THE
# ELECTRICIAN

Vol. CXXXIV. No. 3482. Friday, February 23, 1945. Sixpence

[Registered at the General Post Office. Entered as Second Class at the New York U.S.A. Post Office.]


IS it because gear wheels made of Bakelite Plastics run so silently that only the instructed few seem ever to have heard of them? For obviously they deserve to have made a great noise in the world!

For years, gears of toughened steel have been meshed with Bakelite gears—and they run for years ! . . . There is less wear on the steel gear wheel. Where resistance to corrosion is imperative, the Bakelite gear cannot be beaten.

Gear wheels may not be your particular problem: yet it may be important to you to remember that there is available to you to-day a man-made material capable of standing up to hardened steel.

Just one more instance where Bakelite Plastics have replaced a natural material because they do the job in hand more efficiently . . .

BAKELITE LIMITED, 18 GROSVENOR GARDENS, LONDON, S.W.1

TREFOIL

**BAKELITE PLASTICS**

REGD. TRADE MARKS

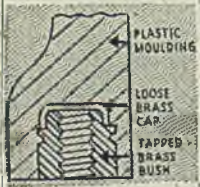
*Pioneers in the Plastics World*

### THAT WAS THE RUB

As we don our rubber or plastic impregnated raincoats, little do we think of the trials of our forebears a hundred years ago. In winter their rubberized water proofs stood up by themselves, while in summer they became so sticky that they could not be unfolded.

### FROM WAR TO PEACE

The experience of the army, in using thousands of plastic insulators for telephone wires, has established that plastics have special properties that resist the extremes of climate. This points to the use of plastics for a far greater number of peacetime outdoor purposes than ever before.




### HINTS FOR THE DESIGNER

A special feature of plastic moulding is that metal inserts can be moulded integrally in them. One of many examples are tapped bushes for fixing-screws. When tapped bushes are to be moulded in, always ensure that the end of insert is screened. Use either blind-ended inserts or a loose metal cap as illustrated. Open-ended inserts mean expensive tapping operations to clear the 'flash' or waste material from the thread after moulding.

### COLOURFUL PLASTICS

UREA RESINS, used in modern plastics, provide an unlimited colour range. Translucent and opalescent grades give cheap light-weight mouldings with good dimensional stability. Because urea plastics are odourless and tasteless, they are ideal for mouldings which make contact with food.

### THINGS TO COME

As plastics have such a resistance to extremes of weather, may we not see the day when plastic tiles will make a welcome contribution to a brighter Britain? You know that glass-clear plastics are a recent development? So might not tiles of this material, as an integral part of the roof, provide skylights that would brighten top-floor landings and rooms?

## MANUFACTURERS' SUPPLIES SECTION

## MISCELLANEOUS ADVERTISEMENTS

### SITUATION VACANT

**COUNTY BOROUGH OF BLACKPOOL.**

APPOINTMENT OF BOROUGH ELECTRICAL ENGINEER.

APPLICATIONS are invited from persons experienced in the management and administration of an electricity undertaking for appointment as Borough Electrical Engineer of the Council.

The salary will be:—First year, £1,490 per annum; second year, £1,620 per annum; third year and thereafter, £1,750 per annum, plus cost of living bonus.

The appointment will be subject (i) to the provisions of the Local Government Superannuation Act, 1937, (ii) to the person appointed satisfactorily passing a medical examination by a medical officer on behalf of the Council and (iii) to the other terms and conditions relating to the appointment.

Application forms, together with terms and conditions of the appointment, may be obtained from this Office, and must be returned to the undersigned, endorsed "Borough Electrical Engineer," not later than the 10th March, 1945.

Canvassing directly or indirectly will be deemed a disqualification.

TREVOR T. JONES,
Town Clerk.

Municipal Offices,
Town Hall Street,
BLACKPOOL.
21st February, 1945.

---

**ASSOCIATED MUNICIPAL ELECTRICAL ENGINEERS.**
**(Great Britain and Ireland)**
**and**
**THE ELECTRICAL POWER ENGINEERS' ASSOCIATION.**

NOTICE.

**BLACKPOOL CORPORATION.**

**Appointment of Engineer and Manager.**

THE Standing Joint Committee of the above Associations desire to point out that the above advertised post is not in accordance with Clause 10 of the Agreement made by the National Joint Committee of Local Authorities and Chief Electrical Engineers (Electricity Supply Industry), under which clause the latest available data of output indicates a commencing salary of £1,505 per annum. All engineers, whether engaged in the Electricity Supply Industry or not, are urgently requested not to apply for the post now being advertised, and if an application has already been made it should be withdrawn.

W. ARTHUR JONES, A.M.I.E.E.
Secretary,
Standing Joint Committee.
A.M.E.E.—E.P.E.A.

---

**FOR SALE**

LAMP Lowering and Suspension Gear, T.R.S., lead and other Cables, Winches (hand) hundreds of thousands in use, Searchlights (sale or hire), Carbon rods, Ebonite, Fibre Hightensite, Porcelain House-wiring and other Cleats, Reels and Knobs, Mirrors, Lenses, etc —London Electric Firm, Croydon.

---

**PATENT AGENTS**

**MEWBURN, ELLIS & CO.,**
PATENTS, DESIGNS AND TRADE MARKS,
70 & 72, Chancery Lane, London, W.C.2.
*Grams: "Patent, London." 'Phone: Holborn 0437 (2 lines)*
And at—NEWCASTLE: 3, St. Nicholas Buildings.

---

# THE ELECTRICIAN

*Established 1861. The Oldest Weekly Illustrated Journal of*

**Electrical Engineering, Industry, Science and Finance**

*Bouverie House, 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London." Telephone: Central 3212 (Ten Lines).*

*Midlands Office: Daimler House, Paradise Street, Birmingham. Telephone: Midland 0784. Glasgow Office: 116, Hope Street, Glasgow, C.2. Telephone: Central 3970.*

*The Offices of* THE ELECTRICIAN *are closed on Saturdays in accordance with the "Five-day Week" plan adopted by Benn Brothers, Ltd., and its associated publishing organisations. Until further notice the offices will be open between the hours of 9 a.m. and 5.30 p.m. from Monday to Friday.*

No. 3482. [No. 8. Vol. CXXXIV] February 23, 1945 Annual Subscription 25s Overseas 30s.


*CHIEF CONTENTS OF THIS ISSUE*



## Power Stations

THE relaxations in the censorship regulations which until a few weeks ago prohibited the publication of particulars of power stations, extensions and generation developments, have now been effective long enough for at least a tentative opinion to be formed with respect to possible trends in future design. There have already been described the Little Barford and Littlebrook stations, and any conclusions resulting from consideration of those descriptions may be amended in the light of the details given this week regarding Earley, and the description of the Llynfi station which will follow next week. From the details given so far, however, it will be apparent that the war has had considerable influence upon design, not only in regard to availability of plant, but also respecting location, fire hazards, and precautions against air-raid damage, and, it may well be that power station construction may still be governed by the last three conditions even after the war.

Little Barford and Littlebrook may be said to be of two worlds, for, projected before 1939, they were put into commission in the early war years, with plant which had been ordered before the war, and each has much of special interest compared with peace-time procedure. So far as Earley is concerned, this bears the distinction of being the only station in the country to be built and owned by the Central Board, and was built purely as a war emergency station.

The decision to construct the station was made in July, 1940, as part of a programme of war emergency generating plant and gave rise to the Central Electricity Board (Provision of Generating Stations) Order, 1940, upon which comment was made in our issue of October 4 of that year. It will be remembered that while the Order gave consent to the Board to provide and operate generating stations, it could only do so after the Commissioners were satisfied that the Board was unable to enter into arrangement with the local authority for the operation of any such station.

In the case of Earley, an invitation to build and operate the station was declined by Reading Corporation and the Board therefore erected the station itself, at the same time making arrangements with Edmundson's Electricity Corporation for its operation on behalf of the Board.

Primary considerations in the construction of the station were speed and economy in materials, and as there were being manufactured in this country at the time a 40 000 kW turbo-alternator and three 200 000 lb./hr. pulverised fuel

boilers for installation at Congella, negotiations were entered into with the Electricity Supply Commission of South Africa for taking over the plant. The boiler design had to be considerably modified to suit the coal to be supplied at Earley, but thanks to the public-spirited action of the South African Commission in waiving their claim to the sets, and rapid construction on site, the station went into commercial operation at the beginning of December, 1942, just under two years from the commencement of building operations. In 1942 it was decided to extend the station by installing a second 40 000 kW set, and two further boilers, and this extension is now nearing completion. Work has just commenced on the final extension for commissioning next year, when the ultimate capacity of the station will be 120 000 kW, with 1 400 000 lbs./hr. of boiler plant.

### Thermal Efficiencies

ANOTHER station constructed under war conditions was that at Castle Meads, belonging to Gloucester Corporation, and here again the plant capacity of 40 000 kW, with five 100 000 lb./hr. boilers was influenced by the conditions obtaining at the time of building, in that the boilers were built to specifications already drawn up for units in use elsewhere. The 60 000 kW Llynfi station about which particulars will be given in our next issue, although basically similar in layout to Little Barford, includes a number of interesting modifications and, owing to shortage of materials, many substitutes had to be provided. This—what for the want of a better word might be called—compromise in the building of war-time stations has not, however, in any way reacted against their overall efficiency for, bearing in mind the adverse coal position, inadequate labour and so on, the figures are sufficiently encouraging for us to hope that, when peace-time conditions return, the pre-war level of efficiency may be improved upon.

### Cable Industry's Freedom from Disputes

THE Joint Industrial Council for the Electrical Cable Making Industry reaches this year the 25th anniversary of its formation, having since its conception been largely instrumental in securing a high degree of stability of employment and having successfully solved every dispute which has arisen in the industry during the past 25 years. Symbolic of the spirit which exists between the employers and the trade unions in the industry is the fact that at the first meeting of the Council in 1919, the late Mr. Ll. B. Atkinson was elected chairman and only relinquished that office at his death, twenty years later. During the war years the Council has solved with success such problems as the employment of women on men's work, conditions of employment for part-time workers, while joint representations on questions affecting the well-being of employees in the industry have also been agreed to. With such a record to its credit the Council looks forward with every confidence to the future, and if experience is anything to go by we may hope that the next twenty-five years may be equally free from industrial disputes.

### Miss Haslett Returns from Sweden

FOLLOWING her recent return from Sweden, which country she visited at the invitation of the British Council, Miss C. Haslett, director of the E.A.W., had something to say about domestic electrification and Swedish homes, at an informal luncheon on Monday. Contrary to popular belief in this country, Sweden is by no means as completely electric as she might be, for, though a complete statistical survey of the number of electric cookers in use is not available, it is estimated that no more than between 10 and 15 per cent. of the country's households are so equipped. During the summer months electric cooking is apparently more generally used, than in the winter, while in housing schemes developed during 1943, the electric cooker is taking a more prominent position. Another point not generally appreciated is that because Sweden is a cold country, domestic heating is of the central type and there is little evidence of space heating by electrical means. In the towns and cities the whole of the population is connected to electricity supply, while in the rural areas about 85 per cent. of the dwellers are current consumers, though not in that volume which we in this country would have achieved among our

own householders but for the war. All of which rather suggests that our Swedish friends must have been much impressed with what Miss HASLETT had to tell them.

### The E.A.W. Comes of Age

THIS year will be one of celebration for the Electrical Association for Women, for, born in 1924, the association has reached the age of 21 years. From small beginnings the association has, under the tactful and capable leadership of its director, Miss C. HASLETT, become so valuable a part of the industry that its influence is felt in almost every section. In the education of the housewife in electrical methods, in the promotion of electrical development among women generally, in the training of personnel for absorption by the industry— in all these things the association has carried out work which it is hard to assess; while its influence in housing circles, the design of domestic equipment and kitchen planning is already evident in published reports and recommendations. Its work has often formed the basis upon which to build similar associations in overseas countries, while the association has, too, the credit of being the only one in the industry about which no one at any time has levelled other than favourable criticism. Commenting upon the formation of the association in 1924, we said that it would provide a platform for the expression of the women's point of view on any question relating to electricity which may affect their private or public interests; the fact that the association is now grown out of all recognition and will this year come of age is evidence of the success with which it has provided that platform.

### Overseas Trade

ATTENTION being addressed by both private enterprise and the Government to the task of increasing British export trade after the war, was added to this week by the publication of the overseas trade returns for the year 1944, which though higher in value than in 1943, were £13 000 000 short of the 1942 total and less by £213 000 000 when compared with 1938. Eliminating the influence in values, the volume of exports, in spite of the additional shipments to Russia of machine tools and electrical equipment, was 31 per cent. of the 1938 figure, against 29 per cent. in 1943, and 37 per cent. in 1942. The decline is not, however, all bad, for the falling off of shipments must obviously have been influenced by the curtailment of shipping space following the assemblage of craft for D-day, and the employment of increased shipping in the maintenance of our Armies since June. It is of interest too, to reflect upon how the average export prices of the various groups of manufactures have risen since before the war. On this point the Board of Trade returns give some valuable information, and for half a dozen groups average export values last year were more than double those in 1938. The 1944 index number (1938 = 100) for the machinery group was 169 and that for electrical descriptions 177.

### Electrical Exports

SO far as shipments of electrical goods were concerned a value of £12 637 292 was reached, compared with £11 162 895 in 1942; generators, motors and converting machinery were among the heavy equipment also shipped in increased quantities during the year. The total of electrical exports for the year were valued at £24 848 409, compared with £17 859 358 for 1943 and £16 427 526 in 1942, and, bearing in mind the large amount of munitions being made by the industry—products for which the returns make no allowance—this is no small achievement. Shipments of such large equipment as generators, improved by £944 000, compared with last year, motors by £841 011, switchgear by £85 885, and transformers by £346 436. Among other goods which contributed to the improved position may be mentioned submarine cables, rubber insulated wires, radio transmitting apparatus, lighting fittings and lamps, house service meters, and primary batteries. Considering the demands which are being made upon the manufacturing capacity of the industry, both with respect to the war effort and home needs, this contribution to the country's overseas trade figures is one which, given freedom from Government interference, offers every encouragement for the future, and is indicative of the volume of trade which the industry could bring about if only its fetters were removed.

# We Visit Belgium

## A S.H.A.E.F. Facility to See Lines of Communication

THE electricity supply situation in Belgium is at the moment of writing very difficult indeed. In Brussels the use of electric power and light is restricted between the hours of 6 a.m. and 6 p.m. daily. This means that the town is without electricity for heating, cooking, or lighting for the whole of the working day. Coal is difficult to obtain and the same restrictions apply to gas as prevail in the case of electricity.

During the whole of our representative's stay in Brussels he found only one office which had lighting for twenty-four hours a day. Perhaps there were others, but this one in particular was the transmission room at headquarters through which passes a steady average of forty thousand words of Press copy daily en route for the newspapers of the world.

This room alone in the headquarters has its own power supply.

The room is equipped with a generator of 10 kW output plus a batch of d.c. 24 V rectifiers. During the night, when normal supply is available equipment is run off the mains.

The transmission room is equipped with ten teleprinters but as a general rule only six are kept on circuit. These have facilities for sending material direct to London on circuits at about 66 words per minute.

Each message when handed in by a war correspondent is put on to a perforated tape which is fed through automatic transmitters at a constant speed.

### London Connected with Battlefronts

Lines from the room run direct to the Ministry of Information in London; lines go forward to the battlefront regions and one goes direct to the Canadian Army. A teleprinter switchboard enables the Royal Corps of Signals staff to make practically every circuit automatic in operation, thus permitting the handling of 100 000 words per twenty-four hour day. So far this peak has not been reached, but there have been occasions when as many as 90 000 words have been transmitted without unnecessary hold ups.

Transmission from this theatre of war commenced with one manually operated teleprinter at Creully Castle. As the advance continued transmission was taken on to Bayeux where there was only one channel to London. As there were many messages to be sent back, this channel was used as two by transmitting messages on two different frequencies.

A terminal unit enables the sending of normal messages to be carried on; this is simplex working, but the capacity of the teleprinter circuits can be doubled by the duplex system. By using a special filter the circuit may be used for speech.

A feature of the equipment is that from any kind of a.c. supply the required 24 V d.c. can be obtained. This is achieved through a bank of special rectifiers with adjustable mains transformers.

An unrehearsed official check up on the time taken to receive messages in London from Brussels recently showed that in the morning there was an average delay of seventeen minutes from the time the message was handed to the censor in Brussels to the time the message left the M.O.I. building in London.

---

# Tax Reliefs

THE Income-Tax Bill introduced by the Chancellor of the Exchequer in the House of Commons will give effect to the proposals outlined in the last Budget speech for affording tax reliefs to industry.

The main proposals include an initial allowance of 10 per cent. of the cost of new industrial buildings, and an annual allowance of 2 per cent. to write off the balance of the cost; an initial allowance of 20 per cent. of the cost of new plant and machinery, and an increase in the annual allowance; an allowance to write off the cost of patent rights, and a corresponding charge on the vendor; an extension of the allowance for expenditure on scientific research and for exceptional depreciation of buildings, plant, and machinery.

While it is still proposed that the Bill should come into effect after the war, from an " appointed day" the Bill provides that the new allowances shall apply retrospectively to expenditure on buildings, plant, and machinery incurred since April 1, 1944. Another improvement is that the initial allowance of 20 per cent. of the cost of new plant and machinery is to be extended to cover second-hand machinery.

The allowance provided in last year's Finance Act for scientific research expenditure is to be extended to payments made after April 6, 1944. An allowance will also be made for capital expenditure on buildings, plant and machinery for research incurred after January 1, 1937. The present " exceptional depreciation " allowance will be extended to buildings, plant and machinery not scrapped but retained in the business if they are worth less than their cost.

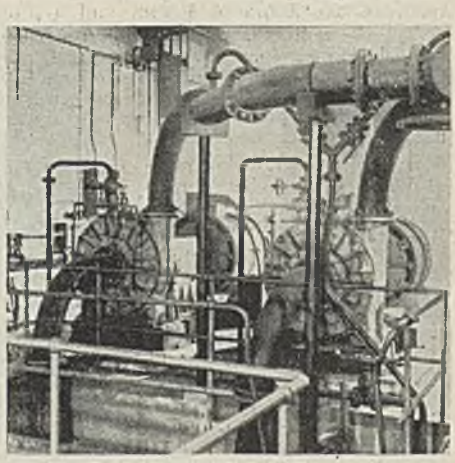
# Earley Power Station

## Main Features of Boiler House and Generating Sets

THE Earley power station which is the subject of editorial comment on p. 155 is owned by the C.E.B., is operated by Edmundsons Electricity Corporation Ltd., and is sited between the Thames and the G.W.R. main line. All coal for the station is rail borne and four reception sidings, each accommodating 40 waggons, have been constructed alongside the main line. The waggons are weighed on a 40-ton weighbridge and emptied by means of a rotary type tippler capable of handling any standard railway waggon up to 20 tons capacity. An electric capstan is provided to assist in the operation.

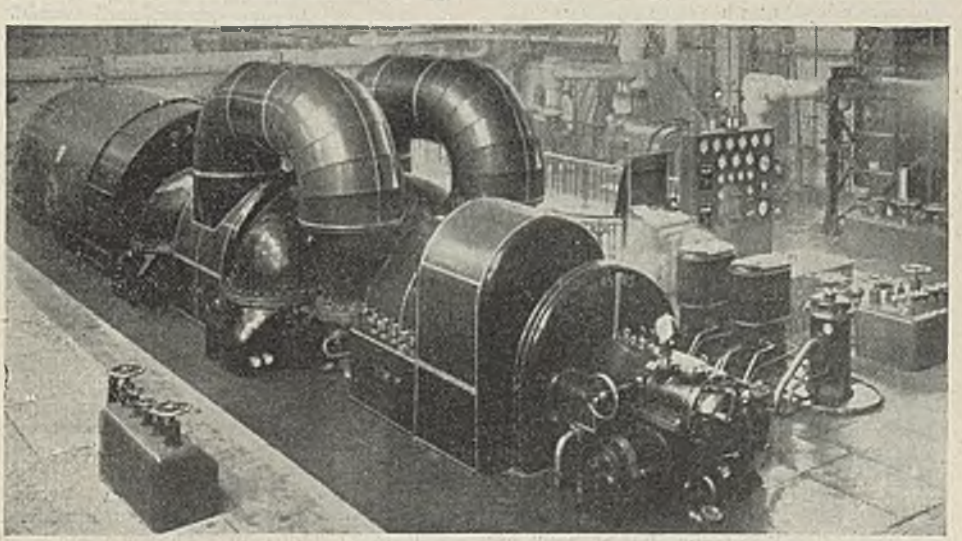
If necessary, the coal is passed through two crushers located below the receiving hopper and it is then elevated by a skip hoist and discharged into a bifurcated chute. The chute feeds a radial conveyor, from the end of which the coal falls to form the initial pile for the drag scraper storage equipment, and alternatively it feeds the first of three belt conveyors leading to the boiler house. The last belt discharges into the bunkers by means of a travelling tripper which may be confined to any desired section of the bunker aisle. The bunkers are of 250 tons capacity per boiler, and the handling plant has a capacity of 75 tons per hour.

The drag scraper coal store occupies a sector of about 160° and has a capacity of 27 000 tons. When reclaiming, the coal is drawn by the scraper bucket into a hopper feeding the main skip hoist. The tail car, to which the haulage ropes are attached, is fitted with a hand winch to move it round the perimeter track, but a standard gauge track is also laid to enable the car to be moved by the site locomotive.



**General view of the ash pumps**

The boiler plant consists of five (ultimately seven) p.f. units, two of which are



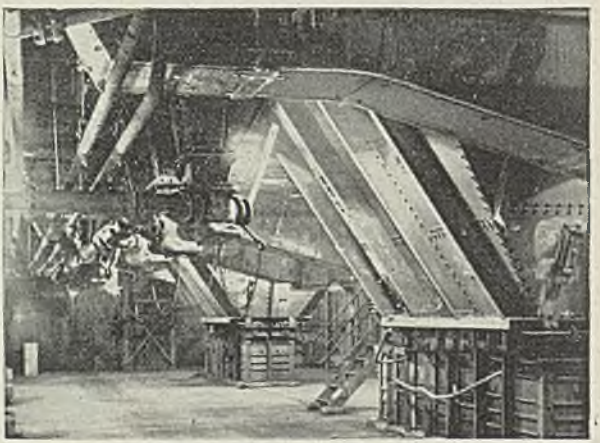
**40 000 kW turbo-alternator set. The ejector valve control desk is in the left foreground; the blast wall between Nos. 1 and 2 sets, feed pumps, and turbine instrument panel are in the background**

nearing completion, but are not yet in service. Each boiler is designed for a maximum continuous output of 200 000 lbs./hrs., at a pressure of 635 lbs. per sq. in. and a temperature of 850°F.

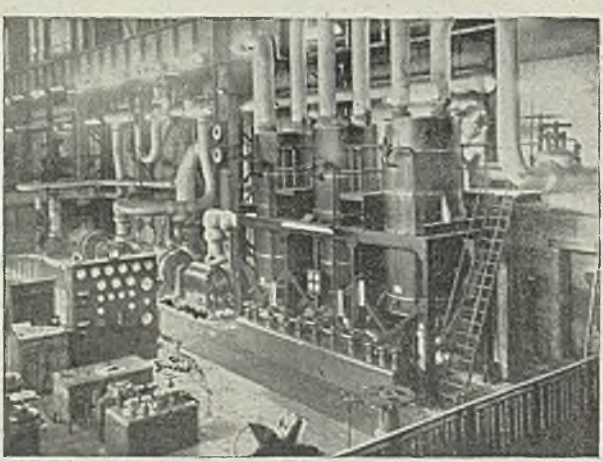
The boilers are of modified tri-drum type with a fourth drum at the lowest point of the circulatory system feeding the water walls, and the inclined tubes forming the slag screen over the refractory lined ash hopper. The superheater is of the pendant type, divided into two primary and two secondary sections, the latter occupying the centre portion. Automatic superheat control is by desuperheater, interposed between primary and secondary sections. The economiser is of the twin-tube type with steel tubes having shrunk-on cast-iron fins. Both air heaters are plate type, and can be wholly or partially bye-passed. Recirculation from the primary heater outlet to the f.d. fan inlet is also provided for.

Each boiler unit has two induced and two forced draught fans. Control is by two-speed s.c. motors and dampers, the i.d. dampers being automatically regulated to maintain a pre-set furnace pressure of about 0.2 in. water gauge below atmosphere. The control system is air-actuated at 30 to 40 lbs. per sq. in.

The pulverised fuel equipment operates on the unit principle without intermediate storage, and there are two sets per boiler, each comprising coal feeder, Lopulco roller-type pulveriser, separator and fuel fan. Each mill has a capacity of 13 200 lb./hr. with 6 per cent. moisture in the coal and 10 950 lb./hr. with 15 per cent. moisture. The mills run at constant speed but the coal feeders and separators have variable speed d.c. drive and the exhauster fans variable speed a.c. drive, all controlled from the boiler instrument panel. The burners are of the corner-firing type set at an angle in each corner, and secondary air ports are arranged around the burners, with tertiary air ports at a higher level.



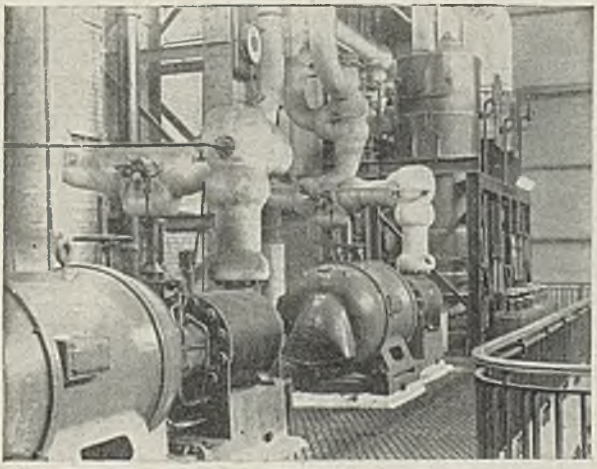
**Boiler ash hoppers, with the grit hoppers and Hydrovac dust extractors on left**



**High pressure feed water pumps. Left foreground, auxiliary steam valve desk; left centre, turbine instrument panel; left background, boiler feed pumps, two electric and one steam stand-by; centre, high pressure feed heater valve desk; right foreground, main steam isolating valve and bye-pass**

The lighting-up equipment was originally designed for light petroleum oil, but as this was in short supply it was redesigned to handle creosote pitch mixture. This mixture will not flow freely below 90° F. and above that temperature it tends to deposit free carbon out of suspension, unless kept in motion. A temperature of over 140° F. is necessary for combustion, but carbonisation in the pipes may occur at over 200° F. To meet these conditions the storage tanks have thermostatically-controlled heaters, and the pipework is wrapped with Pyrotenax heating cable divided into sections, each with separate thermostatic

control set at 90° F., the whole being covered by lagging. The piping forms a ring main in which constant circulation is maintained by pumps. Immediately before the burners there are terminal heaters with thermostatic control adjustable between 120° F. and 220° F.



**Boiler feed pumps and high pressure feed heaters**

The boilers are fitted with three types of soot blowers—single nozzle retractable, multi-jet rotating, and multi-jet traversing; all take superheated steam at full boiler pressure, are electrically-operated and have automatic sequence control.

There is one electrostatic precipitator per boiler, of Sturtevant manufacture. The ash and dust handling and disposal plant, is of Babcock and Wilcox manufacture. It is operated by high pressure water supplied from a single pumping plant, but is otherwise divided into two separate sections, one handling ash or clinker from the furnace hoppers, and the other dust and grits from the rear boiler passes and precipitators.

The generating plant comprises two (ultimately three) 40 000 kW turbo-alternator sets, one of which is still in course of erection. The machine generates at 33 kV, at a speed of 3 000 r.p.m. and has a power factor of .85. The subsequent machines are to be duplicates of the first.

The turbines are of the two-cylinder tandem reaction type with a double exhaust cylinder. There are 38 stages in the h.p. cylinder and 6 in the l.p. cylinder. The blading is of stainless iron except at the exhaust end where it is of mild steel with erosion resisting shields. The h.p. cylinder is supported at the steam inlet end on a pedestal fixed to the foundations, and axial expansion at the exhaust end is provided for by Muntz metal plates between the supporting feet and brackets on the l.p. exhaust casing. The supporting feet are arranged near the horizontal centre line of the turbine to allow the cylinder to expand concentrically in a radial direction. The l.p. cylinder is located at the exhaust casing adjacent to the h.p. cylinder.

Provision is made for turbine blade washing, a small connection being provided to enable a regulated quantity of water to be introduced into the main steam supply after the isolating valve, with the machine running at slow speed.

The double flow l.p. cylinder exhausts into a single two-pass surface condenser, having Admiralty Mixture tubes with ferrules at both ends. The first machine has a quick-starting ejector and a two-stage running ejector. The remaining sets will also have a standby running ejector.

Duplicate 100 per cent. motor-driven vertical spindle extraction pumps deliver the condensate through the ejector coolers, drain cooler and the single l.p. feed heater to the boiler feed pump suction main. The temperature at this point is 194°F. at m.c.r. The feed temperature is further raised to 356°F. at m.c.r. by three h.p. heaters on the discharge side of the feed pumps, making four stages of feed heating in all. The l.p. heater tapping is on the l.p. cylinder of the turbine and the remaining three tappings are on the h.p. cylinder. Heater drains are cascaded to the condenser. An automatic bye-pass valve diverts feed water from all three h.p. heaters in the event of an abnormal rise of water level in the steam space of any one heater. There are two bled steam evaporators, jointly capable of evaporating 4 per cent. of make-up water.

The l.p. heater and evaporators are at basement level and the h.p. heaters are above the turbine floor level. Controls are grouped in valve desks adjacent to the turbine gauge board for ease of operation. The feed pumps comprise two motor-driven and one steam standby pump for the first set, and one motor and one steam pump for the second set. All are Weir pumps of 100 per cent. capacity for one turbo-alternator set, and are designed for a total pressure of 850 lb./sq. in.

The surge tanks, which normally ride on the feed system between the drain cooler and l.p. heater, are of 9 000 gals. capacity for each set and are enclosed in housings on the turbine house roof. Any excess of eva-

porated make-up over surge tank capacity spills into a 27 500 gals. reserve feed tank. The river water used for make-up is softened to about 3 degrees of hardness in a Kennicott lime and soda softener.

### The Alternator

The alternator generates direct at the switching voltage of 33 kV and is capable of running continuously at any load up to 40 000 kW with any wattless output between 24 790 R.kVA lagging and 14 100 R.kVA leading, the inlet temperature of cooling air being 40°C. The rotor current at maximum load and .85 lagging power factor is 300 A, and the main exciter is rated for 450 A at a maximum voltage of 500. A pilot exciter is fitted to give stable excitation over the whole range.

Circulating water is drawn from the Thames and flows by gravity along an open channel from the river bank to the pump house outside the main building. For each turbo-alternator set there is a single vertical spindle axial flow pump of 22 000 g.p.m. capacity. Water discharged from the condensers is led by a short run of cast-iron piping to a seal pit adjoining the pump house, and thence it flows by gravity to the river discharge.

There is no main switchgear in the station, as the sets are switched at the grid sub-station on the opposite side of the railway. The main 33 kV generator switchgear is of the horizontal draw-out metal-clad compound filled type, having a rupturing capacity of 500 MVA. The generators are normally controlled from the operating room at the sub-station, where are mounted the control desk, instruments, relays, metering equipment and voltage regulator. An emergency control panel is provided in the turbine house. Protection comprises Merz Price protection for the alternator, and earth leakage protection for the direct connected unit auxiliary transformer, backed up by separate over-current relays with a high setting on alternator and transformer.

The design of the auxiliary power system is based on the principle of sectionalisation, with several separate sources of supply. Each turbo-alternator set has a 3 000 kVA, 33/3.3 kV unit transformer solidly connected to its terminals, and in addition there are two 5 000 kVA, 33/3.3 kV station transformers, teed off the 33 kV side of 132/33 kV transformers at the grid sub-station. Each of these transformers feeds a separate section of the 3.3 kV auxiliary switchboard, and, whilst paralleling is possible when starting up and changing over supplies, the section switches are normally open. Each unit transformer carries the essential auxiliaries of its associated set and two boilers, and the remaining general auxiliaries are supplied in groups from the station transformers. The major turbine auxiliaries are supplied at 3.3 kV and the smaller motors and boiler auxiliaries at 400 V.

The 3.3 kV switchgear is of the air-break draw out type, electrically-operated and of 75 MVA rupturing capacity. The 400V gear is generally similar but is of 25 or 15 MVA rupturing capacity, and electrically or hand operated according to the duty. The boiler switchboards are housed in separate chambers between the boiler house and precipitators, and the remaining auxiliary boards are in separate sections of an electrical annexe. Control panels for the 3.3 kV boards are mounted in the turbine house. Auxiliary switchgear operation is by a 110 V 400 Ah. battery which will be duplicated with the third set.

Auxiliary motors are of the squirrel cage type wherever possible, and with minor exceptions protection is limited to indication of an earth fault and tripping in the event of a phase to phase fault, motor overload and undervoltage protection being excluded. Each boiler is treated as a unit and a fault on any of its auxiliaries trips out the 3.3 kV supply to the associated boiler transformer.

### Operating Details

Some idea of the operation of the station may be gathered from the fact that for the week ending February 3, the kWh generated were 5 600 000, of which 342 000 kWh were consumed in works. The total coal consumed was 2 522 tons, while 7.3 tons of fuel oil were consumed for lighting-up. The coal consumed per unit generated was 1.009 lbs., and per unit sent out, 1.075 lbs. The overall efficiency of the station during the week was 25.21 per cent.

The consulting engineers were Messrs. Merz and McLellan and the main contractors were: Sir Robert McAlpine and Sons, Ltd. (civil engineering work); International Combustion, Ltd. (boiler plant); C. A. Parsons and Co., Ltd. (turbo-alternators); Babcock and Wilcox, Ltd. (cranes); Reyrolle and Co., Ltd. (switchgear); Aiton and Co., Ltd. (pipework); Robert Dempster and Sons, Ltd. (coal handling plant); Metropolitan-Vickers Electrical Co., Ltd. (auxiliary transformers); Drysdale and Co., Ltd. (circulating water pumps); F. W. Brackett and Co., Ltd. (circulating water screening plant); English Electric Co., Ltd. (auxiliary switchgear); W. T. Henley's Telegraph Works, Ltd. (cabling); Wharton Crane and Hoist Co., Ltd. (workshop crane); S. H. Heywood and Co., Ltd. (lighting and heating); Bryce, Ltd. (lighting and heating transformer); Foster Transformers and Switchgear, Ltd. (lighting transformer); Gent and Co., Ltd. (clocks); Clifford and Snell, Ltd. (Loudaphone and total load indicating equipment); Ivor Speciality Co., Ltd. (soot blowers); Atlas Sprinkler Co., Ltd. (fire fighting equipment); W. T. Avery, Ltd. (road weighbridge); Clarke, Chapman and Co., Ltd. (capstan for coal truck handling); (Sturtevant Engineering Co., Ltd. (boiler board housings and vacuum cleaning plant).

# Industrial Electric Locomotives

## Representative Examples for Operation Above and Below Ground

THE wide variety of conditions for which electric locomotives can cater in industrial service is illustrated by two examples recently supplied by the English Electric Co., Ltd.

Fig. 1 shows a standard gauge locomotive of the centre cab type weighing 13½ tons, used for coal haulage and general shunting at the Sunderland Corporation power station. It is fitted with two nose suspended axle hung traction motors, connected permanently in series for operation from an overhead contact wire at 550 V with earth return.

Fig. 2 shows a locomotive supplied to Imperial Chemical Industries, Ltd. In size and performance it is a repeat of one supplied to the company in 1930, but embodies a number of modifications introduced as a result of the operating experience gained with the earlier locomotive.

This locomotive operates on 2 ft. 6 in. gauge tracks in a main underground road and weighs 6 tons. It is provided with two nose suspended axle hung traction motors arranged for series parallel control for operation from overhead contact wires at 250 V with insulated negative. The controller is fitted with a dead-man's handle arranged to cut off power by opening the main circuit breaker if released. Since the mine in which this locomotive is used is non-gassy, the equipment is not of the flameproof type.

In order to facilitate lowering the locomotive down the mine shaft, it is provided with a removable cab, and the conduit and wiring is arranged to be easily divided close to the joint.

For both locomotives, the controller is arranged to provide rheostatic braking additional to the screw down handbrake. In the case of the mining locomotive, the hand brake can also be operated by a hand lever working on a ratchet and quadrant.

**Fig. 1.—Standard gauge electric loco'. supplied by the English Electric Co., to Sunderland electricity department**

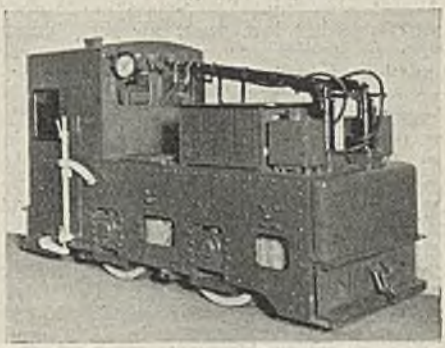


**Fig. 2.—Industrial type trolley loco'. supplied to the I.C.I.**

# Electrical Travellers

THE sixth annual luncheon of the Electrical Trades Commercial Travellers' Association, was held in London, on February 16, when covers were laid for well over 400 persons.

Mr. W. F. Moir, president, was in the chair. In proposing the toast of the association, Mr. Carlton Dyer said that everyone was looking forward to the day when the traveller could resume his normal occupation.

Mr. Moir, in reply, pleaded for greater support of the charities in which the association was interested, namely the Royal Commercial Travellers' School and the E.I.B.A.

Mr. Johnson, in appealing for support of the charities already named, pointed out that last year the association had been able to give both the R.C.T.S. and the E.I.B.A., 75 guineas each and this year a special effort was hoped for.

During the luncheon a collection was made and the record sum of £65 was contributed. Also during the luncheon Mr. Marks presented Mr. T. E. Edwards, the chairman, with an ivory gavel in commemoration of the 21st anniversary of the association which will occur next year.

# Electrical Overseas Trade

## Statistics for 1944 Compared With Those of Previous Two Years

THE Board of Trade has now published accounts relating to the export trade of the United Kingdom for 1944, together with comparable figures for 1942 and 1943. As in the accounts published in October and December last year, all the figures relate to exports of United Kingdom produce and manufactures, and exclude re-exports. There were considerable fluctuations during 1944. For the year as a whole exports were £25 million more than in 1943, but they failed by £13 million to reach the total for 1942, notwithstanding a considerable rise in prices. Exports under the heading "Electrical Goods and Apparatus" were valued at £12 637 292 for 1944, compared with £11 091 370 in 1943, and £11 162 895 in 1942. The value of generators sent overseas was £2 526 380 compared with £1 582 374 in 1943, and £1 232 567 in 1942; the figures for motors were £1 773 697 in 1944, £932 688 in 1943, and £1 331 039 in 1942, while those for converting machinery, switchgear and other electrical machinery were £7 726 389 in 1944, £4 062 312 in 1943, and £2 444 201 in 1942. The total value of electrical exports for 1944 was £24 848 409 as compared with £17 859 358 in 1943, and £16 427 526 in 1942. The classified figures are given below:—

| | Year ending December 31st, 1942. £ | 1943. £ | 1944. £ |
|---|---|---|---|
| Electrical ware (including insulators) | 154 851 | 101 740 | 123 030 |
| Illuminating glassware | 84 376 | 86 441 | 58 530 |
| Electric wires and cables insulated— | | | |
| Telegraph and telephone wires and cables— | | | |
| Submarine ... | 122 544 | 284 983 | 395 827 |
| Other ... | 977,479 | 1 200 138 | 920 230 |
| Other descriptions— | | | |
| Rubber Insulated... | 787 273 | 894 009 | 1 382 334 |
| Insulation other than rubber ... ... | 1 463 790 | 1 299 016 | 1 267 442 |
| Wireless apparatus— | | | |
| Receiving sets and receiver chassis, complete, other than radio-gramophones, excluding valves ... ... | 193 455 | 114 010 | 95 399 |
| Transmitting apparatus, excluding valves | 1 250 988 | 1 062 629 | 839 199 |
| Valves, complete ... | 297 465 | 678 814 | 1 255 322 |
| Parts and accessories, not elsewhere specified... ... ... | 402 929 | 374 185 | 764 815 |
| Telegraph and telephone apparatus other than wireless | 1 376 871 | 1 543 658 | 1 516 528 |
| Electric lighting appliances, accessories and fittings, and parts thereof, not elsewhere specified— | | | |
| Bulbs, complete, ready for use... | 769 858 | 556 478 | 564 998 |
| All other descriptions ... ... | 530 993 | 343 933 | 398 144 |
| Batteries, primary, complete ... ... | 142 312 | 112 495 | 142 932 |
| Accumulators— | | | |
| Complete— | | | |
| Portable (including accumulators for road vehicles) ... | 240 576 | 263 237 | 336 713 |
| Stationary ... | 135 523 | 124 633 | 119 221 |
| Parts and accessories ... ... | 179 902 | 137 401 | 141 611 |
| Electrical cooking and heating apparatus (including industrial) ... ... | 161 289 | 82 555 | 107 283 |
| Electrical instruments (other than telegraphic and telephonic)— | | | |
| House service meters, complete ... ... | 134 796 | 100 047 | 85 119 |
| All other descriptions ... ... | 257 205 | 309 320 | 466 845 |
| Insulating materials, not elsewhere specified... ... ... | 244 714 | 176 212 | 241 767 |
| All other articles | 1 483 933 | 1 433 617 | 1 595 573 |
| Electrical machinery— | | | |
| Generators ... | 1 232 567 | 1 582 374 | 2 526 380 |
| Motors ... ... | 1 331 039 | 932 688 | 1 773 697 |
| Converting machinery— | 15 655 | 41 79 | 19 076 |
| Transformers for lighting, heating and power, including coils ... ... | 746 147 | 1 026 593 | 1 375 029 |
| Rectifiers for power-house use ... ... | 37 367 | 38 018 | 54 722 |
| Starting and controlling gear for electric motors ... ... | 471 599 | 313 522 | 371 195 |
| Switchgear and switchboards (other than telegraph and telephone) ... | 1 074 552 | 1 364 615 | 1 453 500 |
| Electrical machinery, not elsewhere specified... ... ... | 98 881 | 1 279 771 | 4 451 867 |
| Vacuum cleaners and parts ... ... | 17 597 | 2 433 | 4 091 |
| Total ... | 16 427 526 | 17 859 358 | 24 848 409 |

**Brazilian Railway Electrification.**—The Paulista Cia has stated that it intends to carry out the electrification of its line to Bauru and has already ordered 12 electric locomotives. The Mogiana line has improved its system, the Sorocabana is to be electrified up to the State of Santo Antonio, and the San Paulo Railway has already sent to the President its project for the electrification of the San Paulo-Jundiai line.

# Electrical Personalities

*We are always glad to receive from readers news of their social and business activities for publication in this page. Paragraphs should be as brief as possible.*

**Mr. V. J. Radbone** has been elected a director of Associated Electrical Industries Ltd.

**Mr. J. T. Morgan** has been appointed secretary of the Electrical Machinery Traders' Association.

**Mr. E. H. Wootton** has resigned from the board of Harris and Sheldon, Ltd., and has joined the board of A. Hawkes and Co.

**Mr. William Joseph Marston,** late engineer and manager of the Coventry electricity undertaking, left £9 193 (net £9 144).

**Mr. E. A. Anderson,** a director of A. Anderson and Son, Ltd., electrical engineers, has been elected a member of Middlesbrough Town Council.

Frigidaire, Ltd. announce that **Mr. G. Keith Drew** has been appointed sales director, succeeding **Mr. W. Brett Daniels,** who will now handle sales and service of Frigidaire products in the London area.

G. and J. Weir, Ltd., announce the appointment of **Mr. James G. Arnott** (foundry manager of the Clyde Alloy Steel Co., Ltd.) to be general manager of the Holm and Argus foundries.

**Mr. Arthur Wood,** traffic superintendent for the Yorkshire Traction Co., Ltd., since 1919, is to retire after 42 years' service. His successor is **Mr. R. Coutts,** assistant superintendent for 12 years, and former manager of the old Dearne District Light Railway.

**The Metrovick cast in "Distinguished Gathering"**

The Chairman (Sir Allan Powell) and the Governors of the B.B.C. gave a dinner on February 16 at Claridge's on the opening of the Commonwealth Broadcasting Conference, called together by the B.B.C. Among those present were Sir Edward Appleton, Sir Harry Railing, Sir Noel Ashbridge and Sir Edward Wilshaw.

**Mr. Walter C. Mountain** is retiring from the position of manager of the Melton Mowbray Electric Light Co. in May. He has been associated with the company, first as secretary then as manager, for 42 years. His successor will be **Mr. C. E. Wood,** who for 19 years has managed the Stamford Urban Electricity Supply Co.

The Committee of the I.E.E. Scottish Centre have nominated **Mr. R. I. Kinnear** (chief electrical engineer, John Brown and Co., Ltd.), as chairman of the centre, and **Messrs. H. M. Speirs** (sole partner, H. M. Speirs and Co.) and **J. Gogan** (development superintendent, the Clyde Valley Electric Power Co.), vice-chairmen for the next session.

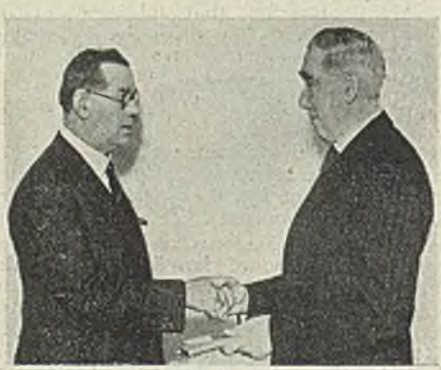
**Mr. H. G. Hagon,** a director of Taylor, Taylor and Hobson, Ltd., has completed 50 years' service, and to celebrate the event the firm's "25" Club held a dinner in the works canteen. Directors and employees joined in tributes, and on their behalf Mr. Warmisham made a presentation to Mr. Hagon, and Miss A. M. Perkins to Mrs. Hagon. Presentations were also made to **Mr. G. Stafford,** who retired from the directorate last year, and to **Mr. E. Oram,** sales manager until his recent resignation.

The Metropolitan-Vickers Dramatic and Operatic Society has achieved a further success, the play chosen on this occasion being, "Distinguished Gathering," by James Parish. It was performed recently at the Metropolitan-Vickers Club Theatre before large audiences on four nights and, by request, repeated on four nights, in aid of local funds for the Services, at Sale Town Hall, where the players had an enthusiastic reception. At its club theatre Sir Thomas Robinson, the Charter Mayor of Stretford, Lancs., with the Mayoress, attended, and at Sale the Mayor of that borough publicly thanked the society.

The Liverpool Electric Power and Lighting Committee have recommended that **Mr. J. W. Smith,** chief inspector of works be promoted to the position of works superintendent, at a salary of £500 per

annum, plus war bonus, and that **Mr. L. C. Maple** be appointed radiological engineer to the municipal hospitals.

**Mr. Harry Green** has retired from the position of general liaison officer in charge



**Sir Frank Gill presenting a cheque to Mr. Harry Green**

of the co-ordination of trunk and toll cable schemes for Standard Telephones and Cables, Ltd., and United Telephones (B.I. and Southern) in conjunction with the Post Office, which he had held from 1934. At a farewell luncheon Sir Frank Gill presented Mr. Green with a cheque and an autographed card as an expression of the esteem in which he was held by his many friends.

**Mr. W. S. Proctor** has been appointed telephone manager for the Glasgow area in succession to **Mr. Robert Teasdale** who has retired. Mr. Proctor who was area engineer Dundee and then regional engineer Edinburgh, is an expert on tele-communications and joint author of a text book on telephony.

**Mr. H. C. Pierson,** the general sales manager. of Metropolitan-Vickers Electrical Co., Ltd., has retired, but retains his seat on the board. He is succeeded by **Mr. Ivor R. Cox** who also retains his present position as managing director of Metropolitan-Vickers Electrical Export Co., Ltd. **Mr. Duncan MacArthur** has been appointed deputy general sales manager, retaining his position of home sales manager. He has also been elected to the board of Metropolitan-Vickers Electrical Export Co., Ltd.

**Mr. H. Cecil Booth,** chairman and joint managing director of the British Vacuum Cleaner and Engineering Co. Ltd.,, has, on grounds of advancing years, relinquished his position as joint managing director. The board has appointed **Mr. J. J. Hambidge,** joint managing director, to be sole managing director, and **Mr. D. Watkins** will remain assistant managing director. Mr. H. Cecil Booth, the inventor of the vacuum cleaner, has been director of the company since its inception in the early years of the century and managing director since 1914. He will continue to be chairman of the board.

There was another long discussion by the Bolton Town Council recently on a recommendation of the Electricity Committee to pay £7 000 to the Borough Electrical Engineer and his staff for work in connection with extensions at Back-o'-the-Bank power station. The recommendation was confirmed. The grants were defended on the ground that the Council having given the Electricity Committee power to settle, had no right to protest now. It was stated that Lancaster had paid £10 000, and Torbale, Preston and Blackburn about £40 000. Coun. Longworth, chairman of the Electricity Committee, said that by the settlement £30 000 had been saved.

### Obituary

**Mr. Henry Morris Ash,** aged 94 years. He spent his working career as a draughtsman with Siemens Bros. and Co., Ltd., and took part as a hydrographer in the laying of the 1894 Mackay-Bennet Atlantic cable. He retired in 1910.

**Prof. William Brown,** on February 14, aged 88 years. He was educated at Glasgow University, and was laboratory assistant to Lord Kelvin. In 1888 he went to Ireland as assistant physicist at the Royal College of Science. Later he was appointed lecturer in electro-technology, and became professor of applied physics there in 1909. From 1910 to 1911 he was chairman of the Dublin centre of the I.E.E. In 1921 he retired from active teaching. Prof. Brown was a distinguished research worker in the subject of magnetism and had published over 45 papers. In collaboration with Sir William Barrett and Sir Robert Hadfield, he carried out investigations disclosing the unusual magnetic properties of iron and nickel alloys.

**Mr. David Weir,** on February 12, aged 56 years. He had represented the British Thomson-Houston Co., Ltd., for several years on various sections of the B.E.A.M.A. Mr. Weir was educated at Dunfermline High School and Glasgow University. Prior to entering the university, he had some years training in mechanical and electrical engineering. He then joined the B.T-H. Co., and, except for four years spent in the Forces during the 1914-18 war, remained with them until his death. Starting in the testing department at Rugby, he gained further experience in the d.c. design engineering department, and then joined the contract department under the late Mr. J. P. Gregory.

# The Electrical Refrigeration Industry

## Fusion of C.E.R.A. and D.E.R.A. Announced

THE fusion of the Commercial Electric Refrigeration Association and the Domestic Electric Refrigeration Association into one body to be known as the British Refrigeration Association was announced by Mr. E. G. Batt, independent chairman of C.E.R.A., at the second annual luncheon of that association in London, on Wednesday.

The chief guest was Mr. A. V. Alexander, First Lord of the Admiralty, who spoke of what the Royal Navy owed to the refrigeration industry, and the part the industry had played in maintaining food supplies. The Navy, he said, disposed of more than 30 per cent. of refrigerated meat sales and about 27 per cent. of the retail milk distribution. What their trade had done in the past in the cooling of milk and afterwards, cold storage, he hoped would be extended after the war in the direction of preserving home-grown produce. If the refrigeration industry in the future kept as up-to-date as they had done for the Navy, they would do a pretty good job in the reconstruction of our national life and the maintenance of that standard of prosperity to which we hoped our men and women would return.

### Naval Requirements

Referring to the extensive use of refrigeration in the Navy, Mr. Alexander said they now found themselves faced with the problems of the maintenance, provisioning and supply of ships in far distant waters. The war in the Far East had shown a big increase in the demand for air conditioning plant, water coolers, ice-cream plant, and to meet that demand the Navy's requirements for refrigerating machines of from ¼ H.P. to 50 H.P. totalled about 500 a month which he was told was nearly 25 per cent of the present capacity of the industry.

Mr. Alexander also told something of the story of refrigeration in the Merchant Service during the war and how in 1940 and 1941 the urgent problem of providing the necessary refrigerated ships for conveying meat and bacon was tackled, and the necessity for reducing the meat ration was avoided.

The chairman, in response, said that the C.E.R.A. now had a membership of 248, representing machinery manufacturers, insulation contractors, distributors and service engineers. Each of these sections of the industry was responsible for the conduct of its own affairs under the general direction of the Council.

His Council felt, that unless the utmost care was taken to control the disposal of surplus Government stores, damage might occur to the interests of the industry and they had asked the departments concerned to ensure that the association was adequately represented on any body which might be set up to deal with the matter.

### Fixing Standards

Among other matters, the Council had requested the British Standards Institution to establish a standard specification for condensing units, whilst the insulation contractors forming Section "B" were investigating the possibility of fixing standard dimensions for service cabinets and small coldrooms normally supplied with commercial refrigeration installations.

The Council also felt that for the post-war years there should be established a fair trading code, and with this in mind during the past year special sub-committees had been set up to prepare recommendations.

The latest official returns showed that the exports of refrigeration machinery had dropped from 2 830 tons, having a value of £396 373, in 1938 to 516 tons, having a value of £108 990, in 1943. The development and experience gained during the war by the refrigeration industry placed it in a position fully to play its part in the future, and he hoped their engineers would be able to produce equipment of adequate size within the limits of the purchasing power of everybody.

Experience had led them to decide that certain changes should now be made in the constitution of C.E.R.A. so that it might effectively deal with home and export problems affecting any size of plant from the smallest domestic to the largest industrial unit. Hitherto the domestic market had been dealt with by the Domestic Electric Refrigeration Association (D.E.R.A.) whilst C.E.R.A. had limited itself to the medium size commercial plants. In pursuance of the idea of having one association which could speak for all sections of the refrigeration industry, it had been decided to join C.E.R.A. and D.E.R.A. together with the interests of the larger plants in one association which would be known as the British Refrigeration Association (B.R.A.).

The chairman also submitted the toast of the guests, to which Mr. E. E. Hoadley, of the E.D.A. Council, responded.

# News in Brief

**Wireless Installation.**—The Manchester Town Hall is to be equipped with a wireless installation. There will be permanent lines and a permanent control point inside the building.

**Institute of Transport.**—A meeting to commemorate the twenty-fifth anniversary will be held on March 22.

**School Lighting.**—The Bradford Education Committee has authorised the installation of fluorescent lighting at Belle Vue High School at an estimated cost of £649.

**Industrial Savings.**—The management of the English Electric Co., Ltd., at Stafford, have informed the National Savings Committee that they have decided on the continuation of their savings organisation in the post-war period.

*TWENTY-FIVE YEARS AGO*

*FROM* THE ELECTRICIAN *of February 20: The Electricity Supply Act will mean, we all hope, a renaissance in the electricity supply industry. Many of the old rigidities which "cribbed, cabined and confined" undertakings will melt away under the sunbeams of the easy procedure inaugurated.*

**South Wales Branch of Institute of Physics.**—The inaugural meeting of a South Wales branch of the Institute of Physics will take place at 2.30 p.m. on March 10, in the Physics Department of University College, Swansea (Singleton Park) when Dr. C. Sykes, F.R.S., a member of the Board of the institute and Principal of the Brown-Firth Research Laboratories, Sheffield, will deliver an illustrated lecture on "Physics in Metallurgy." Further particulars of the branch may be obtained from the acting Hon. Sec., Dr. T. V. I. Starkey, the Technical College, Mount Pleasant, Swansea.

**Jubilee Celebrations.**—The Cheltenham Electricity Committee is to make arrangements for jubilee celebrations in May.

**Electrical Exhibition.**—The Chesterfield Electricity Committee has arranged to take part in an electrical exhibition at the premises of the Co-operative Society in Elder Way, at a cost of £450.

**Welcome and Welfare Fund.**—The Wessex Electricity Co. are contributing towards the advertising for an effort to raise £1 000 for the Newbury Welcome and Welfare Fund for Service men and women.

**Electrification of Farms.**—At a meeting of the Cheshire N.F.U. County Committee, at Chester, there was strong support for proposals to increase the facilities for the electrification of farms, and Mr. J. A. Duncan said that members of the appropriate committee were to attend a special lecture in Chester on the subject of "Electrical Aspects of Farm Mechanisation."

# Contracts Open

WE give below the latest information regarding contracts for which tenders are invited. In the case of overseas contracts, particulars are to be had from the Department of Overseas Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated.

**Tynemouth T.C.,** February 24.—Supply of electric lamps for the year ending March 31, 1946. Schedules and forms of tender from the Borough Surveyor, 19/20, Howard Street, North Shields.

**Ashford (Kent) U.D.C.** February 26.—Supply and installation of a 300 000 cu. ft. per day carburetted water gas plant with automatic operation, together with electric coke-skip hoist. Particulars from the Manager of the Gasworks, Ashford, Kent.

**Bury T.C.**—February 26, Supply of one 60 kW steam-driven d.c. generating set, and one Lancashire steam boiler. Particulars from the Gas Engineer, Gas Works, Bury.

**Chesterfield T.C.,** March 1.—Supply and delivery of one 500 kVA, 6 600/415 V outdoor transformer. Specification from Mr. W. W. Grimes, 172, Chatsworth Road, Chesterfield.

**Manchester T.C.,** March 1.—Supply, delivery and erection of four outdoor-type sub-station kiosks and switchgear. (Spec. No. 815). Particulars from Mr. R. A. S. Thwaites, Electricity Department, Town Hall, Manchester; deposit, £1 1s.

**Shipley U.D.C.,** March 2.—Supply and delivery of paper insulated cables for twelve months from April 1, 1945. Specification from Mr. Nigel L. Duncan, Electricity Works, Dockfield, Shipley, Yorks.

**Westhoughton U.D.C.,** March 7.—Supply of electric lamps for the year ending March 31, 1946. Particulars from Mr. F. H. Walker, Town Hall, Westhoughton.

# Overhead Lines on A.C. Systems

## Problems of Operation, Maintenance and Testing

THE subject for discussion at the meeting of the I.E.E. Transmission Section, on February 14, was a paper by Messrs. R. C. Hatton and J. McCombe on "The Operation, Maintenance and Testing of Overhead Lines and Associated Equipment on A.C. Systems."

The paper emphasised that for the efficient operation, maintenance and testing of electrical equipment in complex a.c. systems, it was of fundamental importance to provide adequate transport and communication systems, a carefully selected and trained staff located at strategic points, and centralised control of all operations, and to enforce the strict observance of a suitable code of safety regulations.

The maintenance of the various components of overhead lines and outdoor substations, which experience on the authors' system had shown to be necessary or desirable, was detailed, and suitable intervals for such maintenance work were indicated.

An analysis of faults was made for both the overhead lines and transformers on the system; the steps which had been taken, or which it was proposed should be taken, for counteracting them, were described. The predominance of faults due to lightning was emphasised and the precautions which could be taken were discussed.

**Mr. H. Willott Taylor** (Edmundsons Electricity Corporation) asked for information as to the cost of the private system adopted for communication as compared with the use of the Post Office system. Also had the flame method of cleaning ironwork been tried, and had any use been made of pneumatic tools for cleaning ironwork for spray painting? Were the fir poles mentioned creosoted by the Ruping method or in some other way and which was the better method in the authors' opinion? The authors had not used glass insulators, but they had been in use in other undertakings for over 8 years with success, and in one case they had been adopted exclusively instead of porcelain for the last 18 months or two years. No reference was made to single-piece insulators, but some of his undertakings had been using them exclusively for many years and they were found to give less trouble than the two-piece insulator. Indeed, there had not been one failure with them. Some standardisation of insulators was required. The paper did not deal adequately with unearthed lines, which he regarded as a big step forward in the reduction of maintenance costs.

**Mr. C. F. Bolton** (Central Electricity Board) spoke of the importance of the selection of maintenance staffs and said this was a matter to which sufficient attention had not been paid in the past. Undoubtedly the greatest safety precaution was the proper training of personnel, and particularly to observe the safety precautions. With regard to the permit-to-work card, the most important thing was to specify the apparatus that had been made dead. B.S.S. 1086, Code of Practice, 1942, had a good deal to say with regard to the permit-to-work card, and it should be studied very carefully. While glass insulators had given good service for many years, the danger was that if there was a slight crack which was not obvious, they might disintegrate and be a danger to the man working on the line.

**Mr. H. F. Marsh** (Mid-Lincolnshire Electric Supply Co., Ltd.) said that hard drawn copper was the best overhead line conductor for all normal situations. There did not seem much advantage in putting a bitumenised tape round the steel core, and his company were replacing the steel core with cadmium. He believed that fatigue troubles were due to having too long spans in exposed positions.

**Mr. J. S. Forrest** (C.E.B.) said the Board had made experiments with radio communication before the war and came to the conclusion that a radio link might be useful in emergency for getting into touch with maintenance men working in difficult country. Could the authors give any indication of the types of insulators associated with the failure figures given in the paper? He agreed that the cleaning of insulators was still a problem, and asked the authors to give the working stresses in the conductors which had failed. Corrosion of steel cored aluminium conductors had been experienced by the C.E.B., and he suggested that manufacturers could help by protecting the conductors with grease before despatch. The duplex gap lightning arrester shown in the paper had a gap which, in his view, was very much on the low side. He used 9-ins. for 33 kV. and 5-ins. for 11 kV. As to multi-phase flash-overs, he had found that the use of Petersen coils limited the faults to about 60 per cent. of what was likely to be anticipated.

**Mr. R. A. W. Connor** (Luton Corporation Electricity Undertaking) suggested that the difficulties with regard to wireless communication were not so much the technical ones as the regulations imposed by the Post Office. With regard to the duplex

gap arrester illustrated in the paper with 2-in. gaps, he said that on the Luton undertaking they used a gap of 3⅛-in., for the 33 kV lines. During the recent severe weather trouble had been experienced due to the ice which formed on the top horn partially thawing and the water dripping down and making contact.

**Mr. F. C. Walmsley** (Micanite and Insulators, Ltd.) said the authors' condemnation of compound filled condenser type bushing should not be taken as general. Most of the troubles were due to the method of sealing. Therefore, the compound filled bushing should not be condemned as entirely unreliable, especially as it scored on the question of cost. A certain amount of care should be taken in differentiating between the oil-filled condenser type bushing and the oil-filled barrier type.

**Mr. F. N. Beaumont** (London Power Co.) agreed that maintenance should go very much farther than merely keeping the plant in working condition. It should have an eye to the future. The criterion of design was not so much what the designer thought of it today as what the maintenance engineer would think of it tomorrow. Therefore, there must be close co-operation between the designer, manufacturer and users.

**Mr. B. H. G. Rogers** (Mid-Southern Utility Co.) said that with regard to creosoting poles, he had had a rather unfortunate experience with poles falling after about 12 years' service. For conductors his undertaking had used cadmium-copper for a long time and had no failures due to the "key." It was a stranded conductor. After six years' experience with lightning arresters he found it difficult to assess their value definitely, but from information collected it seemed that the number of outages had been reduced by about 50 or 60 per cent.

**Mr. J. R. Harding** (Pirelli-General Cable Works, Ltd.) referring to the authors' telephone system, said no mention was made of aerial wires. They had the advantages, compared with bare wires, that they could be designed in most cases to be equal in strength to the line conductors under ice loading conditions, inductive interference was reduced, and additional circuits could be introduced at very little extra cost. For these reasons they were used on several other large systems. Had the authors any preference for pin or suspension insulators on 33 kV lines and had they found any advantage in using solid conductors in place of stranded to offset the disadvantage of greater liability to kink, and the increased number of joints to be made in the field owing to the shorter lengths in which they were supplied, unless factory joints were incorporated?

**Mr. C. O. Boyse** (Callender's Cable and Construction Co., Ltd.) said that the authors' recommendation with regard to spans were sound, and suggested that the more logical and simple way of designing a line was that the sag should be determined not at an intermediate condition of loading with a factor of safety of 2, but with a fairly heavy ice and wind loading up to the maximum possible stress the conductors would take.

**Major T. Rich** recalled that some 20 years ago he sent some glass insulators to Sheffield University, and was laughed almost to scorn. The point with regard to the glass insulator was that if anything went wrong with it there was no need for a test; the trouble showed itself straight away from the ground. He emphasised the desirability of suitable line location for safety reasons. It might be possible to find tracks which were less liable to lightning or to sleet, frozen fog, etc.

## HYDRO-ELECTRICITY

Constructional scheme No. 2, just published, describes two hydro-electric projects of the North of Scotland Hydro-Electric Board, one in Perthshire and the other in Ross and Cromarty.

The Perthshire scheme involves the Rivers Tummel and Garry and their tributaries. It is a major scheme with an installed capacity of approximately 150 000 kW and an output of 293 000 000 units per annum. The Ross and Cromarty scheme is a small one for local needs, and is located on the River Kerry, with an ultimate capacity of 3 000 kW. It is known as the "Gairloch Project." The total estimated cost of the two projects is £6 450 000.

The Loch Sloy hydro-electric scheme has been confirmed by the Secretary of State for Scotland in an Order published. The events leading up to the recent inquiry by Mr. John Cameron, K.C., are described in a White Paper [Cmd. 6596], price 3d. Recommending that the scheme should go forward, Mr. Cameron says that in future the North of Scotland Hydro-Electric Board should, before putting forward new schemes, make quite certain that they have selected practicable sites. In this case the Board decided, shortly before the inquiry, to change the site of the Loch Lomond power station. The report says that the Board established clearly the urgent public need for electricity which would be made available nationally from the Loch Sloy project. No serious technical objections were made and, in Mr. Cameron's opinion, objections on the grounds of cost and amenity failed, though none of the objections was frivolous.

# Modern Permanent Magnets

## Their Design and Economic Utilisation

AT a meeting of the I.E.E. Measurements Section, on February 16, a paper by Mr. D. J. Desmond on "The Economic Utilisation of Modern Permanent Magnets" was read and discussed.

The paper first established the equation to the demagnetisation curve and then proceeded to discuss the uses of permanent magnets in typical pieces of apparatus. The working of the magnet under these various conditions was considered and the useful part of the magnetic energy calculated. This introduced a new method by making use of the unit permeance of a circuit, or the permeance as seen from each centimetre cube of the magnet.

Certain approximations were made in this calculation and the limitations of the simple theory were then discussed. A method was given of designing a magnet in terms of the constants of the iron circuit.

Figures were given for two modern alloys in common use, and curves were plotted for the complete solution to all design problems. The interchangeability of these two alloys was discussed and it was pointed out that not all the additional energy of the anisotropic alloy could be usefully employed. This was due to the larger curve factor which reduced the recovery when a demagnetising force was removed. It was shown that the $(BH)_{max}$ value was not the criterion as to the usefulness of a magnet, except in the simplest case, nor was it necessary for the magnet to work at the $(BH)_{max}$ point.

**Mr. C. E. Webb** (National Physical Laboratory) said this was one of the most valuable papers on permanent magnets since the classical paper by Evershed. The principles laid down in that paper did not apply to the whole field of permanent magnet practice, and the present author had fulfilled something of the function of applying them to a wider field. Among his symbols the author had given $\mu_r$ as representing reversible permeability—the slope of a recoil line. Personally, he thought a more simple and expressive term would be "recoil permeability," because the permeability represented by $\mu_r$ was no more reversible than any other and, moreover, the term had already been used for another quantity. It was suggested in the conclusions, quite rightly, that one of the most important characteristics of these materials was the recoil permeability and that it depended on the curve factor. But in actual fact, the curve factor was extraordinarily constant in the case of certain magnet alloys such as the martensitic alloys or the Alnico type, and he would have said that the most important factor in determining the value of the recoil permeability was the ratio of remanence to coercive force.

**Prof. L. G. A. Sims** (Royal Naval College, Greenwich) said the paper marked a second epoch in the history of permanent magnet theory by taking Evershed's theories a step forward. The author made the deliberate assumption that every part of the magnet worked at the same point on its $BH$ characteristic. He would like to know whether that was borne out by practical experience.

**Mr. A. J. Tyrrell** (Mullard Radio Valve Co., Ltd.) said that although the author had referred to two types of anisotropic magnets, viz., Alcomax and Ticonal, these magnets were available under a third name, "Alnico V," which was manufactured and known throughout the United States. The author did not state which type was used for his calculations, but it would appear from the mention of the value of a $(BH)_{max}$ of 3 millions, and a reversible permeability of 3, that they were based on the least efficient anisotropic material, viz., Alcomax, whereas Ticonal and Alnico V, as commercially manufactured, had a $(BH)_{max}$ of 4½ to 5 millions and a reversible, or recoil permeability in the region of 4, which the author, in his conclusions, stated were more desirable characteristics. Calculations and charts should be based on the performance of the best materials available, particularly when the materials in question were in abundant supply in this country and the United States.

**Mr. F. C. Knowles** (Evershed and Vignoles Ltd.) said it was a pity this excellent paper failed to give the designer help on the question of computing the leakage flux which, according to the diagrams, one could assume to be of the order of 40 per cent. of the total flux. It would be very useful if the author could add something which would enable them to carry out design properly rather than adopt "cut-and-come-again" methods. In order to take advantage of the many modern materials coming along, the instrument manufacturer must design afresh. Not only had the instrument maker the problems which the author mentioned regarding generators, but he had the questions of size and weight and also something which had not been mentioned, viz., constancy, which was very important. It was remarkable that whereas with the older materials, if the armature

was removed and put back after stabilisation the field was reduced; with the newer magnetic materials there was a gradual tendency for magnetic field to increase.

**Dr. H. G. Taylor** (Philips Industrial) expressed the view that the paper was unduly biassed towards generators and magnetos. There were others, he said, who were mainly interested in the use of magnets for meters and other instruments and, therefore, the author had not placed sufficient emphasis on the significance of $BH_{max}$ for a large number of cases.

**Dr. G. F. Tagg** (English Electric Co., Ltd.) said the author was interested in getting the magnet in as small a space as possible and getting as much flux as possible. He did not agree with the assumption that every particle of the magnet worked at the same point on its *BH* characteristic, and whereas Evershed's method was a true step by step method, the author's seemed to approach the problem in one step.

**Mr. Pizzey** (Elliott Bros., Ltd.) said there was a tendency for the designer of moving coil instruments always to design for stability rather than for maximum utilisation of the magnetic material which the author had indicated. Another point not always realised in moving coil instrument design was that the sensitivity was proportional to the square of the increase in the flux density, and not directly proportional. Since modern magnetic materials were introduced some 10 years ago, moving coil instrument design had been faced with difficulties, because the changes in flux density were becoming embarrassing. The very high densities now being obtained caused serious trouble with magnetic impurities in the moving system.

**Mr. F. Knight** (Sheffield) referred to the development of anisotropic alloys, which started some 15 years ago, and said that further improvements had taken place since the paper was prepared. He called attention to the considerable approximations made in the paper, which should be borne in mind, and said that unfortunately reluctance could not be neglected, as it had been in the paper, particularly with apparatus working with high flux densities.

**Mr. J. Prince** (Ferranti, Ltd.) said there was a lack of information both in the technical journals and in the paper on such a fundamental point as the stability of steel, and asked if the author had any information with regard to this over a long period of time.

# Electrical Cable Making Industry J.I.C.

THE Joint Industrial Council for the Electrical Cable Making Industry reaches this year the twenty-fifth anniversary of its formation. The Council was formed at a conference held on July 10, 1919, between representatives of the C.M.A. and the trades unions representing the workers in the industry, and its first meeting was held on September 4, 1919. In September, 1921, the Independent Cable Makers Association joined the Council and has, ever since, participated in its activities.

At the 1919 meeting, the trade unions requested that a chairman be appointed from the employers' side, and Mr. Ll. B. Atkinson was unanimously elected to fill the office; although the constitution of the Council provides for the appointment of a chairman for one year, the trade unions each year proposed that Mr. Atkinson should continue as chairman, and as a result he held that office until his death in September, 1939. On Mr. Atkinson's death, Ald. E. Porter (National Union of General and Municipal Workers) was elected as chairman on a proposal made by the employers' side, an office which he in turn has held continually since 1939.

The cable making industry was among the first to establish regular joint consultation machinery on a voluntary basis, and the present constituent members of the Council are the C.M.A., the I.C.M.A., the United Rubber Workers of Gt. Britain, the E.T.U., the National Union of General and Municipal Workers and the Transport and General Workers' Union. It is interesting to note that the example set by the cable making and other sections of the electrical industry has been followed by a number of other industries.

The period intervening between the 1914/18 and present wars presented many difficulties in the industrial realm, and the machinery of joint consultation in the cable industry was largely instrumental in securing a high degree of stability of employment. No insoluble industrial dispute has arisen in the industry during the past 25 years.

The advent of the present conflict raised many problems, the solution of which vitally affected the life of the employees in the cable making industry, and though the consideration of these gave some concern to the Council, mutually satisfactory agreements were negotiated on (1) the temporary employment of women on men's work; (2) modified procedure for the avoidance of disputes and for conciliation and, if necessary, arbitration; (3) conditions of employment applicable to part-time workers; (4) revision of the classification of specialised occupations in the industry, and of the differentially graded rates.

# Employment in Supply Industry

WE reproduce below the figures with respect to employment in the electricity supply industry, based on a summary statement, prepared by the Electricity Commissioners, showing in respect of all undertakers the number of personnel (a) employed at March 31, 1939; (b) the number released to the Forces and industry; (c) the number lost due to death, retirement and other causes; (d) new staff engaged; and (e) the number employed January 1, 1944.

| (1) Section. | (2) Employed at Mar. 31, 1939. | | (3) Released to Forces or to other Industries. | | (4) Death, retirement and causes other than (3). | | (5) New staff. | | (6) Total employed at Jan. 1, 1944. | |
|---|---|---|---|---|---|---|---|---|---|---|
| | M. | F. | M. | F. | M. | F. | M. | F. | M. | F. |
| Admin., Financl., Tech., Clerical and H.O. ... ... | 20 469 | 6 296 | 9 284 | 1 189 | 3 525 | 3 237 | 4 406 | 7 877 | 12 066 | 9 747 |
| Totals ... | 26 765 | | 10 473 | | 6 762 | | 12 283 | | 21 813 | |
| % of Col. 2 ... | — | | 39·1 | | 25·3 | | 45·9 | | 81·5 | |
| Operatnl., maintnce. and constructnal.... | 20 928 | 140 | 3 806 | 8 | 6 875 | 182 | 14 468 | 1 636 | 24 715 | 1 586 |
| Totals ... | 21 068 | | 3 814 | | 7 057 | | 16 104 | | 26 301 | |
| % of Col. 2 ... | — | | 18·1 | | 33·5 | | 76·4 | | 124·8 | |
| Transmission and distribution ... ... | 72 223 | 675 | 22 726 | 145 | 24 656 | 440 | 14 140 | 2 759 | 38 981 | 2 849 |
| Totals ... | 72 898 | | 22 871 | | 25 096 | | 16 899 | | 41 830 | |
| % of Col. 2 ... | — | | 31·4 | | 34·4 | | 23·2 | | 57·3 | |
| Totals for all Sects. | 113 620 | 7 111 | 35 816 | 1 342 | 35 056 | 3 859 | 33 014 | 12 272 | 75 762 | 14 182 |
| | 120 731 | | 37 158 | | 38 915 | | 45 286 | | 89 944 | |
| % of Col. 2 ... | — | | 30·8 | | 32·2 | | 37·5 | | 74·5 | |

This return excludes the Central Electricity Board.

Notes on the Table: (a) The figures in Col. (2), (3) and (4) include in some instances employees who were engaged after war broke out and who subsequently left or were withdrawn for service with the Forces, etc.; (b) From the Table it will be seen that while there has been an overall reduction in staff of 25 per cent., the staff employed in generating stations has increased by 25 per cent. On the other hand, over the war period there has been a substantial increase in output, thus: Year ended December 31, 1939, 26 409 000 units generated; 1940, 28 773 000; 1941, 32 349 000; 1942, 35 654 000; 1943, 36 942 000. An increase over the 4 years of approximately 40 per cent.

# Electricity Supply

**Cardiff.**—The Electricity Committee is to extend mains at a cost of £2 222.

**Scarborough.**—Sanction has been received by the T.C. to borrow £500 for consumers' apparatus.

**Sunderland.**—The Electricity Committee is to spend £1 957 laying electric cables in road crossings.

**Lichfield.**—The Electricity Committee is seeking sanction to borrow £1 000 for mains and services.

**Cardiff.**—A forced oil circulation and water cooling system is to be provided at Roath power station at a cost of £1 500.

**Barrow-in-Furness.**—Sanction has been obtained to borrow £1 054 for land for the extension of the undertaking and £5 000 for mains and services.

**Watford.**—The Electricity Committee is seeking sanction to borrow £7 500 for mains and services.

**Chesterfield.**—The Electricity Committee is to purchase street lighting control apparatus at a cost of about £600.

**Barrow-in-Furness.**—An order to supply premises in the Ulverston urban district, has been obtained by the Electricity Committee.

**Middlesbrough.**—The T.C. has received sanction from the Electricity Commissioners to borrow £3 026 for supplying electricity to a new factory at Cargo Fleet.

# Industrial Information

**Time Limit Fuses.**—Details of time limit fuses as fitted to current transformer operated overload trip coils in oil immersed circuit breakers, and their operation are given in a new publication (leaflet No. 400) issued by J. G. Statter and Co., Ltd.

**B.E.A.M.A. Contract Price Adjustment Formulæ.**—For purposes of calculating variations in (a) rates of pay, the rate of pay for adult male labour at February 17 shall be deemed to be 90s. 6d.; (b) costs of material, the index figure for intermediate products last published by the Board of Trade on February 17 is 176.9 and is the figure operable for the month of January.

**Electric Irons.**—The Central Price Regulation Committee has approved the following prices, exclusive of purchase tax, for the "Systym" automatic heat control iron, complete with flex and adaptor, marketed by A. Hurst and Co., Ltd.; wholesale buying price, 25s. 3d.; retail buying price, 31s. 6d.; the agreed retail selling price is 42s.

**Littlebrook 66 kV Switchgear.**—In the description in the February 2 issue of the 66 kV switchgear at Littlebrook power station, it was explained that the gear is of Reyrolle manufacture and "pseudo-oil" operated; this should, of course, have read pneumo-oil operated.

**War Effort 1939-1944.**—An illustrated leaflet summarising the firm's war productions from September, 1939, to November, 1944, is being given to the employees of George Kent, Ltd., so that they can see some of the results of their efforts. Copies are also being sent to those in the Forces and to agents overseas. It shows that power stations have been equipped with boiler control apparatus and sets of instruments for essential measurements, while the Services have been supplied with a great variety of products, including wireless sets, electric motors and other electrical equipment.

**Melbourne Trunk Exchange.**—In continuance of the series of articles describing the feature of the Melbourne automatic trunk telephone exchange and the facilities afforded by the Siemens' high speed motor uniselector and high-speed relay, the engineering supplement to the journal of the employees of Siemens Brothers and Co., Ltd., for December and January, deals with the design and application of the company's voice frequency system of signalling and dialling over trunk lines throughout the State of Victoria.

**Radio Frequency Cables.**—British Insulated Cables Ltd., have issued a descriptive list (N.S.C. 12—"B.I. Radio Frequency Cables") giving the main features and essential data on the more important types of B.I. radio frequency cables. These are designed to give the greatest efficiency throughout the frequency range utilised in modern tele-communication equipment and transmission systems. Both coaxial and balanced shielded twin cables are available in many forms to cope with manifold applications in the field of r.f. technique. High frequency power cables have been developed also to meet the highly specialised needs of h.f. heating equipment.

**Shellac.**—The Ministry of Supply announces that the following prices for sales to consumers in the U.K. will come into effect as from February 12, 1945. The prices are net per cwt. ex-store, for quantities of not less than one bag:—Shellac: 1 lemon, 230s.; 2A F.O. lemon 1, 220s.; 2B F.O. lemon 2, 212s. 6d.; 3A F.O. standard 1, 205s.; 3B T.N. pure, 200s.; 4B T.N. London std., 197s. 6d.; 5 button lac, 215s. Seed lac: 8A Kusmi fine, 195s.; 8B Kusmi No. 2, 190s.; 8C Bysaki 3 per cent., 175s.; 8D Bysaki 5 per cent., 165s. Machine made lacs: Garnet lac A.C., 195s.; garnet lac C.P., 180s.; garnet lac I.G., 175s.; A.B.T.N., 230s.; Crown, 212s. 6d.; C.V., 212s. 6d.; Gamma, 205s.; X.L., 230s.; D.G., 210s.; D.L., 265s.; blond, 285s.; super blond, 305s.

**Secret Radio Exhibition.**—A security ban prevents the publication of any details of the radio components and apparatus on show at the private exhibition, organised by the Radio Component Manufacturers' Federation, which opened in London on Tuesday and concluded yesterday, but it may be mentioned that there was a wide range of miniature parts, instruments and apparatus designed primarily for Service radio sets, some of which probably will be incorporated in domestic radio receivers and commercial office communication systems. One of these is a midget loud speaker 2½ ins. in diameter, intended only for speech which is reproduced at normal volume. Wire used in some of the tiny components is so fine as to be almost invisible to the naked eye. One small electrical instrument had to be so robustly constructed that it could operate at high altitudes (at least 40 000 ft.) and underwater pressure without its efficiency being impaired. Other instruments were shown immersed in water to demonstrate that they were impervious to tropical conditions.

# Company News

RD. JOHNSON CLAPHAM AND MORRIS, LTD.—Intm. div. 3¼% (same).

HUGHES-JOHNSON STAMPINGS, LTD.—Intm. div. 2s. per £1 sh. (same). Warrants. Feb. 28.

RICHARD LLOYD AND CO. LTD.—Co. announces net pft. £18 380 for 1944 (£17 548). Div. on ord. 20%, less tax (same).

SPENCER (MELKSHAM) LTD.—Fst. and fin. 10% (same), payable Mar. 21. Net pft. to Sept. 30, after taxatn. £16 665 (£13 001).

LONDON ELECTRIC SUPPLY CORPORATION, LTD.—Div. on ord. 4%, plus 2% drawn from No. 2 reserve mkg. 6% (same), less tax, for 1944.

CLARKE, CHAPMAN AND CO. LTD.—Net pft. for 12 mos. ended Dec. 31, £135 292 (£122 448). Div. on ord. 12½% (same), less tax, payable Mar. 2.

YORKTOWN (CAMBERLEY) AND DISTRICT GAS AND ELECTRICITY LTD.—Undivided pft. fwd. at Dec. 31, 1944, £4 217 and not £5 217 as previously stated by co.

LONDON PASSENGER TRANSPORT BOARD.—Fin. interest payment on "C" stk. 1¾%, less tax, mkg. 3% (3¼%) for 1944. Net rev. £4 673 286 (£4 747 280).

FRANCO SIGNS LTD.—Co. proposes to increase the nom. cap. from £200 000 to £300 000 by the creation of 200 000 10s. shs., and to issue 160 000 shs. at 13s. each.

FOSTER YATES AND THOM LTD.—Pft. to Sept. 30, after exes., fees and deprecn., was £57 003 (£84 025). To gen. res., £4 000 (same), div. on ord. 5% (same), fwd. £1 925 (£1 827).

ASSOCIATED ELECTRICAL INDUSTRIES, LTD.—Dirs. propose to increase cap. by creating 1 363 000 8% cum.pref. £1 shs. to be offered in exch. for 1 500 000 7% cum. pref. £1 shs. of B.T-H. Co., Ltd.

ANDOVER LIGHTING AND POWER.—Pft. 1944, £5 675. Brot. in £3 164. Bank int. £39, inc.-tax £4 217, deb. int. £247, int. on consumers' deposits £8, ord. div. 6%, fwd. £3 799, subject to dirs.' fees.

VERA CRUZ ELECTRIC LIGHT, POWER AND TRACTION.—Operatg. rev. 1943, £59 315, less exes. and taxes £56 575, lvg. net £2 740. plus other inc. and exch. gain £3, mkg. £2 743, reducg. deficit to £99 609 (£102 352).

CAPE ELECTRIC TRAMWAYS LTD.—Rev. to June 30, £53 278 (£58 146). London and Cape Town exes. £3 408 (£3 345), dirs.' fees £1 850 (same), trustees' fees £210 (same), leavg. £47 810 (£52 740). Div. 6% £20 473 (same), to replacements. res. £20 000 (same), fwd. £61 769 (£63 433).

JOHN SHAW AND SONS WOLVERHAMPTON LTD.—Net pft. to June 30, 1944, £15 392 (£13 977), plus £16 507 (£13 679) brot. in. Intm. div. 7½% already pd. (same), but no fin. div. (same), to conting. res. £10 000 (£5 000), fwd. £15 750. Prov. for taxn., incldg. subsid. cos., £141 183 (£135 690).

SINGAPORE TRACTION CO. LTD.—Excess of deb. ints and London exes. over income to Sept. 30 was £8 702 (£9 059), plus deb. sinking fund instalmt. £3 290 (£3 258), staff paymts. £3 292 (£2 922), mkg. debit £15 284 (£15 239). Brot. in £4 549, plus surplus tax provn. £1 639, reducing debit blce. to £9 096.

SOUTHERN RAILWAY CO.—Net rev. for 1944, £7 000 052 (£866 increase). With blce. brot. in £85 602, sum for distributn., £7 085 654. Dirs. recommend fin. div. 2½% on prefd. ord. stk., mkg. 5% (same), also 2% for yr. on deferd. ord. stk., less tax (same), payable Mar. 23. Carrd. fwd., £82 074 (£85 602).

WESTINGHOUSE BRAKE AND SIGNAL CO. LTD.—After prov. which may be subject to adjust. for E.P.T. and all workg. exes. except deprecn. and dirs.' fees, tradg. pft. to Sept. 30 £414 339 (£416 681). To deprecn. £53 867 (£51 633), dirs.' fees £3 578 (£2 929), inc.-tax £195 000 (£188 845), leavg. net pft. £161 894 (£173 274). Fwd. £93 872 (£95 544).

*(Continued on page 176)*

# Metal Prices

Monday, February 19.

| | Price. | Inc. | Dec. |
|---|---|---|---|
| *Copper*— | | | |
| Best Selected (nom.) per ton | £60 10 0 | — | — |
| Electro Wirebars ... ,, | £62 0 0 | — | — |
| H.C. Wires, basis ... per lb. | 9⅝d. | — | — |
| Sheet ... ... ,, | 10⅞d. | — | — |
| *Phosphor Bronze*— | | | |
| Wire(Telephone)basis per lb. | 1s. 0⅛d. | — | — |
| *Brass* (60/40)— | | | |
| Rod, basis ... ... per lb. | — | — | — |
| Sheet ,, ... ... ,, | — | — | — |
| Wire ,, ... ... ,, | 10⅞d. | — | — |
| *Iron and Steel*— | | | |
| Pig Iron (E. Coast Hematite No. 1)... per ton | £6 18 6 | — | — |
| Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... ,, | £27 10 0 | — | — |
| Mild Steel Tape (Cable Armouring) basis 0.04 in. ... ,, | £20 0 0 | — | — |
| Galvanised Steel Wire No. 8 S.W.G. ... ,, | £26 0 0 | — | — |
| *Lead Pig*— | | | |
| English ... ... per ton | £26 10 0 | — | — |
| Foreign or Colonial ,, | £25 0 0 | — | — |
| *Tin*— | | | |
| Ingot (minimum of 99.9% purity) ... per ton | £303 10 0 | — | — |
| Wire, basis... ... per lb. | 3s. 10d. | — | — |
| *Aluminium Ingots* ... per ton | £110 0 0 | — | — |
| *Spelter*... ... ... ,, | £25 15 0 | — | — |
| *Mercury* (spot) Warehouse ... ...per bottle | £69 15 0 | — | — |

NOTE.—Above prices are nominal only, no allowance being made for tariff charges, charges for insurance, etc. Prices of galvanised steel wire and steel tape supplied by Cable Makers Association. Other metal prices by British Insulated Cables Ltd.

DELTA METAL CO. LTD.—Tradg. pft., 1944, after E.P.T., etc., £244 283 (£241 448), plus divs. from subsid. cos. £8 500 (£9 750) and fees £25 (£26), mkg. £252 808 (£251 224). To deprecn. £34 077 (£47 180), dirs.' remun. £5 645 (£6 817), leavg. £213 086 (£197 227) added to £28 710 (£25 483) brot. in. Prov. inc.-tax £140 000 (£123 000), off freehold prem., plant and equipmt. £10 000 (same), to employees' fund £1 000 (same), div. 12½% and bonus 7½%, both tax free (same), fwd. £30 796.

PERNAMBUCO TRAMWAYS AND POWER CO., LTD. — Operatg. rev. 1943 £697 486 (£601 099), less exes. incldg. taxes £669 734 (£528 057) and property retiremt. £26 387 (same). Add other income (net) £1 586 (£1 082), mkg. £2 951 (£47 738). Int. on debs. £45 699 (same), other int. £37 (£45), prov. Brazilian inc.-tax on int. £3 749 (£3 725), amort. disc. on debs. £1 294 (same), int. charged to construction £32 (£784), leavg. loss before exch. adjustmts. £47 796 (£2 242). Deficit at Dec. 31, 1943, £168 920 (£121 816).

# Coming Events

**Friday, February 23. (To-day.)**

I.E.E., N.W. CENTRE, RADIO GROUP.—Manchester. "Television Broadcasting Practice in America, 1927/44," D. G. Fink and D. G. Espley. *6 p.m.*—I.E.E., N.E. STUDENTS, Old Assembly Rooms, Newcastle-on-Tyne. Annual dance.

INSTITUTE OF FUEL.—I.E.E., London, W.C.2. Joint conference with the National Smoke Abatement Society. *10 a.m.*

**Saturday, February 24.**

I.E.E., LONDON STUDENTS' SECTION.—Visit to the London Hydraulic Power Co., Grosvenor Road, S.W.1. *2.30 p.m.*—I.E.E., N.W. STUDENTS' SECTION, visit to Trafford Power Station.—I.E.E., N. MID. STUDENTS' SECTION, Great Northern Victoria Hotel, Bradford. Discussion, "Frequency Modulation." *2.30 p.m.*

**Monday, February 26.**

I.E.E.—London, W.C.2. Informal meeting. Discussion, "Location of Industry." (Opened by D. B. Williamson.) *5.30 p.m.*—I.E.E., N.E. CENTRE, Newcastle-on-Tyne. "Standardisation and Design of Turbo-Alternators," G. A. Juhlin, *6.15 p.m.*—I.E.E., WESTERN CENTRE. Bristol. Inaugural meeting of Installations Group. "The Future of Domestic Wiring Installations." Forbes Jackson and W. J. H. Wood. *6 p.m.*

**Tuesday, February 27.**

I.E.E., N. MID. CENTRE.—Leeds. "Standardisation and Design of A.C. Turbo-Alternators," G. A. Juhlin. *6 p.m.*—I.E.E. WESTERN CENTRE, INSTALLATIONS GROUP, Cardiff. Inaugural meeting. "The future of Domestic Wiring Installations," Forbes Jackson and W. J. H. Wood. *5 p.m.*—I.E.E., N.E. STUDENTS' SECTION, Newcastle-on-Tyne. Students' Lecture. "Electrical Engineering Research," H. W. H. Warren. *6.30 p.m.*

ILLUMINATING ENGINEERING SOCIETY.—Institution of Mechanical Engineers, London, S.W.1. Joint meeting with the Royal Institute of British Architects. "The Relationship between Interior Design in Building and Artificial Illumination." Dr. J. W. T. Walsh. *5.30 p.m.*

**Wednesday, February 28.**

I.E.E., RADIO SECTION.—London, W.C.2. "Multipath Interference in Television Transmission," D. I. Lawson. *5.30 p.m.*—I.E.E., SCOTTISH CENTRE, Edinburgh. "Remote Switching by Superimposed Currents," J. L. Carr. *6 p.m.*—I.E.E., S. MID. STUDENTS' SECTION, Birmingham. "The Development and Administration of a Large Electric Supply Undertaking." F. W. Lawton. *7 p.m.*

BRITISH INSTITUTION OF RADIO ENGINEERS. MIDLANDS SECTION.—Birmingham University. "Magnetic Dust Cores." E. R. Friedlander. *6 p.m.*—LONDON SECTION, 11, Upper Belgrave Street, London, S.W.1. "Dielectric Heating by the Radio Frequency Method," L. Grinstead. *6 p.m.*

**Thursday, March 1.**

I.E.E.—London, W.C.2. "Stray Losses in Synchronous Electrical Machinery," P. Richardson. *5.30 p.m.*

**Friday, March 2.**

ROYAL INSTITUTION OF GREAT BRITAIN.—London, W.C.1. "Some Aspects of Pre-War and Post-War Television," H. L. Kirke.

**Saturday, March 3.**

I.E.E., LONDON STUDENTS' SECTION.—Visit to the Stonebridge Park, Middlesex, power station of the L.M.S. Railway. *2.30 p.m.*—I.E.E., N.W. STUDENTS' SECTION, visit to the Greengate and Irwell Rubber Co., Manchester.

# Commercial Notes

### County Court Judgments

NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within 21 days.*

MIDDLETON, R. (male), 21, Newport Ct., London, W.C.2 (Tdg. as Radio and Electrical Services). £45 1s. 6d. Nov. 9.

MANOR RADIO SERVICE, 6a, Beeches Av., Carshalton Beeches, radio engineers. £17 4s. 6d. Dec. 12.

### Satisfaction

LONDON AUTO-ELECTRIC, LTD.—Sat'n. Feb. 3, of debs. reg. Dec. 9, 1933, to the extent of £250.

### Company Winding Up

THE BRIMINGTON ELECTRIC SUPPLY CO. LTD. (Members Voluntary Winding-up).—A general meeting of the members of the above named company will be held at the National Schoolroom, Brimington, near Chesterfield on March 22, at 7.30 p.m., to receive the account of the liquidator.

### Notice of Dividend

GLOSSOP. Arthur Austin. 33, Parkhead Crescent, Ecclesall, Sheffield, lately carrying on business at 7 and 12, Norfolk Market Hall, Sheffield. Radio service engineer and radio dealer. Second and final dividend of 1s. 5½d. per £1, payable March 3, 1945. 55, Queen Street, Sheffield.




. . . and it wants ATLAS LAMPS because of the demand created by our large-scale advertising appearing in every main thoroughfare and regularly in the National and Provincial daily and evening papers and magazines. It pays you to supply this demand; you get higher profits, attractive sales aids, and perfect freedom to stock whatever make of other good lamps you like. Write for terms to-day.

THORN ELECTRICAL INDUSTRIES LTD

# ATLAS LAMPS

*Nothing better has come to light*

THORN ELECTRICAL INDUSTRIES LTD., 105-109, JUDD ST., LONDON, W.C.1. 'Phone: Euston 1183
Northern Branch: 55, Blossom Street, Manchester. 'Phone: Central 7461
N.E. Depot: 46, Sandhill, Newcastle-on-Tyne, 1. 'Phone: Newcastle 24068

T/16

Printed in Great Britain by Straker Brothers Ltd., 194-200, Bishopsgate, E.C.2, and published by Benn Brothers, Ltd., at Bouverie House, 154, Fleet Street, London, E.C.4.—Friday, February 23, 1945.