advertising for a deputy general manager for its undertaking "to take up duty in Hong Kong shortly after the reoccupation of the Colony has been completed." Recent news from the area gives grounds for hoping that the expulsion of the Japanese from Hong Kong will not be long delayed, although their continued possession of Formosa would remain a threat to the Crown Colony.

* * *

Perversity can surely be the only explanation of a reported decision to change over the public lighting at Sunbury and Ashford Common, Middlesex, from electricity to gas. So far I have seen no figures or facts quoted in support of the proposal, but there must be something wrong somewhere for such a backward movement to be considered.

—**REFLECTOR.**

Maximum Demand Tariff

Explaining its Working to Industrial Users

By W. B. Askew,
A.M.I.E.E., Assoc. A.I.E.E.

FACTORY owners and managers are not always fully informed as to ways and means of extracting full value from a maximum demand tariff. The best method of approach is not through starting a discussion that entails quoting grid costs, distribution costs, after-diversity demand, etc., but by explaining the fundamentals of the tariff by means of some such convenient analogy as is provided by the operation of a ring railway system serving a town and giving passenger facilities at a number of stations. After assessing the volume and frequency of the traffic, the railway company can combine the running charges of the individual trains with the standing charges of the various stations and operating staffs and then issue a ticket to each passenger on a unit basis of *x*d. per mile. Similar conditions prevail when the ordinary electricity consumer is charged a flat rate of *x*d. per kWh.

Standing Charge and Running Cost

When, however, a factory requires facilities which cannot be met by the existing system, the railway company may build a line for its special use, charging the factory *x*d. per mile, based upon the running cost of the individual trains required at the factory, plus a standing charge which will vary with the amount of use of the private line.

Suppose two factories to be supplied with individual railway lines, factory " A " requiring twenty-four trains to arrive between 8 and 9 a.m., and factory " B " receiving the same number of trains daily at the rate of one per hour. The running cost of the trains to each factory will be the same, but the demand made upon the individual traffic lines by factory " A " will require a much larger station and operating staff than that of " B." Its maximum demand charges must therefore be proportionately greater.

If the same system of charges were applied to factories " A " and " B," the latter would be at a comparative disadvantage. Just as the railway company would place a "number taker" on the side of the track to report upon the number of trains passing a given spot during the rush-hour, so a kVA maximum-demand indicator indicates the maximum flow of electricity during any one half-hour between meter readings.

As an example, taking the running costs of the railway supplying the two factories at £100 and the standing charges for factory " A " at £100; the running charges for " B," on account of its higher load factor would be only £20, making the totals £200 and £120, respectively. The manager of factory " A " would naturally consider whether arrival of trains could not be arranged so as to spread the traffic more evenly over the day's work. Substituting the electrical equivalents, it would probably be found that certain motors could be switched off during periods of maximum works output, *e.g.*, a motor installed to maintain a level of water in a storage tank which could provide all requirements during the peak period. This sort of investigation can be carried into other fields as, for instance, the possibility of switching off heating apparatus for short periods without serious reduction of temperature.

Whether it be railway or electricity supply, the main consideration is improvement of load factor. As the railway company will normally offer special terms to keep traffic off the main lines during the passenger peak hour, so in electricity supply an automatic reduction in charges is made when the load factor is improved by reducing the maximum demand in relation to the number of kWh used. This can be indicated to the works manager by means of a chart showing the variation in overall cost per kWh at different load factors. The attention of works managers should be drawn to the possibility of installing control devices which ensure automatically that only essential apparatus is used during maximum demand periods and allow others to be switched in as soon as the risk of increasing the maximum-demand indications has passed.

Effect of Power Factor

Another item which may have an important bearing upon maximum demand charges is power factor. A homely analogy can be taken of two horses pulling a cart in the same direction and thereby producing maximum work from their efforts. A sketch can be made showing the horses pulling the cart but with an angular displacement between them so that the useful work is less than maximum effort and then the effect of applying a force

at right angles to the line of straightforward pull in restoring maximum work. The corrective force is the equivalent of connecting condensers to the circuit to restore the phase displacement.

Steps should be taken to ascertain the over-all power factor when the works are running at maximum output. Ideally, each piece of apparatus functioning at a poor power factor is fitted with its own condensers, but this is not always practicable, particularly when the wiring has already been laid out.

It may, nevertheless, be possible to install condensers on sections of the main switchboard which control individual power units. Failing this, the use of a block of condensers to correct the power factor of the whole works under its worst conditions should be considered. With this method, however, the question as to whether the power-factor correcting condensers should be switched off at light load should be examined. Often the capital charges on the condensers is liquidated in the second or third year by the reduction in maximum-demand charges.

Electrical Development

Commissioners Relax Wartime Restrictions

IN a circular letter to electricity supply undertakings in April, 1942, the Electricity Commissioners stipulated that new or additional supplies of electricity should be afforded only if they were shown to be necessary in connection with the war effort or were for domestic or other purposes where serious or exceptional hardship would result if the supply were not provided. It was later indicated that these should be the guiding rules, even where fuel economy might be achieved by substituting electricity for other fuels.

The Commissioners have now notified undertakings that these restrictions may now be regarded as suspended, provided that certain considerations are observed. The position as regards labour and materials will continue to limit the amount of development which any undertaking can carry out for some time and it is therefore important that precedence should be given to essential supplies, in particular those required in connection with the war effort or with food production.

After these essential requirements have been met priority should be given to supplies for the following purposes :—(a) Those for essential civilian needs, such as water or sewage pumping; (b) Supplies to new buildings and to existing buildings rehabilitated after war damage or released from requisition, re-instatement of supplies and facilities required by returning evacuees, supplies to premises requiring additional facilities consequent upon the occupation of one house by two or more families; and (c) Other supplies for domestic or other purposes where the withholding of a supply would result in genuine hardship.

To ensure that the maximum number of people will benefit with a minimum expenditure on labour and materials, priority should also be given to the connection of premises on the routes of existing mains though for the time being preference within that priority should be given to the connection of those premises which have no reasonable facilities already.

It is pointed out that a licence will still be necessary for any building or civil engineering work costing more than £100 in the provinces (£10 after August 1st) or £10 in London and S.E. England in any 12-month period. The Commissioners propose shortly to address a letter to the undertakings concerned indicating a simplified basis on which authorisations will be given for such work costing more than £10 but less than £100.

In the case of public authority undertakings the Commissioners will be prepared to consider applications for consent to borrow for development on the foregoing lines and in respect of hire and hire-purchase schemes related to this development. Undertakings are asked to ease the Commissioners' task by applying for consents or authorisations only in respect of those projects which they expect to carry out within a reasonable period with the labour and materials available.

Labour requirements for housing and other post-war building are likely to delay the carrying-out of the five-year programmes already submitted by undertakings; accordingly even essential works should be so designed as to require the minimum of building labour. The Commissioners therefore do not anticipate that they will be able to approve, save in exceptional circumstances, the carrying-out of schemes for the building of new offices, showrooms or workshops or major alterations to such buildings during the first post-war year.

Undertakings' attention is drawn to the Government's White Paper on Employment Policy (Cmd. 6527) and it is stated that the Government is considering the lines on which the procedure proposed in paragraphs 62 and 63 can be applied to the programming of capital expenditure by public utilities. In conclusion undertakings are reminded that Treasury consent to capital issues is still required.

It is stated that the Minister of Fuel and Power has sent a similar letter to gas undertakings.

COMMERCE and INDUSTRY

Metal Licensing Relaxed. Hackney's Lack of Staff.

Exports to Channel Islands

THE Board of Trade has made the Export of Goods (Control) (No. 5) Order (S.R. & O. 1945, No. 754, Stationery Office, 1d.) which dispenses with the need for licences for the export of goods to the Channel Islands, with certain specified (non-electrical) exceptions.

Cheaper Aluminium Hollow-ware

Following a reduction in the price of aluminium sheet in March, the Board of Trade has now made Orders reducing manufacturers', wholesalers' and retailers' prices for aluminium hollow-ware. The Hollow-ware and Kitchen Hardware (Control of Manufacture and Supply) (No. 5) Order, 1945 (S.R. & O. 1945, No. 721) reduces the manufacturers' cash maximum prices for all the scheduled articles of spun or drawn aluminium hollow-ware, with the single exception of the cheaper type of 6-pint kettle, the price of which is unchanged. The cash maximum prices set out in the previous Order will continue to apply to any goods supplied before July 2nd. Wholesalers' and retailers' cash maximum prices for the same articles will be correspondingly reduced by the Aluminium Hollow-ware (Maximum Prices) (No. 2) Order, 1945 (S.R. & O. 1945, No. 761) which comes into operation on July 16th.

Copper, Zinc and Nickel Licences

The Ministry of Supply announces some easing of the licensing procedure with regard to copper, nickel and zinc. In the case of service and home civil orders it is no longer necessary to submit schedules of orders to cover applications for licences for copper, zinc and nickel. Instead, each application must be accompanied by the following signed statement :—" We certify that the quantity requested on the accompanying application is needed to cover orders for our products, and that in the case of applications for virgin metal full allowance has been made for our expected intake of scrap." In the case of export orders, there is no change in the existing procedure.

Inquiries should be made to the Joint Controllers, Non-Ferrous Metals Control, Grand Hotel, Rugby.

Ball and Roiler Bearings

The Minister of Supply has issued the Control of Ball and Roller Bearings (No. 3) Order, revoking the Control of Ball and Roller Bearings (No. 2) Order, 1942, the purpose of which was to control the acquisition and stocking of ball and roller bearings by prime users. The No. 1 Order still remains in force.

Industrial Canteen Wages

The Industrial and Staff Canteen Undertakings Wages Board, under the chairmanship of Mr. W. Gorman, K.C., has now reached a decision to give notice of its intention to submit to the Minister of Labour and National Service wages regulation proposals for minimum remuneration and holidays with pay affecting certain workers employed in industrial and staff canteens. A notice setting out the detailed proposals will be sent to all employers in the industry known to the Wages Board and a period of twenty-one days allowed within which written representations may be made regarding the proposals. A further meeting of the Board will be held to consider representations received and the question of submitting the proposals, with or without amendments, to the Minister with a view to his making an Order giving them legal effect.

Reinstatement Order

Sub-Section (2) of Section 12 of the Reinstatement in Civil Employment Act, 1944, provides that men or women released from the Forces or Civil Defence services and directed to work of national importance by the Ministry of Labour and National Service shall be deemed to have continued their war service until they cease to be employed upon the work to which they were directed or until the Minister makes a limiting Order fixing a date on which their war service shall be treated as at an end. Such an Order has now been made; it is entitled the Reinstatement in Civil Employment (Termination of Further Periods of War Service) Order (S.R. & O. 1945, No. 783, Stationery Office, 1d.). The limiting date is that on which the persons affected receive written notice from the Ministry or the Ministry of Labour for Northern Ireland stating that they will no longer be required to perform the whole-time service to which they were directed. Such persons may exercise their reinstatement rights, even though they are still performing the whole-time service referred to, not later than the fifth Monday after the limiting date.

Labour Shortage at Hackney

At last week's meeting of the Hackney Borough Council the Electricity Committee reported further on the serious labour situation at the generating station. The Committee stated that since the previous report in September, 1944, there had been considerable correspondence with the Ministry of Labour, the Electricity Commissioners and the C.E.B. and as a result of pressure brought to bear there was an improvement for a time in the number of men submitted. The position had, however, again deteriorated to such an extent that No. 1 boiler house had been shut down for the past ten weeks and the full demands of the C.E.B. could not be met.

The report referred to the abnormal sickness during last winter, the war strain on the men and the imperative need for them to have their annual holidays although no assurance of this could be given without additional labour. The routine summer overhaul was already behind schedule. In four months out of many interviews only eight men were found for employment at the station, and in the same period fourteen were released by the National Service Officer while a number of other applications

for release were pending. At the moment twenty-six additional men were needed at the station in order to satisfy the anticipated requirements of the C.E.B.

AC Stator Units for Aircraft

Since the equipment of the " Shetland " flying boat with AC motors of B.T.H. design and manufacture, further progress has been made and the accompanying illustration shows a group of 400-cycle AC stators made by the B.T.H. Company for a new type of aircraft.

The two largest stators are for alternators, the one in front being for a 1·2-kVA high-frequency inductor alternator for the radio and radar supplies. The larger stator at the back is for a 7·5-kVA, 400-cycle, three-phase alternator for the main power supply; it runs at 8,000 RPM and feeds the smaller units shown, which are all for induction motors of the 4-pole type running at approximately 12,000 RPM. The smallest, held in the hand, has an intermittent rating of 0·1 HP and the others range up to 1·5 HP. All these units use glass insulation as a safeguard against the arduous operating conditions.

Stators for aircraft motors and generators

New Ipswich Station

In our issue of June 22nd we reported the driving of the first of 6,500 piles to provide foundations for the new power station which the Ipswich Corporation is building for the C.E.B. The Franki Compressed Pile Co., Ltd., informs us that it is doing the pile driving work, acting as sub-contractor to Edmund Nuttall, Sons & Co. (London), Ltd.

Belgian Trade Inquiry

We learn from Monsieur Carlo Bruno, the managing director, of the formation of the Application Générale Electro-Mécanique (A.G.E.M.) with offices at 130, Chaussée de Charleroi, Brussels. The new company, which has a capital of 500,000 Belgian francs (to be raised to 1,500,000 fr.), is to deal with all kinds of electrical and electro-mechanical plant and materials for sale to the installers, industrial, commercial and domestic. The A.G.E.M. is anxious to establish relationships with British manufacturers with a view to securing representation for Belgium and neighbouring countries and as soon as circumstances permit Monsieur Bruno hopes to pay a business visit to this country.

Purchase Rights in Northmet Area

At a recent meeting of the Southgate General Purposes Committee a report was submitted of a conference convened by the London & Home Counties Joint Electricity Authority of local authorities in No. 4 area, of the authority possessing purchase rights over the electricity supply undertaking of the Northmet Power Co. The other authorities represented or invited to be represented at the conference were Enfield, Edmonton, Potters Bar, Tottenham and Wood Green. Similar conferences of the local authorities with purchase rights in the remaining areas of the Joint Electricity Authority have been or are being held.

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

After discussion the No. 4 area conference decided to appoint a sub-committee to prepare a reasoned statement of proposals for the exercise of purchase rights and to confer with the Electricity Commissioners if thought desirable.

Fatalities

College Pupil's Death.—The death of Eileen Thornton (17), a pupil at the Lowther School for Girls, Bodelwyddan, near Abergele, was inquired into at an adjourned inquest held at Rhyl. It was stated that a smell of gas had been noticed in the store-room next to the gas-generating room, where vaporised petrol-gas was produced for the laboratory bunsen burners. At the close of some chemistry tests Miss Thornton went to switch off the motor and afterwards came running out of the engine-room with her clothing ablaze.

Mr. R. A. Picken, Electrical Inspector of Factories for North Wales and the North-West said that after examining the plant he formed the opinion that something must have gone wrong as far as the gas-generator was concerned, causing gas to escape, and this was probably ignited by a spark from the main switch when Miss Thornton went to switch it off. He would suggest that all the electrical apparatus in the room should be flameproof and also that the size of the gas compressor should be so related to the capacity of the generator as to reduce

to an absolute minimum any risk of the seals on the generator being destroyed. Prof. F. J. Teago, Professor of Electrical Engineering at Liverpool University, agreed with Mr. Picken's recommendations, and also with his theory as to the cause of the accident.

The coroner said that the college authorities seemed to have done all that was required of them to ensure the safety of the gas-generating plant.

Used Iron to Heat Bath.—A nine-year-old girl, Joan Angell, who had no electricity in her own home, was stated at an inquest at Ludlow to have used an electric iron to heat a bath while on a visit to her aunt's home. A cousin, Norah Angell, said that after plugging into the light socket Joan put the iron into the bath and undressed. Later, hearing a scream, she found Joan half in and half out of the water, clutching the taps. Mr. E. S. Sanderson-Hennard, of the S.W. & S. Co., stated that the girl would have received the fatal shock when she took hold of the taps. A verdict of " Misadventure " was recorded.

The Cable Companies' Merger

We report in the " Financial Section " of this issue the approval of the majority of the stockholders of British Insulated Cables, Ltd., and Callender's Cable & Construction Co., Ltd., of the merging of the companies in British Insulated Callender Cables, Ltd. As from June 29th the new company acquires the main assets of the two concerns and will be responsible for their liabilities. Future communications to the new company should be sent to the address to which correspondence has hitherto been sent.

Crompton Parkinson Development

Crompton Parkinson, Ltd., announce that as from July 1st the three companies which they acquired in 1941, the Young Accumulator Co., Ltd., A. E. Morrison & Sons, Ltd., and Electricars, Ltd., will cease to function as separate sales entities and will be merged into the Crompton Parkinson organisation. Orders outstanding and not invoiced at June 30th are to be executed by Crompton Parkinson, Ltd., by whom the invoicing and rendering of accounts will be carried out. The brand names under which the products have been previously sold—" Young ", " Morrison-Electricar " and " Electricar "—will be retained.

Tropical Packaging

It has been decided to continue the Anglo-American Services Exhibition on Tropical Preservation and Packaging, which was opened at Feltham, Middlesex, in October last, for another three or four months. The number of applications for invitations in the early months was far in excess of the day-to-day capacity of the exhibition, and limitations had to be imposed on the number of representatives sent by individual firms. It is now possible, however, to accept a much wider representation from industrial firms, and managements can be permitted to send key members of their staffs engaged on preservation and packaging work. Parties will be organised from all parts of the country. Applications for invitations for such personnel as shop managers, foremen, and charge hands, should be sent to the Exhibition Officer, Anglo-American Services Exhibition, Central Ordnance Depot, Feltham, Middlesex.

Electrical Machinery Traders

A general meeting of the Electrical Machinery Traders' Association will be held at the Holborn Restaurant, Holborn, London, W.C.1, at 2.30 p.m. on Tuesday, July 17th.

Trade Publications

Metway Electrical Industries, Ltd., King Street, Brighton, 1, Sussex.—Very comprehensive illustrated and priced list (No. MYD.1) of replacement heating elements of many shapes for different makes of fires, irons, kettles, wash boilers, boiling rings and hair dryers.

British Insulated Cables, Ltd., Prescot, Lancs.—Pamphlet (NSC.13) describing the construction and installation of non-bleeding cables of the " Sandwich " type, built up of alternate layers of pre-impregnated and dried non-impregnated paper tapes.

IEDA Publications Dept., Stanground, Peterborough.—Well illustrated booklet printed in two colours briefly describing diverse kinds of building and civil engineering works carried out by the Mitchell Construction Co., including power stations, hyperbolic reinforced concrete cooling towers and conveying plant. Also illustrated brochure concerned with new " ML " building products in the form of bricks, slabs and hollow blocks, made from waste ash, offered by the Ieda Trading Co., Ltd.

Elliott Brothers (London), Ltd., Century Works, Lewisham, London, S.E.13.—Illustrated booklet (list 812, fourth reprint) describing the construction and operation of different types of electrical recorders of temperature, humidity, gas analysis, etc., including the latest " S " type which is smaller and cheaper than the regular " L " types.

Applicants for copies of these publications should write on business letter headings.

Trade Announcements

The General Accessories Co., Ltd., is closing its Bristol works from July 28th to August 7th. A skeleton staff will deal with urgent correspondence.

Dyson & Co., Enfield (1919), Ltd., will be closing their works from July 28th to August 8th.

INFORMATION DEPARTMENT

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

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

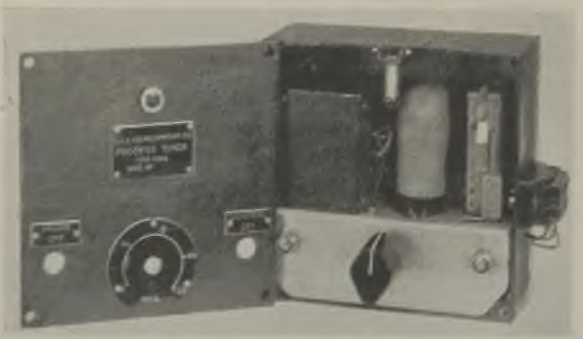
" Pluslite," Horstman (?).

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Electronic Process Timer

A SMALL self-contained timing device of the electronic class for the control of a variety of processes is announced by the G. G. C. DEVELOPMENT CO., 109, Belgrave Road, London, S.W.1.



Electronic process timer

Type PT. 101A is assembled in an ironclad case measuring 6 by 6 by 3 inches and weighing 10 lb. Its standard range extends from 0 to 25 seconds and only one T. 41 "Mazda" valve is used, the controlling circuit being suitable for AC up to 5 A at 230 V, or 1 kW, although larger contactors may be fitted. Control can be effected by setting a dial to the time required for repetition of operations, or for providing delay between functions.

Although originally intended for machine tools, this device may be used for regulating the operating cycle of such machines as bar twisters for making concrete reinforcing rods, the moulding time of rubber and plastics presses, heat treatment of metals as well as for timing photographic exposures and similar purposes needing variable control.

Improved Fire Alarm System

Many fire alarm systems are limited in scope by the fact that once the circuit has been closed (by breaking the glass in the alarm contactor) the system becomes inoperative until such time as the glass has been replaced and the circuit restored. Then again, it is impracticable in some systems to carry out thorough tests without causing an alarm signal to be given.

The system recently developed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, overcomes these limitations. Thus, when an alarm has been given on a particular line, that line can be immediately isolated and the remaining lines will be ready to register further alarm signals should the fire spread. In addition, continuity tests can be made on each circuit separately, including the appropriate line indicator, without interrupting the availability of the system for instant operation. The indicator panel with screens appropriately lettered, corresponding line-jacks, a warning bell and lamp and a relay are all mounted in a strong hardwood case.

When an alarm is given and has received attention all bells are silenced by inserting a plug in the appropriate line-jack, thereby cutting out the alarm bells for that circuit only. At the same time, the insertion of the plug lights a red lamp on the panel which will continue to glow until the circuit has been restored to normal by replacement of the glass in the alarm contactor. When this is done the lamp is extinguished and a bell rings on the panel to indicate that the circuit has been opened again. Withdrawal of the plug silences this bell.

Domestic Appliances

B. & T. COMPONENTS, LTD., 4-12, Whiston Road, E.C.2, have introduced a "streamlined" iron. The handle of the iron is bakelite, the metalwork being either chromium-plated or anodised aluminium in primrose, light green or light blue. A special feature is the ease of replacement of the element and resetting of the thermostat. Another type of iron is shaped to fit the hand.

A heater-cooker produced by the same concern has a 1-kW rod-type element protected with a "Perspex" guard for the heater section, which is arranged almost vertically, the horizontal cooker position having two 500-W elements concealed under a sheet-metal plate. Anodised aluminium in two colours will be the final finish. A combined rubber flex and plug is used on both the appliances.

Intensive Engineering Courses

MR. W. C. S. Phillips, Head of the Department of Electrical Engineering and Physics, Borough Polytechnic, S.E.1, tells us that his department has again arranged intensive courses in electrical and radio engineering under the Hankey Scheme. They will commence on Monday, October 2nd, and intending students should apply as soon as possible. The conditions for entry are the same as for previous courses; they are full-time six-month courses in which students obtain free tuition and a maintenance grant.

Transmission-Line Surges

With Special Reference to Travelling Waves

By R. J. Birkinshaw,
A.R.T.C.S., Graduate I.E.E.

THE most severe stresses that line elements of a transmission line have to withstand are due chiefly to atmospheric disturbances, switching operations and arcing grounds. These take the form of impulse waves, the shape of which is illustrated in Fig. 1, causing a changing electrical condition to be transferred along the line, away from the point of initiation. This change may be considered to occur as two travelling waves

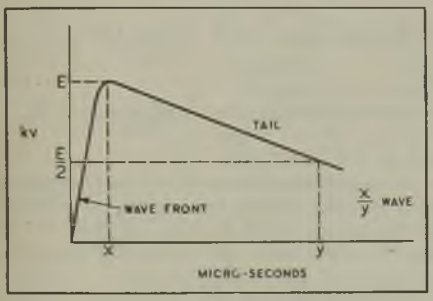


Fig. 1

mutually sustaining each other, one being a change in current and the other a change in voltage.

Atmospheric disturbances caused by lightning are due to cumulative electrical charges on droplets of water vapour suspended in air. As the accumulation of these charges increases, the electrical strength of the surrounding air is exceeded and a discharge or lightning flash is initiated, usually negative.

Lightning strokes to earth are of two kinds, α and β strokes. An α stroke is a comparatively slow stroke and relies upon induced electrostatic charges to ionise the air surrounding the highest points. Its characteristics are the lengthy time of production of discharge and the striking of tall objects. A β stroke is usually caused by intercloud discharges. Its characteristics are extreme rapidity of discharge and apparently random way of reaching earth (*i.e.*, not necessarily striking high objects).

Switching surges in the majority of cases are a result of switching-in operations. In practice their maximum value is seldom more than four times the phase-to-neutral voltage and they do not subject the line to such severe stresses as lightning. Other factors tending to produce surges include cable faults, birds and insulator failures.

In regard to arcing grounds, at one time it was the practice to insulate the neutral point, thus confining a fault to its own particular phase, keeping the line operative and eliminating zero-phase-sequence currents. Within limits this proved successful, but with the advent of longer transmission lines and higher operating voltages a serious trouble arose due to arcing grounds.

Arcing occurs from the faulty line to earth and continues until the line reaches earth potential, when the arc is extinguished. The line potential then begins to rise again and the process is repeated. This produces a series of waves or oscillations which are cumulative in character and tend to break down the other two phases. Elimination of arcing grounds is accomplished either by solidly earthing the neutral (British and American practice) or by arc-suppression or Petersen coils (Continental practice).

Equations for travelling waves are similar to those for vibrating strings which, being less abstract are possibly more easily appreciated. If a string is held taut between two supports as in Fig. 2 and given a displacement in t seconds with a velocity b, then at this point $y = f(x - bt)$ or $\phi(x + bt)$, according to the direction of the displacement. If b is constant and t is increased the term bt increases and x must also

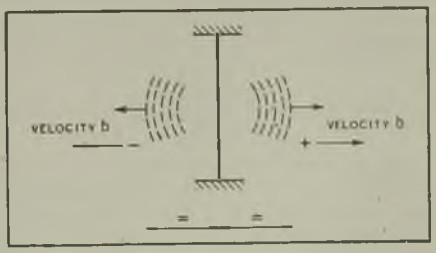


Fig. 2

increase. Therefore $y = f(x - bt)$ represents travel to the right or positive travel. Similarly if the string is displaced to the left $y = \phi(x + bt)$ and the travel is negative.

From the foregoing, the following equation

can be set up $y = f(x - bt) + \phi(x + bt)$...(1)

Eliminating the arbitrary functions,

$$\frac{\delta y}{\delta x} = f'(x - bt) + \phi'(x + bt) \quad \ldots\ldots(2)$$

$$\frac{\delta v}{\delta t} = -bf'(x - bt) + b\phi'(x + bt) \quad \ldots\ldots(3)$$

$$\frac{\delta^2 y}{\delta x^2} = f''(x - bt) + \phi''(x + bt) \quad \ldots\ldots(4)$$

$$\frac{\delta^2 y}{\delta t^2} = b^2 f''(x - bt) + b^2 \phi''(x + bt) \quad \ldots\ldots(5)$$

$$= b^2 \left[\frac{\delta^2 y}{\delta x^2}\right]$$

$$\therefore \frac{\delta^2 y}{\delta x^2} = \frac{1}{b^2}\left[\frac{\delta^2 y}{\delta t^2}\right] \quad \ldots\ldots(6)$$

Consider now a travelling wave. Equations are obtained in exactly the same way as for vibrating strings. Referring to Fig. 3, consider $y = f(x)$ referred to Ox, Oy. During time t this has moved a distance d, hence considering co-ordinate axis Oy to move with it $y = f(x')$ referred to O'y, O'x or $y = f(x - vt)$ where $vt = d$, v being the

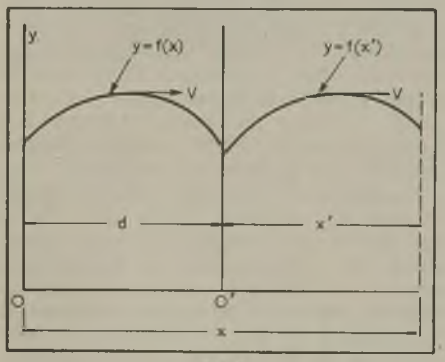


Fig. 3

velocity of propagation of the wave. This has already been proved to be positive travel. $\therefore y = \phi(x + vt)$ is negative travel. Hence from (1) $y = f(x - vt) + \phi(x + vt)$..(7)

$$\text{From (6)} \quad \frac{\delta^2 y}{\delta x^2} = \frac{1}{V^2}\left[\frac{\delta^2 y}{\delta t^2}\right]$$

$$\text{or} \quad \frac{\delta^2 y}{\delta t^2} = V^2\left[\frac{\delta^2 y}{\delta x^2}\right] \quad \ldots\ldots(8)$$

Fig. 4 shows a section of two parallel feeders of an "ideal cable" (*i.e.*, resistance and leakance neglected) having a capacitance and self-inductance per unit length of C and L respectively. Imagine a small section of line δx: the capacitance of this will be $C\delta x$. Since current = capacity in farads × rate of change of voltage, $\delta i = C\delta x \frac{\delta e}{\delta t}$ or $\frac{\delta i}{\delta x} = C\frac{\delta e}{\delta t}$ .....(9)

Similarly for inductance, voltage = inductance in henries × rate of change of current.

$$\therefore \delta e = L\delta x \frac{\delta i}{\delta t} \text{ or } \frac{\delta e}{\delta x} = L\frac{\delta i}{\delta t} \quad \ldots\ldots(10)$$

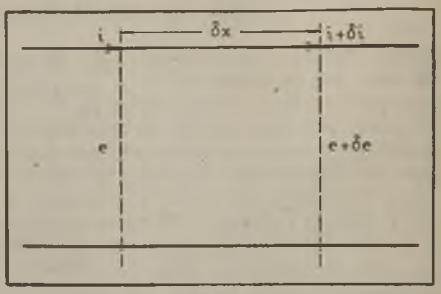


Fig. 4

Differentiating (9) with respect to $t \frac{\delta^2 i}{\delta x . \delta t} = C\frac{\delta^2 e}{\delta t^2}$ .....(11)

Differentiating (10) with respect to x, $\frac{\delta^2 e}{\delta x^2} = L\frac{\delta^2 i}{\delta t . \delta x}$. $\therefore \frac{\delta^2 e}{\delta x^2} = LC\frac{\delta^2 e}{\delta t^2}$ .....(12)

In establishing equation (8) the assumption of a moving y axis was made; in effect it is the voltage which travels, therefore $y = e$ may be substituted. By comparing equations (8) and (12) $\frac{1}{V^2} = LC$ or $V = \frac{1}{\sqrt{LC}}$ ....(13)

Assuming the dielectric of the line is air, the capacitance of two parallel feeders spaced d.cm. apart with a radius r.cm. is given by $\frac{1 \times 9 \times 10^{-11}}{4 \log_e d/r}$ farads per cm.

Adopting the same symbols, inductance $L = 4 \log_e d/r \times 10^{-9}$ henries per cm.

From equation (13) $V = \frac{1}{\sqrt{LC}} =$

$$\frac{1}{\sqrt{4 \log_e d/r \times \frac{1}{4 \log_e d/r} \times 10^{-9} \times 9 \times 10^{-11}}}$$

$$= \frac{1}{\sqrt{\frac{1}{9 \times 10^{11} \times 10^{9}}}} = \frac{1}{\sqrt{9 \times 10^{20}}}$$

$\therefore V = 3 \times 10^{10}$ cm. per second. This is approximately the velocity of light. Thus waves travelling along air-surrounded lines have a velocity approaching 186,000 miles per second, which is quite independent of the frequency of the wave.

A practical application of this velocity occurs in the design of delay cables in cathode-ray oscillography. Suppose the incidence of sweep tripping impulse is to come into operation one micro-second before the actual transient to be recorded arrives at the voltage deflection plates of the instru-

ment. Then, length of delay cable required, assuming air dielectric $= \frac{3 \times 10^{10}}{10^6 \times 100}$ metres = 300 metres.

Similarly, if a single-conductor concentric pure rubber cable was used having a specific inductive capacity of 2·2, length of delay cable $= \frac{3 \times 10^{10}}{10^6 \times 100 \times 2 \cdot 2} \simeq 138$ metres.

To investigate surge impedance two assumptions are made, *viz.*, during time of disturbance the power-frequency voltage and current are constant (which is justifiable considering the high velocity of propagatoin of the surge impulse) and wave shapes are rectangular.

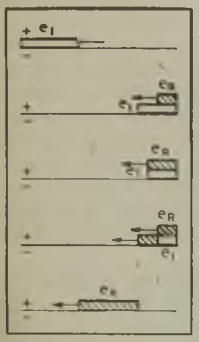


Fig. 5

Travelling waves may consist of a single surge or a train of surges. It will be appreciated that the steepness of the wave front is proportional to the stress in a dielectric. Obviously the most onerous conditions exist when the maximum value is reached instantaneously and remains constant, whence rectangular waves.

Consider section of the line δx. Charge q on this section $= C\delta xe$. Wave of velocity V passes this section in time $\frac{\delta x}{V}$ $q = \int i.dt$.

$$\therefore i = \frac{C\delta xe}{\delta x/v} = Cev \quad \ldots\ldots\ldots\ldots\ldots\ldots (14)$$

Surge impedance $Z_0 = \frac{e}{i} = \frac{e}{Cev} = \frac{1}{CV}$.

Substituting value of V from equation (13)

$$Z_0 = \frac{1}{C\sqrt{\frac{1}{LC}}} = \sqrt{\frac{L}{C}} \text{ ohms} \quad \ldots\ldots\ldots (15)$$

In practice this has a value of approximately 500 Ω for overhead lines and 50 Ω for cables.

Pursuing the stretched string analogy a little further, imagine the string given a displacement within its elastic limit. Assuming no energy loss, it will spring back to a corresponding position on the other side of the datum line from which it was originally displaced. This is analogous to the incident and reflected waves of travelling wave theory.

Three examples are considered below for an infinitely long line or open-circuited line, a short-circuited line and a line terminated by a resistance. The following symbols are employed: i_R, e_R = reflected current and voltage waves; i_T, e_T = transmitted current and voltage waves; i_I, e_I = incident current and voltage waves; Z_0 = surge impedance and R = terminating resistance.

In the first two examples $e = Zi_I$ $e_R = -i_R Z$. Total voltage $= e_I + e_R$. Total current $= i_I + i_R$. $\therefore e_I + e_R = R[i_I + i_R]$. $Z_0[i_I - i_R] = R[i_I + i_R]$; $i_R = \left[\frac{(Z_0 - R)}{(Z_0 + R)}\right] i_I$

$e_R = -i_R Z_0 = \left[\frac{(R - Z)}{(R + Z)}\right] e_I$. $\therefore i_I + i_R = \left[\frac{2Z_0}{Z_0 + R}\right] i_I$; $e_I + e_R = \left[\frac{2R}{Z_0 + R}\right] e_I$.

In (1) $R = \infty$. $\therefore$ Total current $= 0$. Total voltage $= 2E$ (Fig. 5). In (2) $R = 0$. $\therefore$ Total current $= 2i_I$ (first reflection). Total voltage $= 0$ (Fig. 6).

In the third example, $i_1 = i_R + i_T$; $e_I = e_R + e_1$, $\frac{e_T}{i_T} = Z_0$, $\frac{e_R}{i_R} = -Z_0$, $\frac{e_I}{i_1} = R$. $e_R = e_I - e_T = Ri_I - e_T = R[i_R + i_T] - e_T = R\left[-\frac{e_R}{Z_0} + \frac{e_T}{Z_0}\right] - e_T$; $e_R = -\frac{Re_R}{Z_0} + \frac{Re_T}{Z_0} - e_T$.

$\therefore e_R + \frac{Re_R}{Z_0} = \frac{Re_T}{Z_0} - e_T$; $e_R\left[\frac{Z_0 + R}{Z_0}\right] = \frac{Re_T - Z_0 e_T}{Z_0}$; $\therefore e_R = e_T\left[\frac{R - Z_0}{R + Z_0}\right]$. Similarly, $i_R = i_T\left[\frac{R - Z_0}{R + Z_0}\right]$. Hence if terminating resistance R is equal to the surge impedance there is no reflection.

A great danger accompanying travelling waves is the risk to inductive apparatus, in particular transformers. At 50 cycles the characteristics of a transformer (neglecting resistance) are similar to those for a pure inductance, the small turn-to-turn capacitance being negligible.

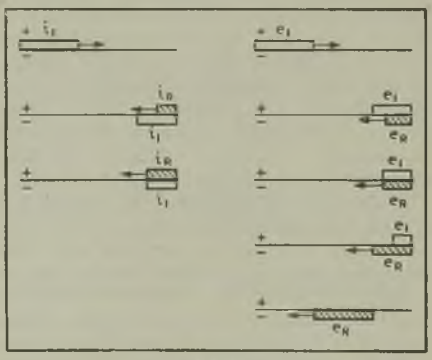


Fig. 6

At higher frequencies, however, the inductive reactance becomes higher while the turn-to-turn capacitative reactance becomes lower, therefore currents due to high-frequency voltages have a marked tendency to take the path of lower reactance. A travelling wave meeting a transformer behaves as a high-frequency wave, the steepness of the wave front being equivalent to the first quarter-cycle of the high-frequency wave (in the case of a rectangular wave it would be of infinite frequency). Therefore the initial voltage distribution depends upon the capacitance, but the steady distribution depends upon the inductance. During this

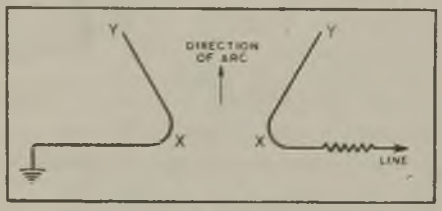


Fig. 7

finite time dangerously high voltages pile up on the line end turns of the transformer, tending to break down the insulation.

There are various ways in which this initial voltage stress may be reduced. One method employs specially wound coils. Another common preventative is the static end ring. It is sometimes the practice to increase the insulation of turns adjacent to the line. This method while working quite well under certain conditions cannot be applied universally. The main criticism is, that by increasing the insulation of the end turns the corresponding turn-to-turn capacitance is reduced, thereby increasing the initial concentration of voltage stress. Other devices to minimise the effect of surges on transformer windings include auxiliary capacitance connected in series or parallel.

The duty of system protection devices is to reduce the wave-front slope, the impulse-wave peak and the impulse-wave tail. The apparatus may be included in the line or branch from the line. In both cases the underlying object is to dissipate the maximum amount of energy under transient conditions.

Earth wires carried above the overhead lines and connected to earth at frequent intervals provide an efficient protection against α lightning strokes and also tend to diminish the effect of travelling lightning disturbances. If the line is struck by lightning the voltage produced will equal the product of the surge current and tower-footing resistance, upon which will depend the severity of a flashover. As the surge current is uncontrollable, the tower footing resistance must be kept as low as possible.

In its simplest form, the horn-gap arrestor (Fig. 7) consists of two arms set at too small a distance apart for the normal line voltage to initiate an arc. Any flashover will occur at XX and, owing to the heating of the air surrounding the arc and to electromagnetic forces, the arc will be forced upwards to YY, where the gap is wider and the normal voltage insufficient for maintenance of the arc. As the horn gap is unable to rupture heavy-current arcs, a current-limiting resistor is usually placed on the line side of the apparatus. A drawback with this type of arrestor is its high-impulse ratio, *i.e.*, the ratio of impulse flashover voltage to the peak value of the normal power-frequency flashover voltage.

The surge absorber consists, in effect, of an inductance in series with the line, having an appreciable earth capacitance due to its being mounted inside a steel tank. A high-frequency surge induces eddy currents in the tank which acts as a short-circuited secondary, thus dissipating the energy which the surge supplies. The effect of the absorber is to uniformly distribute the surge voltage.

In recent years, ceramic non-linear resistors have found an increasing field of application in both light and heavy engineering. The chief materials in use are "Atmite", "Wittonite," "Thyrite" and "Metrosil." These all exhibit an inverse resistance characteristic, *i.e.*, as the voltage increases the resistance decreases thus:—

$$\left.\begin{aligned} V &= KI^{\beta} \\ I &= HV^{\alpha} \end{aligned}\right\} \text{ V and I are not small, where } \beta = \frac{1}{\alpha}$$

Usually the resistors are in disc form, a number of which are connected together in series with a spark gap, and the whole connected between line and earth. When the line voltage rises to, or above, a certain predetermined value, the spark-gap flashes over. While the voltage remains high a large current is permitted to flow to earth. When the surge is discharged the non-linear resistor restricts the normal follow-through current to a small value, which the gap easily clears.

Reference : E.R.A. Publication S/T 35.

Throughout this article the symbol δ has been employed to denote partial differentiation.

ELECTRICITY SUPPLY

Birmingham Accounts. Canadian Water Power.

Birmingham.—NET PROFIT.—The annual report of the Electric Supply Department for the year ended March 31st shows a surplus of £33,130. The revenue for the year was £4,703,820 and the trading expenditure amounted to £3,803,279. The total capital raised to date for the undertaking is £23,768,912, of which £10,659,685 has been redeemed. The quantity of electrical energy sold within the undertaking was approximately 1,261 million kWh.

London.—SCHOOL LIGHTING.—The L.C.C. is to install electric lighting at the Gordon School, Woolwich, at an estimated cost of £1,000.

Mansfield.—EXTENSION OF AREA.—It is proposed to apply for a Special Order extending the area of the electricity undertaking so as to include Scarcliffe and Shirebrook parishes in the Blackwell rural district, together with Carburton, Cuckney, Holbeck, Nether Langwith, Norton and Welbeck in the Worksop rural district.

St. Faith's and Aylsham.—ELECTRICITY FOR TEMPORARY HOUSES.—The Rural District Council has decided to ask for its temporary houses to be provided with electrical domestic equipment.

Skipton. — CHARGES INCREASED. — Electricity charges, which have remained unaltered throughout the war, have been increased as from July 1st the Electricity Commissioners having approved the revision. Under the "all-in" tariff the running charge is now ½d. instead of ¼d., adjustments are made in the fixed charge, and all tariffs are increased by 10 per cent.

Tynemouth.—LOANS.—The Town Council has applied for sanction to borrow £8,000 for mains and services and £4,000 for substation plant.

Watford. — ELECTRICITY ON THE FARM. — Working demonstrations of electrical equipment for farm and home will be given at the Watford and District Agricultural Show at Cassiobury Park on July 14th.

PUMPING PLANT.—The Water Committee is to consider the electrification of one of the pumping stations where the plant is thirty years old.

Willesden.—SUPPLY TO EMERGENCY HOUSES. —Application has been made to the Electricity Commissioners for sanction to borrow £14,000 for substation equipment and mains for the sites of the emergency factory-made houses.

Overseas

Canada. — WATER-POWER RESOURCES. — According to the annual review of the Dominion Water and Power Bureau, Surveys and Engineering Branch, Department of Mines and Resources, the present recorded water-power resources amount to 25,439,400 HP under conditions of ordinary minimum flow and 39,511,700 HP ordinarily available for six months of the year, which corresponds to a potential turbine installation of more than 51,350,000 HP. The total turbine installation (as at January 1st, 1945) is 10,283,763 HP, so that a large proportion of the water power of Canada still awaits development. The wartime expansion in hydro-electric facilities was virtually completed in 1944, the net increase for the year being only 69,250 HP—the smallest recorded since 1939—and no large power projects are now under construction. The provinces of Quebec and Ontario (5,848,572 and 2,673,443 HP respectively) contain nearly 83 per cent. of the total developed water power.

BONNEVILLE POWER CONTRACT.—Bonneville Administration and the British Columbia Electric Railway Co. have signed a contract by which the former will build a line to meet one to be built from Vancouver, B.C., for delivery of Columbia River power to Vancouver. The initial demand will be for 22,000 kW, but this will eventually be increased to 60,000 kW. Transmission will be by a 23,000-V wooden pole line from Arlington, Washington, northwards.—*Reuter's Trade Service.*

Spanish Morocco. — POWER SUPPLY. — The Spanish journal *Metalurgia y Electricidad* reports that there are sixteen power stations in operation in Spanish Morocco, all but one of which are thermal. The two most important plants in the area are those of the Sociedad Electras Marroques, Tetuan, and of the Compania Espanola de Minas del Rif. The two stations of the Tetuan concern represent 70 per cent. of the aggregate productive capacity and the Rif concern's plant 17½ per cent. The latest figures of power output are those for 1941, when it amounted to about 30 million kWh.

TRANSPORT

Norway.—RAILWAY ELECTRIFICATION.—According to a statement by the Director General of the State Railways, electrification of all Norway's main railway lines is to be undertaken immediately in response to general public demand. Work on the Bergen-Voss line will start immediately.—*Reuter.*

South Shields.—TROLLEY-BUSES.—The Town Council's last tram service operating to the Ridgeway will be replaced by trolley-buses by the end of this year provided labour and materials are available. Trolley-buses are also to be run to the Lawe.

Wolverhampton.—EXTENSION OF TIME. — The Ministry of War Transport has made an Order extending for three years the time for the commencement of running of trolley-buses on certain routes.

RADIO and TELEPHONY

India.—TELEPHONE LINK WITH CHINA.—The telephone line between Calcutta and Kunming has now been completed, and India has been linked with China by telephone for the first time. The new line is about 1,750 miles long and runs through some of the most difficult and undeveloped country in the world. It has been built with British material by American engineers and Indian and Chinese labour. Work on the line began in April, 1943.—*Reuter.*

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

W. T. Henley's Telegraph Works Co., Ltd.—In the course of his speech at the annual meeting last Friday the chairman, Sir Montague Hughman, spoke at some length of the wartime achievements of the company, particularly the manufacture of buoyant cable for magnetic mine sweeping and the "Hais" oil pipe line across the Channel both of which developments have been described in the *Electrical Review*. In addition to this, Sir Montague said that the company had produced more than seven million parts for bombs and shells, as well as parts of rocket-firing apparatus, petrol tanks, radiolocation, cable connectors and for small arms ammunition—a total of over 170 million parts. The Tyre Company had made 14 million gas masks and 23 million tennis balls for the buoyant cable. Well over 150,000 "Solon" soldering irons had been supplied to Government Departments and munition factories and electrical equipment for the Forces had passed through their factories in abnormal quantities.

The Contract Department had carried out work on 576 sites all over the British Isles, as well as a number of secret and important cable-laying jobs for the R.A.F. and Admiralty and cable installations for some large new generating stations. Two contracts for 132-kV gas-cushion cable had been carried out for the Central Electricity Board. The company had sustained a good deal of damage from air attacks including the loss of their head offices in Holborn Viaduct in 1941. Millions of yards of all kinds of cable had been turned out under great difficulty and much had been done in the development and application of plastic insulation.

All this had naturally prevented them from meeting all their customers' requirements but now, although the war with Japan had still to be won, it was hoped that some of the departments would be able to get back to normal peacetime production. Sir Montague mentioned the company's educational work which was in the hands of Mr. V. B. Twiss, M.A., and spoke appreciatively of the work of the company's chief engineer, Dr. P. Dunsheath. He said that 1943 was a record year for the company and that general home business (except outside contracts) and overseas business (16·4 of their total) had been maintained in 1944.

The Telegraph Condenser Co., Ltd.—Speaking at the annual general meeting on June 28th, Mr. W. H. McFadzean, chairman, said that in every type of radio set and instrument used by the Forces, the components manufactured by the company had played a vital part. The main problems had been to meet all demands, both for quantities and for special and ever-changing purposes. Output had been increased to many times its pre-war level. The company had originated many novel designs of condensers as, for example, for use in aircraft flying at great heights and extremely low temperatures and by our armed forces operating under severe tropical conditions. Technical improvements made during the war, added to its reputation for quality and service, should place the company in a strong competitive position. Steps had already been taken to recapture and develop overseas markets. With a view to providing space additional to that available at the main Acton factory, negotiations were well advanced for renting another factory.

The Chloride Electrical Storage Co., Ltd.—The net profit for the year ended March 31st last, after taxation, was £301,033, as compared with £267,672 for the previous year. Reserve for development, etc., again receives £50,000: £57,000 is allocated to employees' benefit and pension funds (including subsidiaries). As reported last week, a final dividend of 5 per cent. and a bonus of the same amount are again being paid on the "A" and "B" ordinary stock, making the total distribution for the year 15 per cent. A sum of £203,913 (£176,905) is carried forward.

The Electric Construction Co., Ltd., in its accounts for the year ended March 31st last, shows a net profit of £86,488, after provision for E.P.T., against £90,120 for 1943-44. From this is deducted income tax provision of £42,500 (£41,000). General reserve receives £20,000 (£15,000), but this year there are no allocations to deferred repairs and the superannuation fund which last year received £4,600 and £2,500 respectively. The dividend on the ordinary stock is maintained at 12½ per cent. and £40,149 (£38,411) is carried forward.

British Insulated Callender's Cables, Ltd.—The resolutions for the amalgamation of British Insulated Cables, Ltd., and Callender's Cable & Construction Co., Ltd., were passed by very large majorities at meetings of the different classes of stockholders of the two companies last week, and at the subsequent extraordinary general meetings.

Johnson, Matthey & Co., Ltd.—Some of the company's activities during the war were referred to by Mr. H. W. P. Matthey, chairman, at the annual general meeting on June 27th. The company's rhodium plating process, he said, had been used in the protection of millions of components of electrical and radio apparatus. Platinum was indispensable in aircraft magnetos and sparking plugs and as a contact material in telephone relays, radio and radiolocation equipment, and many other types of control gear. The use of platinum/rhodium-platinum thermocouples had been extended to temperatures of over 1,600 deg. C. encountered in steel making. Over 250 million silver and silver alloy contacts had been made in the last five years in the form of rivets, turned parts, pressed parts formed from silver inlaid in copper and complete sub-assemblies.

Several tons of "liquid silver" had been prepared for depositing on to mica for electrical condensers and, having invented both a new silver paste and a new method of depositing it, they had produced several millions of silvered mica condenser plates. They had also recently developed a material and a method for depositing silver whereby it could be fused on to electrical porcelain or glass, thus providing a metallised

surface to which other metal could be soldered. Beryllium copper had been rapidly adopted during the war for contact springs in switchgear, instruments and radio equipment, for pressure gauge tubing and similar applications. Other alloys of this type were extensively used as resistance welding electrodes and as castings for structural parts of switchgear, arc furnaces and other electrical equipment. Elkonites were employed in heavy-duty switchgear where great hardness and resistance to electrical erosion were required, but where high electrical conductivity was essential.

Cable & Wireless (Holding), Ltd.—Sir Edward Wilshaw, chairman, and managing director, stated at the annual general meeting on June 28th that taxation in the war years for the group of companies reached a grand total of about £30,000,000. These payments bore rather hardly on them because at the outbreak of the war they were beginning to reap the benefit of a forward policy of development. With regard to the discussions afoot involving the creation in Britain, the Dominions and India of public utility corporations, owned by the state, to take over the conduct of external telegraph and telephone activities now in private hands, he said that talks were still in progress and stockholders would be consulted before any irrevocable steps were taken by the board. During the last few years the group of companies had provided a noteworthy example of the part that private enterprise could play in an emergency.

Cable & Wireless, Ltd. (the operating company).—In a statement made at the annual general meeting on Thursday last week Sir Edward Wilshaw, chairman, outlined the contribution which the company had made to the war effort. They had continued to operate all cable and wireless services from London. In May, 1941, the central telegraph station in Moorgate was destroyed by enemy action but thanks to careful planning their activities were transferred to their present headquarters in Electra House, Victoria Embankment, without seriously dislocating the flow of traffic. In 1944 there was a direct hit on the new office by a flying bomb. Despite the damage their emergency power supply was brought into action and all the overseas telegraph circuits were working within twenty minutes.

Forty-seven new wireless circuits had been opened since September, 1939. Photo-telegraph services were now handling two thousand pictures a month compared with one hundred before the war. Four relay stations had been opened to overcome the fading of the wireless beam and to help provide a continuous wireless service, principally to Canada, Australia and New Zealand. Charges for telegrams over many circuits had been reduced.

Marconi's Wireless Telegraph Co., Ltd.—The lack of young and talented technicians suited to the company's specialised work was a handicap to post-war business mentioned by Admiral H. W. Grant, chairman and managing director, at the annual general meeting last week. The company was, he said, doing its utmost to prevail upon the authorities to return those in the Forces and Government establishments. Like most other British manufacturers the company was at a disadvantage compared with its competitors abroad who had been able to prepare themselves during the war years to exploit commercial markets now opening. This was a matter—as well as the threat of foreign infiltration into British markets—to which it was hoped the Government would give urgent attention.

The Rothermel Corporation, Ltd.—The total net profit of the company and its two subsidiaries for the year ended December 31st last amounted to £7,437. After providing for taxation it is proposed to pay a dividend of 20 per cent. and to carry forward £4,209. At a general meeting held on July 5th, a resolution was to be submitted to increase the capital of the company from £50,000 to £140,000 by the creation of 1,800,000 1s. shares, of which 1,798,960 will be utilised for the purpose of acquiring the share capital of Remax, Ltd. On the completion of the amalgamation Mr. W. H. Gatty Saunt, chairman of Remax, and Mr. A. S. Gregg and Mr. M. A. Hassid, joint managing directors, will join the board of Rothermel.

Walsall Conduits, Ltd.—At the annual meeting a statement presented by the chairman (Mr. A. E. Read) referred to the company's wartime production of many kinds including equipment for use in radiolocation, flarepath lighting and other special lighting apparatus, mobile workshops, flame throwers, etc. Most of the work caused little departure from their ordinary peacetime efforts and so there would have to be no change-over in methods of production. Labour shortage had proved troublesome and while the company was anxious to extend its works the production of consumer goods would remain unsatisfied until additional factory space and labour were available.

The Rheostatic Co., Ltd., at a meeting last week approved an increase in capital by the creation of an additional £50,000 of 6 per cent. cumulative preference and £80,000 of ordinary capital. It is proposed to issue £50,000 of the new capital to preference and ordinary shareholders.

W. & T. Avery, Ltd., show a net profit of £139,250 for the year ended March 31st last. This is £127 less than the previous year's figure. The final dividend is maintained at 10 per cent., again making 15 per cent. General reserve receives £20,000 (£10,000) and £45,000 again goes to war contingency reserve leaving £70,477 (£68,465) to be carried forward.

The Electrical Finance & Securities Co., Ltd., records a net revenue for 1944, after tax, of £74,027 (against £68,184). The final ordinary dividend is 6 per cent., making 10 per cent., and with a bonus of 3⅛ per cent. the total distribution for the year is again 13⅛ per cent. A sum of £76,705 (£64,003) is carried forward.

J. Stone & Co., Ltd., report a profit for 1944 of £224,114 (against £238,305). With a final payment of 15 per cent. the dividend on the ordinary shares is again 25 per cent., and £353,660 (£318,660) is carried forward.

Radio Rentals, Ltd., propose shortly to offer 34,000 5s. ordinary shares at 22s. 6d. a share to ordinary shareholders on the basis of one new share for every twelve held.

Hick, Hargreaves & Co., Ltd., have declared a final dividend of 8 per cent., again making 10 per cent. for the year.

New Companies

Ritchie & Co. (Electrical Contractors), Ltd.—Private company. Registered June 21st. Capital, £1,000. Objects: To carry on the business of electrical contractors and engineers, etc. First directors: M. W. Ritchie, 1, Newton Road, Stoke Hammond; and A. C. Long, 23, Napier Street, Bletchley, Bucks. Registered office: 1, Newton Road, Stoke Hammond, Bletchley.

Graham Bracewell, Ltd.—Private company. Registered June 21st. Capital, £1,000. Objects: To carry on the business of manufacturing electricians, mechanical, radio and electrical engineers, etc. First directors: W. Graham, 170, Halifax Road, Briarfield; and A. Bracewell, 71, Halifax Road, Briarfield. Registered office: 11, Nicholas Street, Burnley.

B.C.R. Installations, Ltd.—Private company. Registered June 21st. Capital, £100. Objects: To carry on the business of manufacturers of, and dealers in, electrical apparatus and goods, etc. Subscribers: W. S. Corlett, 201a, Birkbeck Road, Beckenham; and A. R. Elliott, 80, Copthorne Avenue, Harrow. Registered office: 45, Berwick Street, W.1.

D. B. MacKie & Swaffield, Ltd.—Private company. Registered June 23rd. Capital, £10,000. Objects: To carry on the business of manufacturers of, and dealers in, electrical equipment and plant, etc. Directors: D. M. B. Mackie, 143, Rickmansworth Road, Watford; and G. C. Swaffield, 35, Brangwyn Drive, Brighton.

Ellvin & Co., Ltd.—Private company. Registered June 19th. Capital, £100. Objects: To carry on the business of manufacturers, importers, exporters, factors, wholesalers and retailers of dynamos, motors, armatures, magnetos, batteries, lamps, wireless and television sets and accessories, etc. First director: L. H. Sayer, 9, Castleton Road, E.17. Registered office: 252, Risley Avenue, N.17.

Ryan (Wanstead), Ltd.—Private company. Registered June 20th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in electrical, radio, television and mechanical apparatus and accessories, lamp shades, etc. First directors: E. E. Fradd, Tredannick, Broadfield Way, Buckhurst Hill, Essex, and three others. Registered office: 10, High Street, Wanstead, Essex.

Companies' Returns

Statements of Capital

Euston Manufacturing Co., Ltd.—Capital, £2,000 in £1 shares. Return dated February 9th. 1,137 shares taken up. £1,137 paid. Mortgages and charges: £633 6s. 8d.

Wilkinson, Bentley & Co., Ltd.—Capital, £3,000 in £1 shares. Return dated December 6th, 1944. 1,850 shares taken up. £1,850 paid. Mortgages and charges: Nil.

Lancashire Electric Light & Power Co., Ltd.—Capital, £4,571,415 in 571,415 first preference stock units, 1,000,000 7 per cent. preference stock units and 2,900,000 ordinary stock units, all of £1 and 1,000,000 unclassified shares of £1 each. All first preference stock, 7 per cent. preference stock and ordinary stock units taken up. £4,469,015 paid. £2,400 considered as paid. Mortgages and charges: £1,261,977.

West Gloucestershire Power Co., Ltd.—Capital, £885,000 in £518,500 6½ per cent. participating preference stock, £303,500 ordinary stock and 63,600 ordinary shares of £1 each. £518,500 preference and £303,500 ordinary stock taken up. £587,500 paid. £234,500 considered as paid. Mortgages and charges: £510,255.

Increases of Capital

London Electrical Co. (Blackfriars), Ltd.—An extraordinary general meeting on June 11th, approved an increase of £5,000 in the nominal capital of the company, divided into 5,000 ordinary shares of £1 each, beyond the registered capital of £32,500.

Pioneer Telephone Manufacturing Co., Ltd.—The nominal capital has been increased by the addition of £9,000 in 4,000 ordinary and 5,000 5 per cent. preference shares of £1 beyond the registered capital of £1,000.

Mortgages and Charges

Blackburn Edwards & Co., Ltd.—Mortgage on 290-292, Scotswood Road, Newcastle-on-Tyne, dated June 2nd, 1945, to secure sums not exceeding £600. Holders: Grainger Building Society.

Turner & Booth, Ltd.—Satisfaction on March 12th of debenture dated November 17th, 1936, and registered December 1st, 1936. (Notice filed June 22nd.)

Winding-up Orders

Princely Radio & Television Corporation (of Great Britain), Ltd.—In the Companies Court, Chancery Division, last week, Mr. Justice Cohen made an order for the compulsory winding up of this company. Mr. Danckwerts, for the petitioners, stated that the company had a nominal capital of £100 and owed the Crown £300.

B. & B. Batteries, Ltd., 61, Caxton Road, Wimbledon.—Winding-up order made June 18th.

Bankruptcies

C. R. G. Webb (trading as the Southern Electrical Mechanical Co.), 94, St. George's Road, Brighton, electrical engineer.—Bankrupt discharged May 31st, subject to his consenting to judgment for £50 being entered against him. (£50 paid to Official Receiver in lieu of entering judgment).

J. Boult and **J. H. Boult**, trading in co-partnership as "John Boult," 3, Grosvenor Street, Chester, electricians. (Separate estate of J. H. Boult.)—Last day for receiving proofs for dividend July 17th. Trustee, Mr. A. H. Ward, Hunter Street (Friends' Meeting House), Liverpool, 3, Official Receiver.

C. H. Boot, 29, Lyndon Road, Rubery, Worcs., radio and electrical engineer.—Receiving order made June 25th, on debtor's own petition.

W. B. Ralphs, 2, Mulgrave Road, Middlesbrough, electrical contractor.—Application for discharge to be heard on July 19th at the Court House, Wilson Street West, Middlesbrough.

STOCKS AND SHARES

TUESDAY EVENING.

THE more closely that polling day, Thursday in this week, approached, the more confident Stock Exchange markets became in their expectation that Mr. Churchill would obtain a majority for his party. The anticipation of a Conservative success at the polls has served to dissipate any immediate apprehension in regard to the nationalising of the railways, the utility services, the coal industry and others. From the Stock Exchange point of view, the result of this has been to advance still further prices which had already shown a substantial recovery from the depression that overtook them two months ago.

Home Railways Proposal

In the Home Railway market, the Southern group is better, and there has also been a little support for London Passenger Transport " C ". An interesting proposal, put forward in Manchester, suggests that the profit made by the Government out of the Railway Agreement should be treated as a pool, or cushion, for the railway companies to draw upon, should earnings in any one year after the termination of the Agreement fall below the standard revenue. Southern preferred is 10s. up at 73½. Transport " C " remains at 67½.

Communication Stocks

The statement by the chairman of Cable & Wireless, read at the meeting last Thursday, lifted the war-veil sufficiently to give some slight indication of the service which the organisation has rendered to the war effort. One striking illustration is that of the number of words carried. In the year before the war, 1938, the company dealt with 231,000,000 words ; in 1944, this had swollen to 705,000,000. Notwithstanding all the handicaps imposed by war conditions, Cable & Wireless played a leading part in communication work, and the claim of the chairman, Sir Edward Wilshaw, that what has been done has developed, on behalf of the Empire, the finest telegraphic service in the world, is not likely to be challenged. The chairman maintains that private enterprise is largely responsible for the achievement of the organisation in lessening the cost of messages, as well as increasing the value of the service in other directions. The ordinary stock is better at 87 : the 5½ per cent. preference keeps firm at 115.

Siemens and Others

Siemens have risen sharply during the past few days and the price at 37s. is 2s. 6d. up. The fusion of British Insulated and Callender's Cable has given rise to conjectures as to whether other amalgamations on similar lines may be expected to take place. If they should, it is thought that Siemens may prove one of those likely to be concerned. This is purely a matter of surmise, but its effect is obvious in the strength of Siemens shares. Others have also been influenced by the same consideration, and the market in shares of the equipment and manufacturing companies is decidedly good. Johnson & Phillips have risen 1s. 6d. to 76s. 6d.

Hopkinsons hardened to 84s. 9d. International Combustion at 8⅛ are ex dividend, and 5s. 6d. higher. Midland Electric Manufacturing put on $\frac{1}{16}$, to 7 $\frac{11}{16}$. In Vactric, a fair turnover left the price 1s. 3d. higher at 23s. 3d.

Brush Electrical

The Brush Electrical Engineering Company issued three years ago £143,170 ordinary stock to the Associated British Engineering Company at par. The Stock Exchange Council has just given leave to deal in this stock. In the market, it is thought unlikely that any large amount will come in, and the price of the existing 5s. units remains at 10s. At the last-paid rate of dividend, 9 per cent., the yield is 4½ per cent. on the money.

Ward & Goldstone, Ltd.

The price of Ward & Goldstone ordinary shares seldom alters from week to week. It would seem to have become static at the present quotation of 30s. 6d. One reason is that there is but little market in the shares. Efforts have been directed on several occasions to the creation of a better market for the shares in London, but they met with little success. The price is quoted also in Liverpool. The company has paid dividends of 20 per cent. per annum since 1938 inclusive, giving a capital bonus of 10 per cent. in 1939. The earnings throughout this period have been on a substantially higher scale than the distributions. Goodwill was written off some years ago. The year ends with March and the report appears early in July. At the present price of 30s. 6d., the yield on the money is a modest 3¼ per cent. The current price is the highest reached for ten years, during which period it fell, in the black days of 1940, to 12s. 6d. The issued capital is £174,367, of which £94,367 is in ordinary stock in 5s. units.

Miscellaneous Matters

Less activity has characterised the market for radio shares. A. C. Cossor continue the most active in the group ; the price, after narrow fluctuations, is again 39s. 6d. Philco remained unchanged at 14s. 6d. The Cinema Television Company proposes to take over the Bush Radio, and when this is effected, the Cinema Television deferred shareholders will get three " B " shares in addition to the present one share which they now hold. The price of the latter is 8s. 6d. for the sixpenny share.

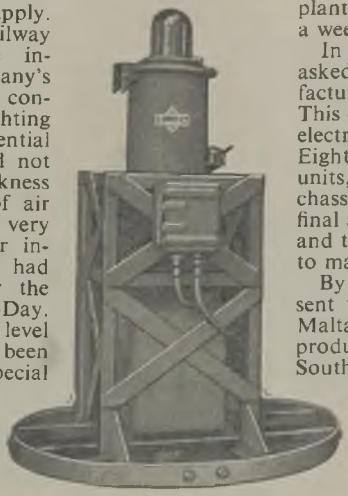
De la Rue have risen 3s. 9d. to 10 $\frac{13}{16}$. Tube Investments at 5½ are $\frac{1}{8}$ higher. Indian utilities have been bought for investors on, or near, the spot. Cawnpore Electrics at 58s. 6d. are 6s. 6d. to the good. Delhi Electrics touched 54s. before reverting to 53s. The Home electricity group is practically unchanged.

Manufacturers' War Work—VII

From Relays to Multiple Rocket Guns

Londex, Ltd.

SEVERAL hundred thousand relays have been manufactured by Londex, Ltd., for the Admiralty, Ministry of Aircraft Production, Air Ministry and Ministry of Supply. Harbour and railway authorities have installed the company's relays for remote control of outdoor lighting where it was essential that work should not stop during darkness except in case of air attack. For one very extensive harbour installation, relays had to be ready for the night before D-Day. Floatless liquid level controls have been supplied for special purposes, *e.g.*, penicillin manufacture, while remote flow indicators have been manufactured for the protection of mobile power plant and wireless transmitters. Automatic process timers were incorporated in complete remote control equipments for war plant installations. New signalling apparatus for air and sea navigation has been developed and several research contracts have been carried out in co-operation with the Fighting Services.



Londex electrical signalling equipment for air and sea navigation

Brook Motors, Ltd.

At the outbreak of war Brook Motors, Ltd., were making AC motors at the rate of 100 a day of every type and size up to 200 HP, in a works extending over three acres. The winter of 1940 passed with increasing demands for motors, but direct armament contracts were obtained to stimulate a spirit of interest and enthusiasm throughout the works. Contracts for high-frequency airborne generators used for radar equipment of fighting planes were the first undertaking, involving machining to limits far beyond standard practice.

At the time of the Dunkirk withdrawal in May, 1940, parts for the Rolls-Merlin engine were being produced, and the radiolocation generators were going into battle within forty-eight hours of leaving the factory. As the works were now no longer large enough, the Duchess Works were constructed for the winding and assembly of standard and fractional-HP motors. Rolls-Royce, Ltd., alone, was ordering Brook motors by the thousand, for its three main factories and engine testing plants, and motor output reached 1,500 a week.

In November, 1942, the company was asked to become a parent firm for the manufacture of predictors for the Bofors gun. This complicated instrument, containing four electric motors, absorbed 100,000 man-hours. Eight "daughter" firms undertook the sub-units, whilst Brook Motors produced the chassis and electrical gear and carried out the final assembly. Five hundred jigs and gauges and twelve months' spadework were required to make the first instrument.

By this thousands of motors were being sent to help rebuild Russian industries and Malta also called for and received Brook products by air and sea, together with India, South Africa, New Zealand, Australia and the Middle East. Many motors never reached their destination and shiploads had to be replaced. By 1942 motor output had risen to 1,800 a week, of which many were flameproof for the Chorley, Thorpe Arch and many other

A.A. No. 3 Mark I predictor for the Bofors gun partly manufactured and assembled by Brook Motors, Ltd.

filling factories, petroleum stations, and coal mines. Fourteen hundred people were making them, including more than 200 part-time employees.

The call-up of many of the younger girls was an acute problem. Electric motor winders take many years to train, and where a skilled worker took six hours to wind a

motor part-timers took thirty for the same machine, while apprentices needed one hundred hours. Finally, all the skilled winders who had left and were at home with children were asked to help, and twenty-eight of them started motor winding in their own homes. Output had risen from three motors per person to 6·5 motors, mainly due to increases in production efficiency with roller and power conveyors throughout and by rigid inspection to ensure interchangeability of all parts.

To other direct contracts had now been added "Squids" (anti-submarine radar controlled depth charge throwers) and a small magnet clutch unit, both on behalf of the Admiralty. By 1944, when the company celebrated its fortieth anniversary, the military outlook was changing and defence was giving way to attack. Predictors, of which 150 had been made, were wanted no more, and in their place electrically operated bomb release units were produced, together with generators for military transport and airborne equipment, the output of airborne generators reaching 20,000 machines.

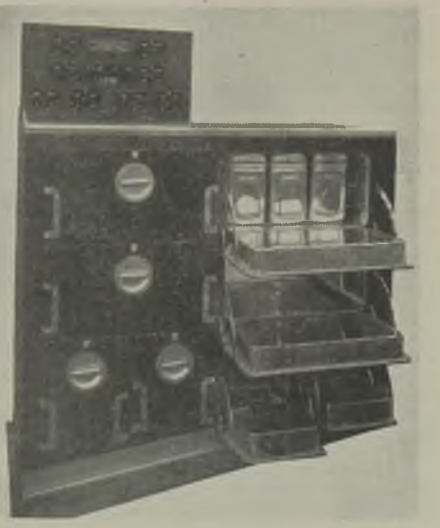
More orders came from Empire countries while at home 2,000 motors were made for radar and 500 for penicillin production. By this time 1,500 people were employed, and more than 9,000 motors per month were leaving the factory.

In 1945 again the demand changed. All parts of all motors had to be specially treated to withstand the conditions of the tropics. Although this has doubled the work on every motor, output has been maintained. During the war over 1,000 additional employees have been and are still employed. Constant research has entirely changed the electric motor, higher quality steels, new electrical insulations and methods of wire impregnation, electric welding of copper and heavy-gauge steel pressings having improved the pre-war machine.

Belling & Co., Ltd.

In the very early days of the war a start was made on hand grenades and trench mortar bombs, the castings being made in the company's own foundry. From 1940 onwards the whole facilities of the company were gradually transferred to war production. Large quantities of Sten gun parts, mortar sights, light beacon directors, radio and wavemeter cases, shims for gun mountings, jeep guards, telescope cases for tanks, transportable compartments for screening from radio and other interference were produced, special equipment for D-Day including periscope covers for tanks, ducts and vents for tank wading, also the release gears for jettisoning these parts.

For the R.A.F., Fleet Air Arm and Allied Air Forces all classes of cases were made, for radio transmission, reception and radar work generally, suspension gear for jettison tanks, food warmers for York aircraft, air warmers for administrative and other buildings, rocket containers for assisted take-off, metal anchors for airfield distribution, glim lights for aerodromes, armature drying ovens for F.A.A., humidity ovens for accelerated test purposes, anti-vibration trays for aircraft, and film spools for reconnaissance work. Many multiple rocket guns as well as hot-cupboards



Belling food storage cabinet for the "York" transport plane

and radiators for fighting ships were supplied to the Admiralty, and some thousands of air warmers were made for merchant ships. On the home front shelter heaters of all kinds were manufactured in great numbers. The items mentioned above are those of which large quantity production was undertaken; space does not permit reference to hundreds of other stores made in small quantities.

In the company's research laboratory, much development work was done on new offensive weapons, and as an indication of the diversity of the products made it may be mentioned that the lightest item weighed a fraction of an ounce whilst the weight of the heaviest was 7¾ tons. At present the company is engaged on a large quantity of cookers for the Government's emergency housing scheme.

New Telephone Factory for Lisbon

The International Standard Electric Corporation, through its subsidiary company, the Standard Electrica Portuguese, is to build a large factory in Lisbon for making telephones and all types of radio equipment.—*Reuter* (Lisbon).

NEW PATENTS

Electrical Specifications Recently Published

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

AKT. Ges. Brown,. Boveri & Cie.—"Choking coil with a double bend characteristic." 6637/43. April 11th, 1942. (569853.)

H. Aron.—"Electrode assemblies or anvils for electrical billet heating machines." 18019. November 1st, 1943. (569996.)

D. G. E. Barrie.—"Bar elements for electric fires." 15387. September 20th, 1943. (569985.)

British Thomson-Houston Co., Ltd. —"Electric valve circuits for controlling current impulses in welding and other load circuits." 16059/42. November 22nd, 1941. (569847.) "Electric current converting systems." 3788/43. March 18th, 1942. (569850.) "Toasting apparatus." 19546/43. November 23rd, 1942. (569903.) "Speed governors." 16765/42. December 3rd, 1941. (569910.) "Electric cable terminals." 11872/43. July 28th, 1942. (569926.) "Vent structure for ovens and the like." 13052/43. August 18th, 1942. (569929.) "Compressors." 1313/44. January 26th, 1943. (569939.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—"Diode rectifier circuits." 16880. October 14th, 1943. (569990.)

Cable & Wireless, Ltd., and F. Warburton.—"Telegraph apparatus." 15223. September 16th, 1943. (569961.)

A. Charles and Smith Meters, Ltd. —"Indicator gauges and like instruments." 18007. December 18th, 1942. (569912.) "Means for reducing clearance or backlash between the moving parts of instruments such as indicator gauges." 18008. December 18th, 1942. (569913.)

A. Charles, A. Turner and Smith Meters, Ltd.—"Indicator gauges for linear dimensions." 17952. December 17th, 1942. (569911.)

J. A. Crabtree & Co., Ltd., W. E. Hill, T. D. G. Wintle and R. W. Morgan.—"Couplings for electrical wiring systems." 15265. September 17th, 1943. (569983.)

R. W. Fisher.—"Electric power systems." 11600. July 16th, 1943. (569978.)

F. J. Flux, H. Lowe, J. Baron and C. C. Ramsden.—"Electric control switches." 21299. December 20th, 1943. (569965.)

Heating Construction, Ltd., and H. G. Darby. —"Washing machines." 20761. December 11th, 1943. (569906.)

Igranic Electric Co., Ltd., and J. R. Taylor. —"Control gear for 3-phase induction motors." 11864. July 21st, 1943. (569888.)

Kingston-upon-Hull Corporation and R. E. Mell.—"Methods of and apparatus for testing and calibrating meters having a continuously rotating element such as electric energy meters." 16049. November 13th, 1942. (569940.)

Marconi Instruments, Ltd., and W. B. Bartley.—"Method of and apparatus for determining moisture in various substances." 12136. July 26th, 1943. (569889.)

Marconi's Wireless Telegraph Co., Ltd., F. E. Baum and J. W. Graham.—"Light current electrical switches such as may be used on radio receivers." 14745. September 8th, 1943. (569956.)

J. W. Meaker.—"Perforation of sheet material by electrical discharges." 21744. December 28th, 1943. (569968.)

T. D. Parkin.—"Multi-range inductance capacity tuning circuit arrangements and tuning scales therefor." 50. January 1st, 1942. (569845.)

Ransomes, Sims & Jefferies, Ltd., D. P. Ransome and B. S. Rogers.—"Contact fingers for electric controllers." 19711. November 25th, 1943. (569904.)

W. H. Riddle, D. Wright, Metropolitan-Vickers Electrical Co., Ltd., and Automatic Telephone & Electric Co., Ltd.—"Protection of electric power systems." 15406. September 20th, 1943. (569986.)

J. Sankey & Sons, Ltd., and G. W. Stockton. —"Electric insulating material." 14960. September 13th, 1943. (569960.)

G. R. Shepherd (Westinghouse Electric International Co.).—"Automatic electric circuit-breakers." 21936. December 31st, 1943. (569971.)

F. Sigmund and W. S. Hlavin.—"Electro-deposition of rubber-like substances on the windings of electrical devices." 9872. June 18th, 1943. (Convention date not granted.) (569921.)

Standard Telephones & Cables, Ltd., and F. Fairley.—"Electric insulators." 19373. November 19th, 1943. (570000.)

Standard Telephones & Cables, Ltd. (International Standard Electric Corporation).—"Radio receivers." 19766. November 26th, 1943. (569905.)

W. E. Stilwell, Jun.—"Circuit-breaker and overload protective device." 13591. August 20th, 1943. (569945.)

United Aircraft Corporation.—"Means for generating high-frequency electric oscillations." 11404/43. June 29th, 1942. (569858.) "Supersonic inspection devices." 14924-6/44. June 29th, 1942. (Divided out of 569858.) (569872-4.)

Electric Fences

TO ensure that the energy supplied to fencing for the enclosure of livestock shall be so limited and controlled that under the most extreme conditions it shall not cause danger, a specification (B.S. 1222-1945) has been issued, restricted to fences operated from batteries. Equipment energised from supply mains is in use, mainly in other countries, but is not recommended for use in this country and is therefore not regarded as standard. The most important section of the new specification is that relating to the performance of the controlling unit. Special attention is also given to earthing and to the enclosure of the controlling unit. Copies may be obtained from British Standards Institution, 28, Victoria Street, London, S.W.1, price 2s. each, post free.

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.

Birkenhead.—July 16th. Electricity Department. Transformers. (See this issue.)

Birmingham.—July 20th. Electricity Department. Circulating water pipework, etc., for Hams Hall "B" power station extensions. (June 29th.)

Darlington.—July 10th. Electricity Department. 6·6-kV overhead line. (June 29th.)

Hull.—July 13th. Electricity Department. Pumps. (June 15th.)

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

Manchester.—July 12th. Electricity Committee. Water valves for Stuart Street generating station, and ash sluicing plant at Barton. (June 29th.)

July 20th. 33-kV and auxiliary and telephone cables between Barton generating station and Benchill substation. (See this issue.)

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

Oulton, near Leeds.—July 16th. West Riding Mental Deficiency Act Committee. Rewiring of Oulton Hall Institution. Specifications, etc., from the county architect, County Hall, Wakefield.

Plymouth.—July 10th. Electricity Department. Ash conveyor belts. (June 29th.)

Willesden.—July 16th.—Electricity Department. Street lighting columns and lanterns. (See this issue.)

Orders Placed

Ashton-under-Lyne.—Electricity Committee. Accepted. 500-kVA indoor type transformer.—Ferranti. 3-panel truck-type switchboard with drop-down pattern isolators.—Switchgear & Cowans. 5-unit distribution board with provision for increased fuse rating.—English Electric Co.

Burton-on-Trent.—Public Assistance Committee. Accepted. Installation of automatic telephone system at assistance offices (£624).—Automatic Telephone & Electric Co.

London. — SOUTHWARK. — Electricity Committee. Accepted. Condensate extraction pump (£120).—W. H. Allen Sons & Co. DC motor (£41).—G.E.C. Switchgear ring main units (£159).—Long & Crawford. L.v. switchgear (£136).—Lucy & Co. Meter testing equipment (£280).—Ferranti.

Manchester.—Electricity Committee. Accepted. 33-kV feeder protective gear.—A. Reyrolle. 33-kV switchgear extensions.—Ferguson, Pailin. 10,000-kVA transformer.—Ferranti.

Requirements for twelve months. Tenders accepted include the following:—Cable cover tiles (six months' contract).—H. J. Baldwin & Co.; Cable Covers, Ltd. Concrete slabs (six months' contract).—Callender's. Conduit and accessories for wiring.—L. Andrew & Co. Insulating cloth.—Hamnett & Andrew. Steam and water tubes and fittings.—S. Gratrix. Tapes.—Callender's; Henley's; L. Andrew & Co.; Rykneld Mills. Insulated wires.—B.I. Cables; Connolly's. Tinned copper wire.—E. & E. Kaye.

Public Health Committee.—Platform type goods truck.—Electricars.

Oldham.—Centrifugal pump, motor, etc.—Mather & Platt. Additional cabling and equipment for carbonising plant at Higginshaw.—W. J. Furse.

Sheffield.—Transport Committee. Accepted. Tramcar motors. Ten pairs at £686 per pair.—Metropolitan-Vickers. Five pairs at £667 per pair.—G.E.C.

Worthing.—Highways Committee. Accepted. Lamp reinstatements (£443).—G.E.C.

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.

Aldridge.—Houses (46), Pelsall and Rushall, for U.D.C.; surveyor, Anchor Road, Aldridge, near Walsall.

Bexhill.—Reconditioning De La Warr Pavilion (£6,205); borough engineer.

Brierfield (Lancs.).—Completion of houses (28) for U.D.C.; H. L. Smith, town clerk, Town Hall.

Brighton.—Convalescent home (£25,000) and junior school, Hanover Terrace (£5,970); borough engineer.

Conversion of showroom, East Street and Grand Junction Parade to children's theatre; Charles Burnham.

Broughton Moor (Cumberland).—Houses (32) for the North-Eastern Housing Association; P. L. Browne, Son & Harding, architects, Pearl Buildings, Newcastle-on-Tyne.

Castle Ward.—Houses (26), Hazlerigg; R.D.C. surveyor.

Cheshire.—Grammar school, Hazel Grove and Bramhall; E. M. Parkes, county architect, The Castle, Chester.

Chesterfield.—Additional classrooms, Old Road Municipal School; A. Greenhough, chief education officer.

Cranbrook (Kent).—Houses (22), Benenden, Hawkhurst and Goudhurst, for R.D.C.; W. Lynn-Thompson, architect, Eastcote, Orpington.

Dunfermline.—Houses (60), with electrical work, Headwell; Andrew Shearer, town clerk, City Chambers.

Glasgow.—Nurses' accommodation, Eastern District Hospital (£4,100); city engineer.

Hamilton.—Carpet factory (1,000 hands); A. Stevenson, Bertram Street, Burnbank.

Huntingdon.—Permanent houses, Ambury Hill site; surveyor, Town Hall.

Leyland.—Houses (30), Sandy Lane, for U.D.C.; J. Turner & Son (Preston), Ltd., builders, William Henry Street, Preston.

Liverpool.—Junior department of the School of Art, and erection of a new F. L. Calder College of Domestic Science; L. H. Keay, city architect, Blackburn Chambers, Dale Street.

London.—Flats (£81,065), Maitland Park, St. Pancras; L.C.C. architect.

KENSINGTON.—Flats (43), and child welfare centre, Bramley Road; borough engineer, Town Hall, Kensington, W.8.

DEPTFORD.—Rebuilding works, Evelyn Street; Molins Machine Co.

Middlesbrough.—Estate plan, Belle Vue Grove; alterations, Longlands Bakery; substation, James Street, for Middlesbrough Casements, Ltd.; alteration to bakery, for Meredith & Son; factory additions, for Greco Bros.; alterations, for Richardson & Son; and rebuilding of premises, Newport Road, for Eaton & Co.; architects for all schemes: Kitching & Co., 40, Albert Road.

Middlesex.—Maids' home, Central Hospital (£21,700); county architect.

Middlewich (Ches.).—Houses (60) and shopping centre, Rolt estate, for U.D.C.; R. J. B. Wilkinson, surveyor, Council Offices.

Newcastle-on-Tyne.—Temporary houses; Gee, Walker & Slater, contractors, Derby and London.

Additions, tobacco factory, for John Sinclair & Co., Ltd., Bath Lane; J. Walton Taylor & Son, Norwich Union Buildings, Westgate Road.

Ogwen.—Houses (50) and community centre on Glasinfryn estate for R.D.C.; Roland T. Jones, architect, Midland Bank Chambers, Bangor.

Ormskirk.—Extension to operating theatre and new nurses' home, Ormskirk General Hospital and Dispensary, Hants Lane; Dr. H. E. Marsden, hon. secretary.

Radcliffe.—Houses (22), Bolton Road; borough surveyor.

Ruthin.—Houses (84), Drill Hall site; F. A. Roberts, architect, Earl Chambers, Mold, Flints.

Southgate. — Housing scheme, Barrowell Green; borough engineer.

Sheffield.—Rebuilding 19 houses on Council estates; R. Charlesworth, Ltd., M. J. Gleeson, Ltd., and Cowley, Murfitt & Sons, Ltd.

Staffordshire.—Temporary school, Goldthorn Park, Sedgley; county architect, Stafford.

Sunderland.—Temporary houses (403) and permanent houses (100); borough surveyor.

Wallsend-on-Tyne.—Kitchen, Western School; borough surveyor, Town Hall.

Wednesbury.—Houses (36), Dale Street; A. Booth, borough surveyor.

Worcester. — Extensions and alterations (£4,000), Grand Stand Hotel; Ansells Brewery, Ltd., Aston, Birmingham.

Supply in Manchester

Electricity Committee's Report for 1944-45

PROGRESS in the development and reconstruction of the Stuart Street generating station is detailed in the report of the Manchester Electricity Committee for the year ended March 31st last. This work was further advanced by the conversion of two boilers to operate at the increased pressure of 375 lb. per sq. in. while forced draught equipment was fitted to ten boilers. Four turbo-alternator sets were dismantled to make room for modern plant, and preparatory work was carried out for the installation of a new 60,000-kW turbo-generator set and two new boilers. Two new wagon tippers and a coal conveyor were completed and a new ash disposal system put into service. Two of the older wooden cooling towers have now been completely removed. Civil engineering work in connection with a new reinforced concrete tower and reconstruction of the turbine and boiler houses for the new plant has been started but progress has been limited by shortage of labour. This and weather conditions have also to some extent retarded the work of laying additional 33-kV feeders.

During the cold spell in January there was a record m.d. on the system of 243,860 kW (an increase of 19·3 per cent.). Although some of the distribution equipment was overloaded no breakdown of apparatus occurred. On one day the C.E.B. called for a load reduction of 20,000 kW in Manchester, and to meet this 2,822 consumers were disconnected for nearly an hour.

The total quantity of electricity sent out from the power stations last year was 954 million kWh, 691,411 tons of fuel being used at an average price of 37s. 3d. a ton. Sales of electricity, apart from export to the C.E.B., increased by 2·3 per cent. to 729·5 million kWh. Lighting heating and cooking supplies were largely responsible for this advance, rising by 22·9 per cent. to 184·57 million kWh.

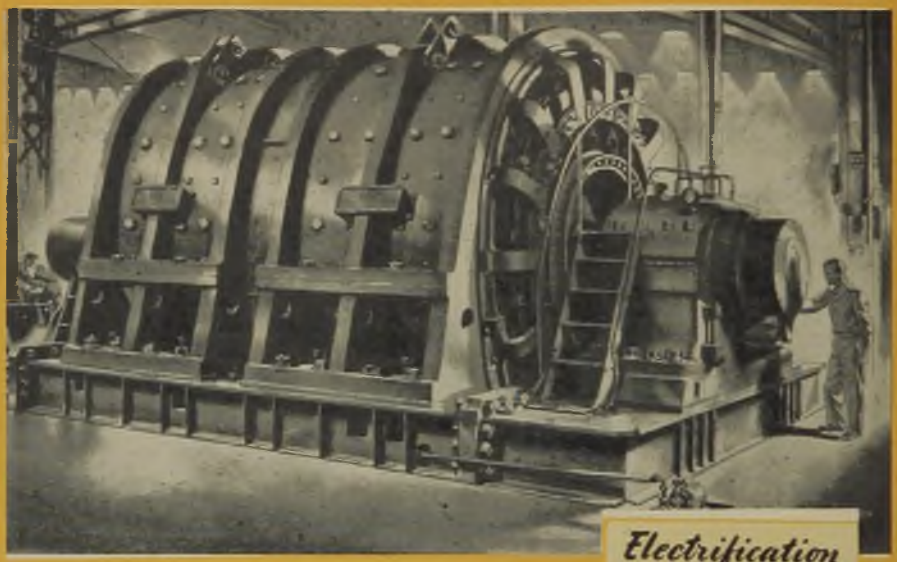
Revenue from the sale of electricity amounted to £2,698,437 (against £2,484,694), total income being £2,797,228 (£2,578,088). Working expenses, inclusive of all generation costs, were £2 386,791 (£2,191,028), leaving a balance of £410,437 (£387,060). After meeting interest, etc., charges there was a net surplus of £15,213 (£2,722), most of which has been used to meet expenditure of a capital nature.

During the year covered by the report Mr. H. C. Lamb retired from the position of chief engineer and manager and was succeeded by Mr. R. A. S. Thwaites.

G.E.C.

in war — as in peace —

at the service of the Empire



Industrial electrification schemes have required vast numbers of G.E.C. motors of all sizes—standard types, motors for individual requirements, and some of the largest motors in use for driving rolling mills and winding engines. G.E.C. experience and resources were invaluable to the Nation when a swift expansion of industrial electrification became imperative and vital issues rested upon Britain's ability to produce munitions and supplies in ever-growing abundance. During these years when the entire resources of the G.E.C. have been devoted to the war effort the Company has made important advances in all applications of electricity, including electronics, which will be available to all concerned with electrification schemes for reconstruction.

Electrification Schemes

G.E.C. Electrification Schemes have been applied to all industries, including: Aircraft Factories; Chemical Works; Collieries; Food Factories; Gold Mines; Iron, Steel and Copper Works; Locomotive and Railway Carriage and Wagon Works; Motor Car Works; Ships and Shipyards; Textile Mills, etc., etc.

G.E.C. always in the forefront of electrical progress

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

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

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

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

Original testimonials should not be sent with applications for employment.

OFFICIAL NOTICES, TENDERS, ETC.

LITTLEBOROUGH URBAN DISTRICT COUNCIL

Electricity Department

THE above Council invite tenders for the supply and delivery of the following: —

One E.H.T. RING MAIN UNIT, 11,000 volts.
L.T. SWITCHGEAR.

Specifications and form of tender may be obtained on application to Mr. G. Hill, Electrical Engineer and Manager, Council Offices, Littleborough.

No tender will be received except in a plain sealed envelope endorsed "Tender for Switchgear." It must not bear any name or mark indicating the sender.

Tenders on the prescribed form, sealed and endorsed as above, must be delivered to the undersigned not later than Monday, 23rd July, 1945.

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

R. C. CLOUGH,
Clerk of the Council.

Council Offices,
Littleborough, Lancs.
5th July, 1945. 2257

CITY OF MANCHESTER

THE Electricity Committee invites tenders for the manufacture, testing, delivery on site and laying complete of: —

33,000-VOLT AND AUXILIARY PILOT AND TELEPHONE CABLES BETWEEN BARTON GENERATING STATION AND BENCHILL SUBSTATION (Specification No. 833).

Specification, etc., may be obtained on application to Mr. R. A. S. Thwaites, Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2, on payment of a fee of one guinea, which amount will be refunded on receipt of a bona fide tender.

Tenders, addressed to the Chairman of the Electricity Committee, to be delivered not later than 10 o'clock a.m. on Friday, 20th July, 1945.

PHILIP B. DINGLE,
Town Clerk.

Town Hall,
Manchester, 2.
28th June, 1945. 2270

BOROUGH OF WILLESDEN

Electricity Department

TENDERS are invited for supplying Columns and Lanterns for Street Lighting. Specifications and forms of tender may be obtained from the Borough Electrical Engineer and Manager, Electric House, 296, Willesden Lane, N.W.2, and must be returned to the undersigned not later than 5 p.m. on Monday, 16th July, 1945, endorsed "Street Lighting."

W. T. PIRIE,
Town Clerk.

Town Hall,
Dyne Road, Kilburn, N.W.6.
27th June, 1945. 2298

COUNTY BOROUGH OF BIRKENHEAD

Electricity Department

TENDERS are invited for the supply and delivery of:

1 300-kVA, 6,600/425-volt Outdoor Type Transformer.
1 500-kVA, 6,600/425-volt Indoor Type Transformer.
1 500-kVA, 10,600/420-volt Indoor Type Transformer.

Specification, conditions and form of tender may be obtained from the Borough Electrical Engineer, Craven Street, Birkenhead.

Tenders, on the form provided, enclosed in a plain envelope (which shall not bear any name or mark indicating the sender), sealed and endorsed "Tender for Transformers Electricity Department," must be delivered to the undersigned not later than 2 p.m. on Monday, the 16th of July, 1945.

Tenders which do not comply with these instructions will not be considered.

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

E. W. TAME,
Town Clerk.

Town Hall, Birkenhead.
22nd June, 1945. 2256

SITUATIONS VACANT

None of the vacancies for women advertised in these columns relates to a woman between 18 and 40 unless such woman (a) has living with her a child of hers under the age of 14, or (b) is registered under the Blind Persons Acts, or (c) has a Ministry of Labour permit to allow her to obtain employment by individual effort.

LONDON COUNTY COUNCIL

VISITING Teachers will be required during the session commencing in September, 1945, for evening or part-time day classes in the following subjects, at the School of Engineering and Navigation, Poplar High St., E.14:

Electrical Engineering, S1, S2 and S3, and Laboratory.
Elec. Welding, City and Guilds Certificate.
Institutional Maintenance Engineering.
Electrical Installation Work, City and Guilds "B" Certificate.

Forms of application obtainable from the Principal at the School (stamped addressed envelope must be sent). Fees, for a teaching period of 2 to 2½ hours, 16s. or 22s. according to subject, plus war allowance of 2s. 6d. a day. Fees include payment for any duties required beyond the teaching period. 2258

WATSON & SONS (ELECTRO-MEDICAL) LIMITED

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

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

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

COUNTY BOROUGH OF ST. HELENS

Electricity Department

Appointment of Senior Demonstrator

APPLICATIONS are invited for the above appointment at a salary in accordance with the Lancashire and Cheshire Provincial Council Scale P.T.A., Grade B (Female), £214 per annum, rising by annual increments of £11 to £236 per annum, plus war bonus which is at present £48 2s. per annum.

Candidates must have had a good general education and hold a recognised Diploma in Domestic Science and Electrical Housecraft and possess a thorough knowledge of the use of electrical domestic appliances. They must be competent to conduct lecture demonstrations both in the Showrooms and on consumers' premises and to advise consumers on the selection and use of electrical apparatus. Experience of large-scale industrial Canteen Work and School Feeding will be an advantage.

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 undersigned and be received by him not later than July 23rd, 1945, in an envelope endorsed "Senior Demonstrator."

P. BREGAZZI,
Borough Electrical Engineer.

Electricity Works,
Carlton Street,
St. Helens,
Lancs.

2272

COUNTY BOROUGH OF CROYDON

Electricity Department

Control Engineer

APPLICATIONS are invited for the appointment of Control Engineer from candidates who have taken a recognised Course in technical training and are experienced in the operation of the Control Room of a large Power Station.

The salary will be in accordance with Grade 9a, Class H, of the National Joint Board Schedule, at present £367 per annum, and is subject to deductions under the Local Government Superannuation Act, 1937.

The selected candidate will require to pass a medical examination and to reside within the Borough.

Applications, giving full particulars of age, training and experience, and accompanied by copies of recent testimonials, should be sent to me endorsed "Control Engineer," not later than noon on Monday, 16th July, 1945.

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

E. TABERNER,
Town Clerk.

Town Hall,
Croydon.

2287

COUNTY BOROUGH OF GREAT YARMOUTH

Electricity Supply Department

Appointment of Deputy Borough Electrical Engineer

APPLICATIONS are invited from Chartered Electrical Engineers for the position of DEPUTY BOROUGH ELECTRICAL ENGINEER to the Great Yarmouth Corporation. Salary in accordance with the N.J.B. Scale, Class G, Grade 1 (commencing at £771 per annum).

Candidates must have been engaged on Electricity Supply for an extended period, and have had practical experience in the Generation and Distribution of Electricity in both Town and Rural Areas.

Applications, on forms to be obtained from the undersigned, must be returned by Monday, 16th July, 1945.

Canvassing members of the Council directly or indirectly will disqualify a candidate.

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

FARRA CONWAY,
Town Clerk.

Town Hall,
Great Yarmouth.

2224

BOROUGH OF GRAVESEND ELECTRICITY DEPT.

Senior Electrical Draughtsman

APPLICATIONS are invited from men released from the Forces and Merchant Navy (under Class "A" arrangements) during their period of paid leave, or men over 51, for the above position in the Electricity Department at a salary in accordance with Class F, Grade 8a, of the N.J.B. Schedule, commencing at £371 per annum and rising to £386 per annum.

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

Candidates should have had a good practical training and also theoretical training up to Ordinary National Certificate in Electrical Engineering or higher, and have had sound experience, employing modern methods, in all branches of the drawing office work of an Electricity Undertaking with a generating station and extensive distribution system.

Applications, stating age, whether married, practical and theoretical training, experience and previous appointments held, should be forwarded to the Borough Electrical Engineer and Manager, Electricity Department, Harmer Street, Gravesend, not later than July, 20th.

H. H. BROWN,
Town Clerk.

4, Woodville Terrace,
Gravesend.

2259

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Assistant Commercial Engineer

APPLICATIONS are invited by the Board for the post of Assistant Commercial Engineer. Applicants must have a good all round experience on the commercial side of an electricity undertaking, operating preferably in a rural area and also giving supplies in bulk to other undertakings. Ability to carry out the technical and commercial investigations and calculations required by the Electricity (Supply) Act, 1926, and the Hydro-Electric Development (Scotland) Act, 1943, is essential.

Salary £750/£1,000 per annum, according to qualifications and experience. The successful candidate will be required to join the Board's superannuation fund after satisfactory medical examination.

Applications, stating age, qualifications and experience, to be sent to the Secretary, 16, Rothesay Terrace, Edinburgh, 3, not later than Monday, 23rd July, 1945.

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

T. LAWRIE, Secretary.

2264

LIVERPOOL EDUCATION COMMITTEE

City Technical College, Byrom Street, Liverpool, 3
(Principal: R. R. Butler)

THE Committee invite applications for the appointment of a LECTURER (full-time) in the Department of Electrical Engineering in the above College.

Candidates should possess Graduate Qualifications in Electrical Engineering and Corporate Membership of the Institution of Electrical Engineers. Industrial and teaching experience is desirable. Demobilised members of H.M. Forces are invited to make application.

Salary will be in accordance with the Burnham Technical Award, and will be subject to 5% contribution under the Teachers' Superannuation Acts.

Forms of application and conditions of appointment may be obtained (on receipt of a stamped addressed envelope) from the Director of Education, 14, Sir Thomas Street, Liverpool, 1, and applications should be received by him not later than 18th July, 1945.

W. H. BARNES, Town Clerk.
Clerk to the Local Education Committee.

2252

APPLICATIONS are invited for the position of Testing Superintendent by a well-known firm of manufacturers in the South-West London district. Salary £450-£550 per annum. Applicants must have first-class experience in A.C. watt-hour meter testing, together with knowledge of small switchgear and instrument work. Write for appointment, stating age, experience, etc., to—Box 2178, c/o The Electrical Review.

DUNDEE TECHNICAL COLLEGE

AN Assistant Lecturer is required in the Electrical Engineering Department to teach junior classes in Electrical Enginering and in Radio Work. Candidates should possess a good degree, or equivalent qualification, in Electrical Engineering; they should have had industrial experience and, while teaching experience would be an advantage it is not essential. The existing salary scale, which is under review, is £300-£15-£400 with addition of War Bonus of £60 and placing according to experience. Applications, on the official form, with copies of not more than three recent testimonials, should be lodged not later than 16th July, 1945, with the Clerk and Treasurer, Technical College, Bell Street, Dundee, from whom forms and particulars may be had. 2273

ASSISTANT Designer with previous experience (over 51 or outside present Engagement Restrictions) required for Electric Motor Manufacturers. State age. Permanent progressive position. Applications welcomed from men shortly due for demobilisation. Apply—Higgs Motors Limited, Witton, Birmingham, 6. 2292

ASSISTANT to General Manager required by firm specialising in Electrical Repairs and Maintenance. Applicants should have held executive position and have practical experience in works administration, factory costs, etc., and be familiar with the design and construction of electrical machines. Knowledge of winding an advantage. Age not over 45. The successful applicant would be required to pass a medical examination and to become a member of the Staff and Widows' Pension Scheme.—Box G.1718, W. H. Smith & Son Ltd., Manchester, 3. 2282

CATHODE Ray Tube Engineer required. University trained, with at least 10 years' experience of cathode ray tube development and manufacture. Must possess initiative to follow a new type through to the shop and ensure economical manufacture. Applications from Class "A" ex-service men only. Write in confidence to—Box 7340, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. 2201

CENTRAL Electricity Board, S.W.E. and S.W. Area, Bristol. Assistant Control Engineer. Applications are invited for the position of Assistant Control Engineer, Grid House, Bristol. Candidates not exceeding 35 years of age with some knowledge of power station work and technical qualifications at least of graduate I.E.E. standard are preferred. Applications to the Manager, C.E.B., Grid House, 26, Oakfield Road, Clifton, Bristol, 8. 2291

CHIEF Draughtsman required (over 51, or Class "A" ex-service men only) by well-known electrical and radio instrument manufacturer. Previous experience essential. Good prospects. Write, stating age and full particulars to—Box 2212, c/o The Electrical Review.

DIESEL Engine Estimator required by old-established engineering company in East Midlands. Experience in preparing tenders and handling contracts for marine generating sets, marine propulsion units, and engines for industrial applications. Knowledge of D.C. and A.C. equipment and of export business would be an advantage. Permanent position with good prospects as assistant to Diesel sales manager. Staff pension scheme is in force. Salary according to age, ability and experience. Apply, giving particulars of education, experience, age and present position, and state when likely to be available. Address—Box 2296, c/o The Electrical Review.

DOMESTIC Electric Appliances, Cooking and Heating Apparatus. Production Manager required for small but progressive works in Midlands. Excellent prospects. Full particulars to—Box 2196, c/o The Electrical Review.

ELECTRICIAN required by Electrical Contractors (Central London). Permanency to suitable man. Applicant must be over 51. Apply—Box 2192, c/o The Electrical Review.

ELECTRIC Lamp Works (non-combine) require the services of a Technical Manager capable of taking complete charge of production of all types of standard lamps. Commencement of service can be arranged. Our staff know of this vacancy. Apply in strictest confidence, giving full details of previous experience, etc., to—Box 7272, c/o The Electrical Review.

EXPERIENCED and reliable Sales Manager required by manufacturers and stockists of all electrical insulating materials, including panels, blocks, strips, punchings, etc., in laminated sheets, vulcanised fibre, ebonite, etc. Buying and estimating experience an advantage. Apply, giving full details of experience, salary required, etc., to Willmott, Son & Phillips Ltd., 52a, Blackstock Rd., Finsbury Park, N.4. Interview by appointment. 2255

FAN manufacturers require Junior Estimator, under 18 or from Class "A" men only. Able to estimate for A.C. and D.C. motors and preferably some knowledge of ventilation. Apply, stating age, experience and salary required to—Box 2290, c/o The Electrical Review.

INVOICE and Order Clerks required. Excellent prospects, permanent positions. Male, under 18 or over 51. Female, under 18 or over 41.—Young & Wildsmith Ltd., Wholesale Electrical Engineers, 35, Little Russell Street, New Oxford Street, W.C.1. 2286

JUNIOR Estimating Engineer. Class "A" man, required for London sales office. Applicants should be conversant with A.C. and D.C. motors, control gear and ventilating fans. Write, stating age and experience to—Box 2281, c/o The Electrical Review.

LONDON manufacturer of electrical accessories wishes to appoint Designer-Draughtsmen, over 51 years of age or outside present engagement restrictions only. Positions offered have good prospects and will carry good salaries. Please give age, experience and salary required. —Box 2199, c/o The Electrical Review.

M.K. Electric Ltd. invite applications for vacancies for Designer-Draughtsmen, over 51 years of age or outside present engagement restrictions only. Applicants should have had previous experience in design and development of electrical accessories. Please write, giving age, experience and salary required, to—M.K. Electric Ltd., Wakefield Street, Edmonton, N.18. 2198

OVERSEAS Employment. First-class Motor Mechanics, age not over 45 years, are required for Ceylon. Candidates should preferably have served an apprenticeship, or equivalent, with a reputable firm of M/T vehicle makers, repairers or general engineers, and they must have had not less than three years' experience in repair shops in the overhaul of engines and other units comprising the chassis of various makes of cars and light and heavy goods vehicles. They must also be good drivers and prepared to undergo a driving test. Experience with compression ignition engines and a good practical knowledge of the electrical equipment of M/T vehicles is essential. Appointment for 2 years. Free passage, outfit gratuity. Wages, including overtime and allowances, will approximate from £10 to £15 per week according to whether single or married. Exemption from Imperial Income Tax. Written applications (no interviews) giving the following essential details: (1) Full name; (2) Date of birth; (3) National Service registration number and local office shown on registration card N.S.2; (4) Medical grade, if known; (5) If discharged from the Forces, particulars of Service number, rank, unit and reasons for discharge; (6) Industrial training and experience; (7) Name and address of present employers; (8) Details of present work, should be sent to the Secretary, Overseas Manpower Committee (Ref. 3516), Ministry of Labour and National Service, York House, Kingsway, London, W.C.2. Applications cannot be acknowledged. 2289

RADIO Valve Engineer required, university trained, with at least 10 years' experience of valve development and manufacture. Must possess initiative to follow a new type through to the shop and ensure economical manufacture. Applications from Class "A" ex-service men only. Write in confidence to—Box 7339, A.K. Advg., 212a, Shaftesbury Avenue, London, W.C.2. 2200

SALES Manager required by medium-sized company in London area manufacturing special electric motors, generators and allied equipment. Sound technical knowledge essential. Progressive post for man with good personality, initiative and energy. Apply, giving age and full particulars and salary required, to—Box 2261, c/o The Electrical Review.

TRANSFORMERS. Works Manager required for N.W. London. Must be fully experienced in manufacture of transformers of all types up to 500 kVA and capable of managing labour. Salary £750, plus commission on profits. Full particulars of age, experience, etc., to—Box 2223, c/o The Electrical Review.

WORKS Manager required by small firm in Midlands, employing 100/150 work people. Must have experience in manufacture of transformers and rectifying equipment. Sound managerial qualifications essential. Excellent salary and prospects for right man. Apply in confidence, giving full details of qualifications and salary required, to—Managing Director, c/o Enoch Cox & Co., Berrington Chambers, Tettenhall Road, Wolverhampton. 2243

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

SITUATIONS WANTED

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

A first-class Maintenance Electrician, 25 years' experience of the erection and maintenance of all types of factory installations. Used to handling labour. Southern Counties preferred.—Box 7268, c/o The Electrical Review.

ADVERTISER (50), experienced all branches, sales-office organisation, many years administrative position, methodical and efficient controller, seeks change.—Box 7256, c/o The Electrical Review.

DISTRIBUTION Mechanician, overhead lines, cables (33-kV jointer), switchgear, protective gear, etc., seeks working administrative position, home or abroad, 20 years' experience.—Box 7267, c/o The Electrical Review.

ELECTRICAL Engineer, exempt, H.N.C., 5 yrs. works, 1 yr. admin., desires position Technical or Sales Representative Midlands.—Box 7237, c/o The Electrical Review.

ELECTRICAL Engineer, trained technically and practically, thirty years' experience in installation work, industrial and residential power and lighting, fourteen years with public supply authority, inspecting and testing and S. and D, used to estimates, costing and accounts. South or South-west districts preferred. Could manage technical side and office for electrical contractors.—Box 7258, c/o The Electrical Review.

ELECTRICAL Engineer, twenty-two years' experience of cable manufacture, including testing at works and on site, also fault location, and the installation of underground mains and overhead lines, requires progressive post.—Box 7222, c/o The Electrical Review.

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

ELECTRICAL Supervision. Energetic man (30), requires position. Installation, maintenance or inspection. Factory and contracting experience. Good organiser.—Box 7219, c/o The Electrical Review.

ENERGETIC Sales Engineer invites representation or agencies. First-class connection, all branches, Midlands and North, own car.—Box 7208, c/o The Electrical Review.

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

EXPERIENCED in production, design of power units, electronics, 4 yrs. development auto telephone apparatus and circuits, M.V. apprentice Grad. I.E.E., seeks position requiring a general knowledge of electrical industry or technical post.—Box 7286, c/o The Electrical Review.

EXPORT Manager, A.M.I.E.E. (37), good education, works training, wide experience, requires position with progressive firm.—Box 7224, c/o The Electrical Review.

FOREMAN, supervisor, experienced power and lighting, practical and technical qualifications, shortly free, genuine.—Box 7282, c/o The Electrical Review.

PLUMBER-Jointer (36), married, requires situation. South or South-east coast preferred. 15 years' experience supply and contracting.—Box 7252, c/o The Electrical Review.

PRODUCTION Engineer (38) desires change in similar capacity, 22 years' planning, D.O., time study, tool room, T.D.O. and shop experience on light elect./mech. products. Salary £650/£700. London, Surrey or Middlesex.—Box 7273, c/o The Electrical Review.

REPRESENTATION offered, thoroughly practical in all things electrical, with old-established connection in Midlands and East Anglia, guaranteed large turnover in good solid business. Firms requiring post-war results can rely on this service. Highest references, many years with Siemens, Korting & Mathiesen Ltd., Tuckers and six years Diamond H. Switches on cookers, etc. Working with son, William, thoroughly trained, or separate agencies. This is genuine business, please communicate—Arthur Walkington, "Ridsdale," Burton Joyce, Nottingham. 7220

ROYAL Engineers. Electrical and Mechanical Officer, immediate demobilisation, desires suitable position of trust. Twenty years' civilian experience in technical and commercial sides of electrical contracting, accustomed to handling labour, could take complete control. London district preferred.—Box 7205, c/o The Electrical Review.

SKILLED Draughtsman requires change, release promised, age 35, 15 years' exp. covering radio, elect. insts., small mechanisms and general engg. Box 7239, c/o The Electrical Review.

SUPERVISING and Estimating Engineer seeks to improve position. Adaptable, C. & G. Final. Used to all classes and big industrial installations. Excellent refs. Min. sal. £550.—Box 7281, c/o The Electrical Review.

YOUNG Electrical Engineer (21), apprenticeship, Higher National Cert., Stud. I.E.E., good draughtsman, conversant with H.T. and L.T. switchgear, layout and design rotary and static substations, heating, lighting, willing to learn, desires interesting post, preferably design.—Box 7213, c/o The Electrical Review.

FOR SALE

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

280-h.p. PETTER VERTICAL 4-CYLINDER "ATOMIC" DIESEL ENGINE, new 1934, No. 220497, 300 r.p.m., complete with bedplate, outer bearing and pulley, starting Compressor, with Engine and Air Bottle, Cooling Tanks and Streamline Filter. First-class condition.

120-h.p. RUSTON & HORNSBY VERTICAL TWIN CYLINDER DIESEL ENGINE, No. B.222, 333 r.p.m., complete as above, first-class condition.

60-h.p. DAVEY PAXMAN VERTICAL TWIN-CYLINDER SPRING INJECTION DIESEL ENGINE, No. 23477, new 1933, 370 r.p.m., complete with bedplate, electric type flywheel, Tanks, Compressor, etc.: 41-kVA CROMPTON PARKINSON Alternator, 365 volts, 3-phase, 50 cycles, available for this machine.

45-h.p. PETTER VERTICAL SINGLE-CYLINDER "ATOMIC" DIESEL ENGINE, new 1933, 375 r.p.m., complete with Tanks, Flywheel, Bedplate, Starting Bottle, etc., overhauled and ready for despatch: 29-kW, 460/230-volt D.C. Generator available for this Engine.

37½/42-h.p. CROSSLEY VERTICAL SINGLE-CYLINDER ENCLOSED "COMPRESSORLESS" DIESEL ENGINE, No. 103235, new 1935, 500 r.p.m., complete with Tanks, Filter, Shaft Extension, Pulley and Bearing, Air Bottle, etc., overhauled and ready for despatch.

22-h.p. BLACKSTONE HORIZONTAL SINGLE-CYLINDER SPRING INJECTION DIESEL ENGINE, No. O.P. 23505, Type OP, new 1942, speed 600 r.p.m., complete with water-cooling Tanks, Service Tank, Filter, Shaft Extension and Belt Pulley: 220-volt D.C. Generator, Battery and Switchboard available.

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26

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Temple Bar 9631. 2220

LESLIE Dixon & Co. for Dynamos, Motors, Switchgear, Chargers and Telephones.—214, Queenstown Road, Battersea, S.W.8. Telephone, MACaulay 2159. Nearest Rly. Sta.: Queen's Road, Battersea (S.R.). 1r

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

MORRIS Electric Lifting Blocks, ½-ton, 220 v., 1 and 2-ton, 440 v. D.C.—S. C. Bilsby, Crosswells Road, Langley Green, near Birmingham. 2279

MOTOR Generator Set, 110 h.p., 3-phase, 400/440 volt, drip-proof, slipring motor direct coupled on bedplate to 66-kW, 110-volt, 1,450-r.p.m. D.C. dynamo with accessories.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 2275

MOTOR Generator Sets and Convertors, all sizes and voltages from ½ kW up to 500 kW in stock.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, City Road, London, N.1. Telephone, Clerkenwell 5512, 5513 & 5514. 28

MOTOR Generators, Small D.C./D.C. Motor Generators, drive off 12-volt accumulator and give 230 volts, 30 m.a. D.C. output; off 6-volt, 110 v., 15 m.a. output. Originally made for Gvt. radio: two commutators, ball bearings, laminated fields, insulated brush gear, covered armature windings. In new condition, 75s. each. Aluminium Tubing, in approx. 12-foot coils, 5/16" I.D., new, surplus W.D. stock, 3s. 6d. each.—Leslie Dixon & Co., 214, Queenstown Road, Battersea, London, S.W.8. 65

MOTORISED ½" Bench Drilling Machine, 13 speeds, £12 2s. 6d.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 51

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

ONE new totally enclosed vertical Lancashire Dynamo 8-h.p. Fan Motor, for 200 v., 2-ph., 50 cys., with four facings, without feet, shaft 2⅞" dia., 10" long, keyway 6" long, with starter complete. Ex stock. For price apply—H. J. H. King & Co. Ltd., Engineers, Nailsworth, Glos. 71

PHONE 98 Staines. 130-kW, 110-v. D.C. Diesel Generating Set; 60-kW, 220-vo. D.C. ditto; 7/9-kW, 110-vo. D.C. ditto; 50-kW, 440/220-vo. D.C. Steam Set; 400-kW Belliss Surface Condenser; Weir Feed Pumps, 9½" × 7" × 21" and 8½" × 6" × 13".—Harry H. Gardam & Co. Ltd., Staines. 60

QUANTITY A.E.G. and B.I. Coin Collector Meters for disposal. All in good condition. Write offer—Payne Bros. (Catford) Ltd., 28, Ravensbourne Park, S.E.6. 7285

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

SELF-Priming Electric Pumps, 300 g.p.h., £12.—John E. R. Steel, Clyde Mills, Bingley. Phone 1066. 53

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

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

STEAM Alternating Sets, Two, 150 kVA, by Browett Lindley, vert. H.S. engine, 150 lbs. pressure.—Norman E. Potts (Birmingham) Ltd., 105, Alcester Road South, Birmingham, 14. 2204

SWITCHBOARDS suitable for dynamos and alternators, all sizes from 100 amp. up to 1,500 amp.—Britannia Manufacturing Co. Ltd., 22/26, Britannia Walk, London, N.1. 25

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

1 to 5-h.p., 400/440, 3-phase, 50-cycle Motors, ex Government stock, no permit required.—Dawson, Caledonia, Oakengates. 2249

6-h.p., 220-volt, shunt wound, 3,000-rev. ball-bearing Metro.-Vic. Motor, with Brookhirst starter, I.C. panel, £18 10s.; 2-h.p. ditto, speed 720/1,440, £16.—Dawson, Caledonia, Oakengates. 2250

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

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

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

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

140-kVA Belliss/Crompton Alternator, 400/3/50, 4-wire. Seen running.—Stewart Thomson & Sons, Fort Road, Seaforth, Liverpool, 21. 47

150-h.p., 420-volt D.C. Motor by English Electric Co., oil ring bearings, 716 r.p.m., compound interpole, C.I. bedplate, 3rd pedestal bearing, pulley 21" × 21", and slide rails. "Igranic" floor type starter panel with volt- and ammeter. This motor is in excellent condition and is being changed due to an A.C. supply being taken. Best offers to—Messrs. T. S. Bell & Co., 35, Tangier St., Whitehaven, Cumberland. 48

160 kW. 500-volts, 700-revs. S.I., two ped. brgs., on bedplate.—Greenhalgh Bros., Burton's Field Mill, Atherton, nr. Manchester. 2295

200 kVA, oil-cooled Transformer, 11,000/400-440 v., 3-ph., 50 cycles, with O.I. circuit breaker. New 1940.—Box 2278, c/o The Electrical Review.

200-kW, 250-volt, 600-r.p.m. Single Pedestal Compound Met.-Vickers Generator.—Box 2177, c/o The Electrical Review.

200 yards 19/.052 single new L.C. Cable.—Electricals Ltd., 14, Claremont Place, Newcastle-upon-Tyne, 3. 2222

250-kVA Alternator, 400 volts, 3-phase, 50 cycles, 750 revs., with direct-coupled exciter; also two 250-kW Rotary Converters, with transformers and switchgear, input 6,600 volts, 3-phase, 50 cycles, output 420/210 volts D.C.—Midland Counties Electrical Engineering Co. Ltd., Grice Street, Spon Lane, West Bromwich. 36

400-volts, 3-phase, 50-cycles, ball-bearing Motors, slip ring induction type: one 140 h.p., 975 r.p.m.; one 150 h.p., 730 r.p.m.; two 200 h.p., 980 r.p.m.—Oldfield Engineering Company Ltd., 96, East Ordsall Lane, Salford, 5. Blackfriars 3842. 2026

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

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D.C. MOTORS, 1, 2 and 3 h.p., 1,000 to 1,500 r.p.m. Any voltage 200 to 500. Must be good make, modern machines.

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EDUCATIONAL NOTICES

EDUCATIONAL NOTICES—*Continued*

MISCELLANEOUS

COMPANY MEETINGS

W. T. HENLEY'S TELEGRAPH WORKS

Great War Record

THE 66th Ordinary General Meeting of W. T. Henley's Telegraph Works Company Ltd. was held on June 29th in London.

Sir Montague Hughman (the chairman) said that from the early days of the war up to the present time one of their most important contributions had been the manufacture for the Admiralty of a cable of unique design for combating magnetic mines. Many designs had been worked out and, after preliminary investigations with a number of heavier than water cables, towing different types of electrode, the Admiralty had decided that a cable which would float on the surface of the sea was necessary. By Christmas, 1939, their chief engineer, Dr. Percy Dunsheath, had conceived the idea of using tennis balls to support the weight of the heavy copper conductor required to carry many thousands of amperes. Altogether on that particular job they had to make over 23 million tennis balls and draw some 200,000 miles of copper wire, and they had supplied over 1,000,000 yards of that cable to the Admiralty to date. Many lives as well as valuable ships and cargoes had been saved by the tennis ball being employed in that original manner.

Another outstanding contract which they had executed was the H.A.L.S. cable for Operation "Pluto." The supply of millions of gallons of petrol to the Forces on the Continent through pipe lines laid across the Channel had been one of the outstanding British engineering achievements of the past few years. By the time one million gallons of fuel was being transmitted daily under the Channel the bulk of that had been through Henley's pipe.

The contract department under Mr. Burnett had carried out work on 576 different sites during the war, spread over the whole of Great Britain, Nortnern Ireland, Scotland, the Orkneys and Shetlands. This department had also carried out a number of secret and important submarine cable-laying jobs for the R.A.F. and the Admiralty and completed cable installations for some of the large new generating stations in the country. During the year two important contracts for the Central Electricity Board for the installation of Henley's 132-kV gas cushion cable had been carried out. Both were put in commission during the year without hitch, and so far are working with complete success.

Much damage by enemy action had been suffered at both the London offices, at Milton Court, and at Woolwich. In spite of all these difficulties efficiency has been well maintained, and tribute was due to Mr. McArthur and his very fine staff, who carried on with the greatest courage and fortitude.

Many special types of cable were made at Woolwich during the war period, and the Ministry of Aircraft Production placed over-riding contracts for cables to enable production to be rationalised. Many millions of yards of cable were manufactured to different patterns and thousands of miles of field communication cables were made for equipping searchlights, A.A. guns and other needs of the Forces for the Ministry of Supply.

Customers could now appreciate that they could not have been supplied with all their requirements during the war when they realised the amount of war work for which the company had been responsible.

1943 was a record year in this company's history in output, tonnage and profits, and this after over 100 years of working. 1944 was not a record; but the results were satisfactory bearing in mind the extraordinary conditions existing.

General home business had been maintained at approximately the same level as in 1943, but outside contracting work had declined.

Overseas business, in spite of continued restriction on export and the many difficulties in connection with foreign trade had been satisfactory, and turnover had been maintained, which is 16.41% of our total business.

The report and accounts were unanimously adopted, and the proposed final dividend of 10% and cash bonus of 5% were approved.

2297

CABLE AND WIRELESS (HOLDING) LTD.

Confidence in the Future

THE Annual General Meeting of Cable and Wireless (Holding Limited was held on 28th June, 1945, in London.

Sir Edward Wilshaw (chairman and managing director) said that Lord Pender, on the completion of 45 years' service in the telegraph industry, commencing with the old cable companies, had now retired from active participation in the group of companies. He had joined the old cable companies in 1900, served on the boards of those companies since 1906, and been the governor and managing director of Cable and Wireless (Holding) Ltd. since the merger in 1929. Many would remember, in the difficult days of the company's early years, the outstanding ability with which he conducted the general meetings in face of great difficulties. He had inspired confidence in the stockholders, and in these more prosperous days they should not forget that and should express their gratitude and wish him well in his retirement and leisure.

In round figures the profit for 1944 was £1,199,000, as against £1,221,000 in the previous year. The proposed dividend was 4 per cent. The dividends received from the subsidiary companies and Cables Investment Trust Ltd. were the same as for the previous year, £1,314,000, while income from other investments at £43,000 showed an increase of £1,000. The taxes on profits paid and to be paid in this country by this group of companies amounted to about £7,000,000 for E.P.T. and about £4,000,000 for income tax, in addition to a further £2,000,000 to be paid in the Dominions, Colonies and foreign countries, making a grand total of about £13,000,000 taxation upon their income.

The investments of the group, which appeared at £18,314,000, had on December 31 last a market value of £18,598,000, showing an appreciation of £284,000, as against a depreciation of £164,000 last year. The income received from investments amounted to £737,000, as against £701,000, and the average yield on the book value of the securities was just over £4 0s. 6d. per cent.

Telecommunications Proposals

There had been references in the Press to various committees and missions which had been examining Imperial Telecommunications problems. It had been stated in November that discussions were afoot involving the creation in Britain, the Dominions and India of public utility corporations, owned by the State, to take over the conduct of external telegraph and telephone activities now in private hands. Later it was announced that Lord Reith had been invited by the British Government to visit the Dominions and India to discuss the future organisation of the telecommunications services of the Commonwealth.

Those proposals and the negotiations which had resulted had given the directors much thought. Whatever might be the trend of the discussions, the stockholders would be consulted before any irrevocable steps were taken by the board.

For the moment he need say no more than that their group of companies during these last few years had provided yet another noteworthy example of the part that private enterprise could play in an emergency.

While in the case of so many other commercial undertakings the transition period from war to peace presented some temporary dislocation in their functions, they themselves, however, were fortunate in that their main task of providing the means by which nations and individuals could communicate rapidly with one another remained unchanged.

The report was adopted. 2269

COMPANY MEETINGS—*Continued*

TELEGRAPH CONDENSER COMPANY

Radio in Modern Warfare

THE Twelfth Ordinary General Meeting of the Telegraph Condenser Company Ltd. was held on 28th June, in London, Mr. W. H. McFadzean, C.A. (chairman of the company), presiding.

The following is an extract from his statement circulated with the report and accounts:—

Output for 1944 showed a further improvement over the previous record achieved in 1943, but, as a result of increased costs and higher depreciation requirements, little benefit has accrued to the company. The total available profit from 1944 is £1,842 higher at £63,781. It is proposed to pay a dividend of 7½% and a cash bonus of 2½% (both less income tax) on the Ordinary capital.

War-Time Activities

The story is being gradually unfolded of the essential part played by radio in modern warfare, and most people are aware of some of its diversified uses. To both the Navy and the Air Force the use of radiolocation has been of invaluable assistance in successfully combating enemy submarines and bombers, while in attack accurate bombing by the Allied Air Forces at night and through cloud has only been possible by the use of radio instruments. With our armies radio has played an equally important role, and has often been described as the "eyes and ears" of our forces.

In every type of radio set and instrument the components manufactured by your company have played a vital part and our main problems have been to meet all demands, both for quantities and for special and ever-changing purposes. Output has been increased to many times its pre-war level through more intensive production at our main factory at Acton and the operation of four dispersal factories and several outworking units. In the field of development we have originated many novel designs of condensers, as, for example, for use in aircraft flying at great heights and extremely low temperatures and by our armed forces operating under severe tropical conditions.

Shareholders have every reason to be proud of the war-time achievements of the company, but I can assure you these have only been accomplished through organisation of the highest degree under the main direction of our general manager, Mr. P. A. Sporing, and the complete co-operation received from all employees.

With the ending of the war in Europe the total demands of the Services are naturally decreasing and we are, therefore, able to give increasing attention and supplies to home and overseas markets. In these spheres the technical improvements we have developed during the war, added to the deservedly high reputation for quality and service which your company has always enjoyed, should place us in a strong competitive position. As regards export business, steps have already been taken and others are under consideration to recapture and develop overseas markets so that your company can play its full part in this vital national requirement.

Achievement of Private Enterprise

In the transition from war-time to peace-time operation there are, however, many problems to be faced. Overriding all other problems in importance and urgency is the question as to the conditions under which industry is to be allowed to operate. This issue is now being put to the nation for its decision, and until this is known one must be reserved about the future. But I can, in concluding this review, make two claims. The first—that your company has achieved its present position under the system of private enterprise, and in that achievement the benefits accruing have, in my opinion, been equitably distributed between shareholders, customers and employees. My second claim is—that the future prosperity of this country and, therefore, of each company and individual lies in a continuation of private enterprise, provided that in our freedom we take full advantage of past experience and tackle all our post-war difficulties with that same determination and team spirit which have been such features of the war-time years.

The report was adopted. 2262

CABLE AND WIRELESS LTD.

(The Operating Company)

Traffic Expansion

THE following is an extract from the speech by Sir Edward Wilshaw, chairman of Cable and Wireless Ltd., at the Annual General Meeting of the company in London on 28th June.

The profit for 1944 shows a small increase of £8,865 at £1,237,757.

In the following brief review I can, I hope, show you some part of the contribution which your company has made to the common victory. In May, 1941, our Central Telegraph Station in Moorgate, with much valuable equipment, was destroyed by fire caused by enemy action. Due to forethought and careful planning, it was possible to transfer our activities to our present headquarters in Electra House, Victoria Embankment, and the flow of traffic was never seriously dislocated. Throughout all the periods of air raids, messengers, in cars or on bicycles, continued to deliver messages, and I know no case where a message failed to be delivered owing to an air raid.

Abroad, on Italy's entry into the war, all the cables west of Malta were cut by the Italians. In the Far East the Japanese, on their entry into the war, over-ran all our cable and wireless stations in that area, depriving the company of the best and fastest route to Australia and New Zealand. The West African route to Capetown had to carry a large share of the traffic thus necessarily diverted, while the long route via the Atlantic, Canada and the Pacific was called in to relieve the strain.

Supply Difficulties

Despite the heavy losses of equipment and the necessity for expanding our services to meet war-time demands, we have had the utmost difficulty in obtaining supplies and transporting them to distant stations.

Nevertheless, the services have been maintained; 47 new wireless circuits have been opened since September, 1939; the total traffic carried in 1938 comprised 231,000,000 words against no fewer than 705,000,000 words in 1944, whilst we have expanded our phototelegraph services until we are now handling as many as 2,000 pictures a month, compared with 100 before the war.

This brief outline of our contribution to the war effort would be incomplete without a heartfelt tribute to our staff, both here and all over the world, operating often in the most dangerous and uncomfortable conditions. The crews of our cable ships have stuck grimly to their work despite all hazards.

Recovery of the Far Eastern circuits will throw a great strain on the company, which can be met only if we have the men and the equipment.

We have emerged from the war strengthened by the thought that by drive, initiative and foresight we have surmounted great dangers and formidable difficulties. We have shown that private enterprise in the right hands can achieve much. Experience has shown that the present system offers the merits of Government control without its disabilities. If left to our own resources and given reasonable encouragement and goodwill by the Governments, we and our associated companies overseas can continue to keep abreast of developments and to offer cheaper and extended telegraph services without adding to the taxpayer's burden.

The report was adopted. 2260

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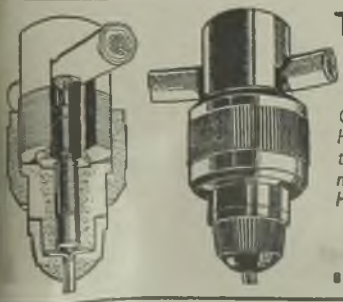

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