

THE ELECTRICIAN

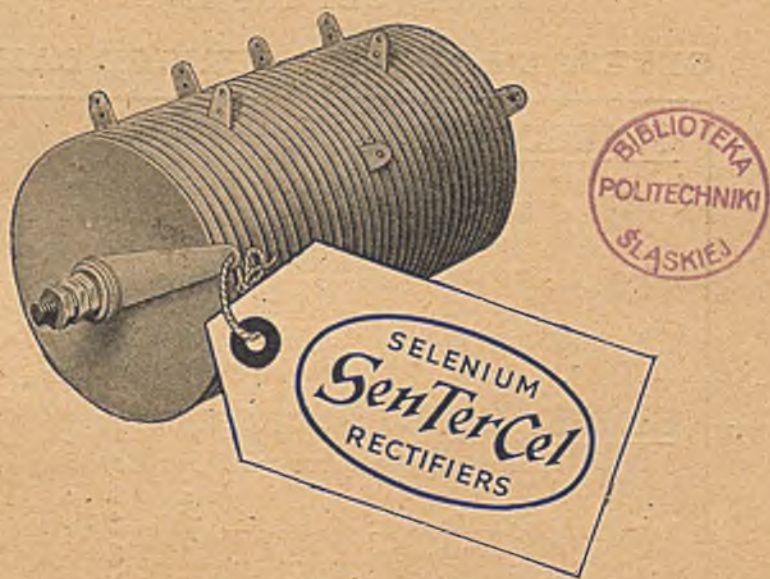
Vol. CXXXV. No. 3503.

Friday, July 20, 1945.

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WHEN we were the only manufacturers of Selenium Rectifiers in this country there was no need to give a special name to our product. The many advantages of the "Standard" Selenium Rectifier over other types has inevitably introduced competition, and we have therefore adopted the name of "SenTerCel" as our trade mark, so that our customers may know that rectifiers bearing this name will have the high standard of performance to which they have become accustomed.

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*75 watt	1	8
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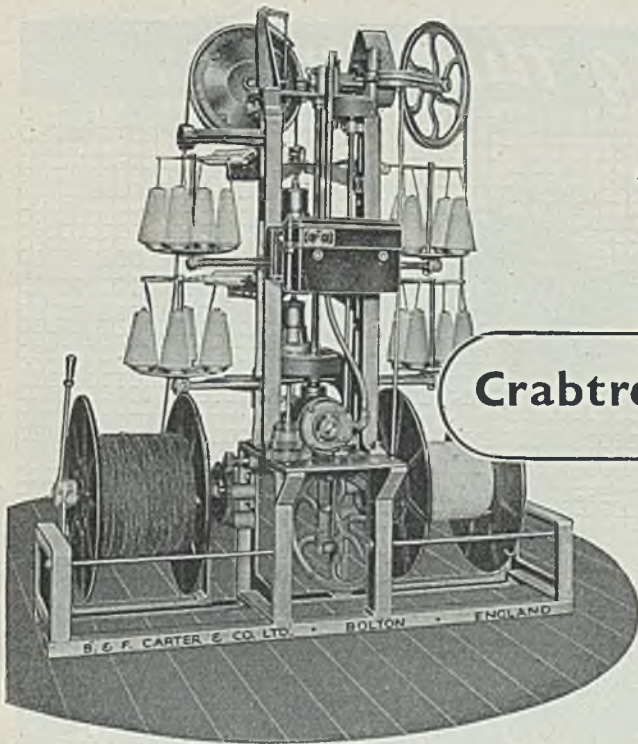
		s.	d.
15 and 25 watt	1	3
40 and 60 watt	1	3
75 watt	1	7
100 watt	1	9
150 watt	2	9

CLEAR

200 watt	4	6
300 watt	8	0
500 watt	10	6

Prices do not include Purchase Tax.

Write for Price List OS 9759 which gives full particulars of all price reductions.



* Carter's "BRAIDEX"
Non-ballooning, Two-way
Core Covering Machine

Crabtree Controlled

THE electrical controls of this ingenious machine are fully automatic and consist of a Crabtree "semi-standard" unit which embodies a 400/12 volt

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The electrical equipment of the "Braidex" machine is an example of the flexibility of Crabtree gear and our Control Gear Department will be equally pleased to advise you on your problems of machine tool control.

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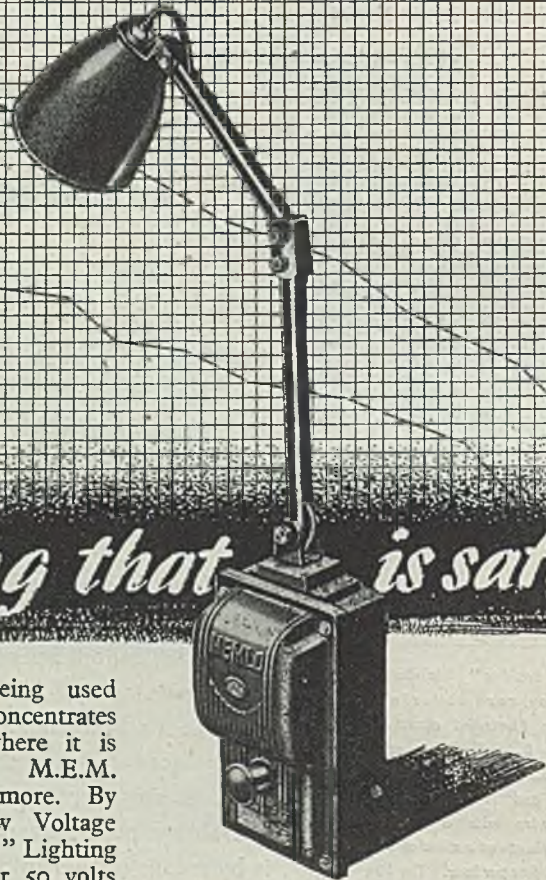
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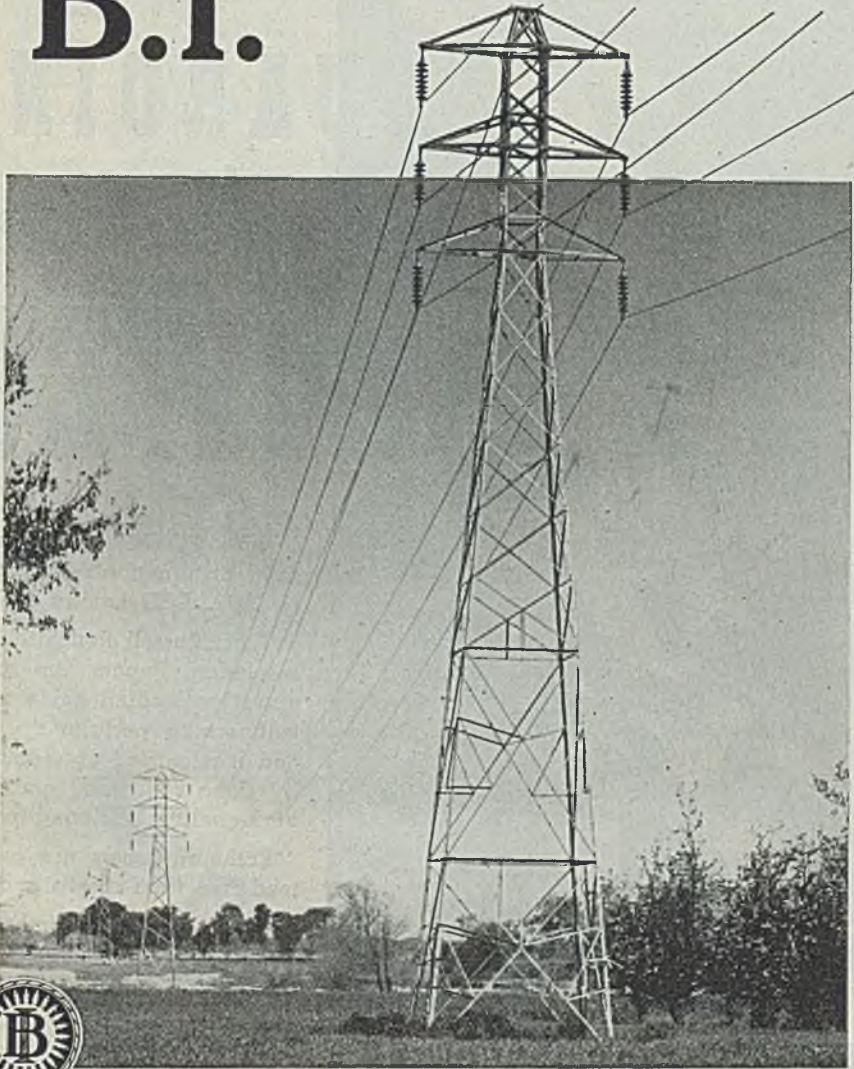
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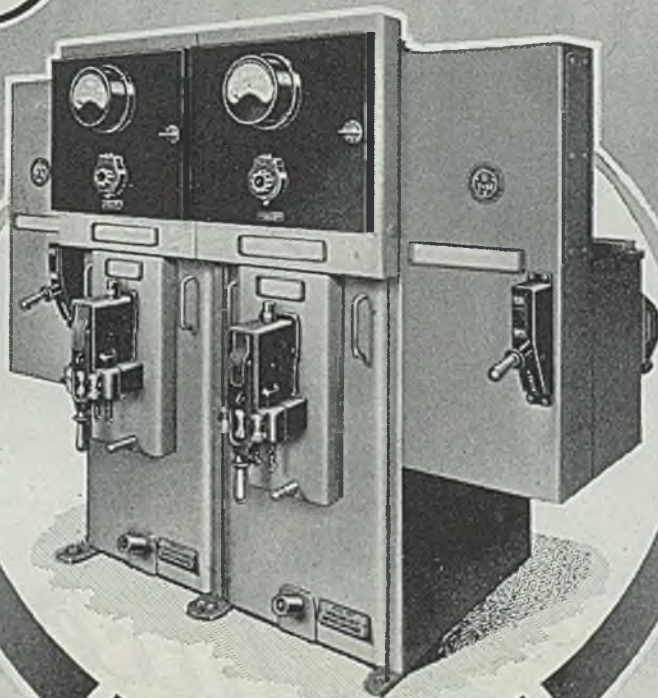
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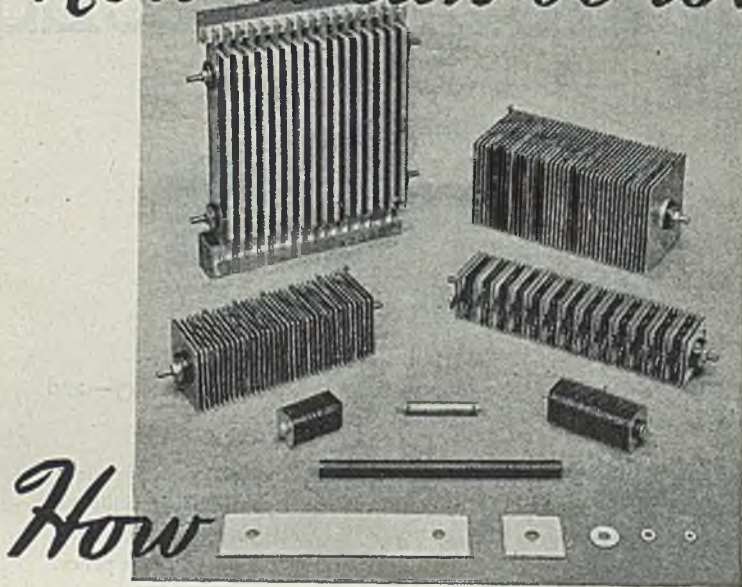
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WATTS	CLEAR OR PEARL				PEARL	
	25 V	50 V	100/130 V	200/260 V	WATTS	200/260 V
15	1/9	1/9	1/3	1/3	—	—
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40	2/-	2/-	1/3	1/3	40	1/6
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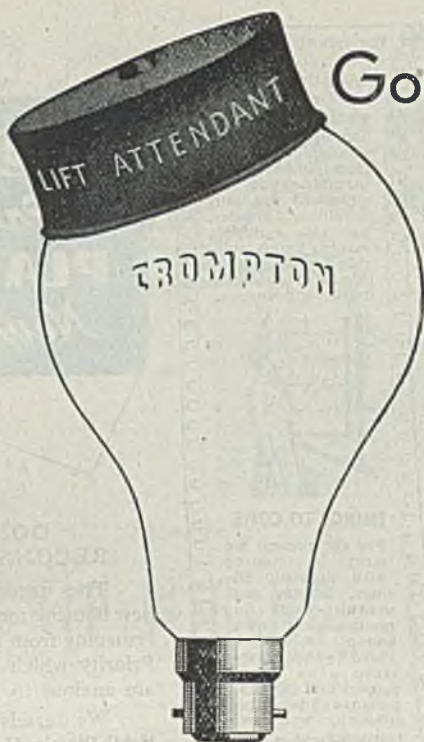
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*Clear and Pearl. 100/130 v
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For details of other reductions please ask for Price List No. D.1033

CROMPTON PARKINSON LTD., ELECTRA HOUSE, LONDON, W.C 2



PLASTIC CEMENT

We generally think of plastics as materials out of which articles are made; but they also have more modest uses. **ESSALITH** another U.E.L. speciality, is an example. This is a cold-setting plastic, which in addition to joining glass, china, etc., is a reliable adhesive for high temperature and electrical services.



HIS DAY IS DONE

The larva of the Goat Moth, here shown, is greatly destructive of wood-work and other articles of the home. Plastic materials, which are immune from its attacks, provide no nesting places for this and similar pests. Another of plastics' little blessings!



DON'T KICK THE CAT!

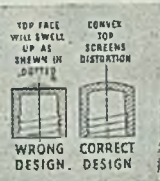
It isn't true that the chemist's cat spilled its milk over formaldehyde and thus created plastics. All the pioneers of the industry belong to

the human species, and prominent among these was the late Dr. Baekeland, who laid the foundations of modern resin moulding. Starting from phenol and formaldehyde, he produced not only moulding powder, but also synthetic varnish resins suitable for the manufacture of laminates, finishes and cements.



THINGS TO COME

For the present we must be content with domestic fittings, fixtures and utensils made in plastics, but who knows what lies ahead? Many war-time uses have proved that plastics possess adequate strength, weather-resistance, etc., for structural parts such as windows, door frames and the like.



HINTS FOR DESIGNERS

In designing a component with internal thread, avoid a flat top face. In production a gas pocket would occur on the underside face of the moulding and so distort the top face. The correct design calls for a convex top which would screen any distortion which takes place during the moulding operation.

DOMESTIC RECONSTRUCTION

The urgent need to provide new housing for the men and women returning from the Forces is a No. 1 Priority which most manufacturers are anxious to meet.

We ourselves have not built an "All-Plastic House" nor have we any desire to live in one! Many ideas have been suggested for plastic applications which we consider are only suitable for the de luxe dwellings of the distant future.

For the present let us be practical. Our service* offers to equipment manufacturers high quality plastic products for electrical appliances, cookers, refrigerators and sanitary ware.

* *Manufacture of Plastics including Rubber and Synthetic Rubbers.*

LORIVAL PLASTICS

UNITED EBONITE AND LORIVAL LTD
LITTLE LEVER, NEAR BOLTON

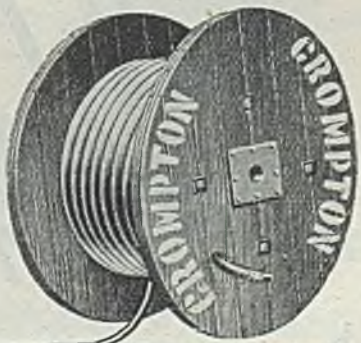
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REDUCED PRICES for many types of Philips Lamps are now in operation. The reductions are in many cases substantial and affect General Lighting Service — clear, pearl and colour sprayed; Traction and Sign lamps.

Full details of the new prices are given in our leaflet L.517, copies of which have been sent to all wholesalers and dealers

on our mailing list. If you have not yet received yours, please let us know.

A FEW OF THE NEW RETAIL PRICES:

Single coil, pearl or clear
100/130 and 200/260 volts

15, 25, 40 & 60 watt. 1/3 (tax 4d.) = 1/7

100 watt. 1/9 (tax 6d.) = 2/3

Coiled-coil lamps will also be available shortly at reduced prices.

*Sell Philips —
The lamps
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Dowsing's The reputation acquired in nearly half a century's diligent labour is no small asset. For us, it is the proud basis on which our future equipment is being built.

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Also Immersion Heaters (1, 2 or 3 k.w.) for converting existing Hot Water Systems.

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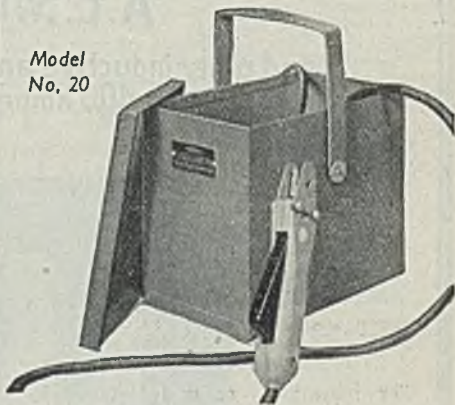
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(Patents pending)

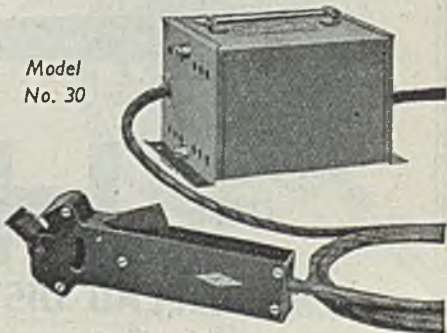
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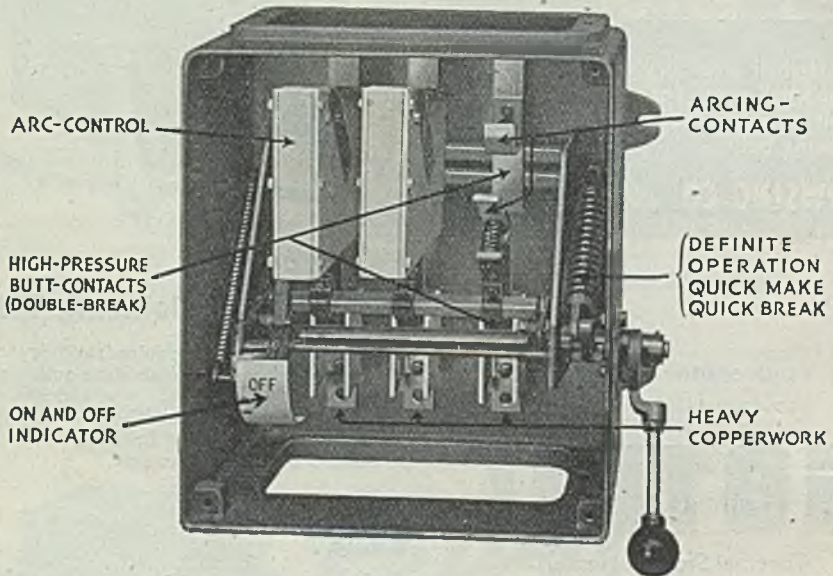
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Simple to erect and extend

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MISCELLANEOUS ADVERTISEMENTS

None of the situations advertised in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 or 40 inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1945, or the vacancy is for employment excepted from the provisions of that Order.

SITUATIONS VACANT

A LARGE ENGINEERING ORGANISATION, wishing to contact a man of real ability in the design and development of fractional horse-power motors, invites communications from Electrical Engineers having a wide theoretical and practical experience in this branch of industry.

The position available offers excellent post-war prospects, and in the event of their contacting a man of exceptional ability and qualifications the company would give serious consideration to the setting up of a separate self-contained organisation for the manufacture of fractional horse-power motors to be managed by the selected applicant.

Replies, stating full details of experience, qualifications, age and present salary, to Box L.P.M., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

MANAGER required, with general experience in the manufacture of lead storage batteries. State experience and salary required.—Write Box L.P.O., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

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CITY AND COUNTY BOROUGH OF BELFAST.

ELECTRICITY DEPARTMENT.

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(a) Carbon Dioxide Fire Extinguishing Equipments for Electrical Sub-Stations (Specification No. G.49);

and

(b) Replating Regulating Cells of Storage Battery (Specification No. G.51).

Forms of Tender may be obtained from the City Electrical Engineer and General Manager, East Bridge Street, Belfast.


Each tender in sealed envelope marked "Tender for Electricity Department," and endorsed with name and address of the person tendering, must be lodged with the undersigned not later than 4.0 p.m. on Friday, 3rd August, 1945.

An official receipt must be obtained for every tender delivered by hand. Tenders sent by post should be registered.

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Trouble-free Chargers fitted with selenium all-metal rectification. Thirty years experience behind every Runbaken product. Booklet K5 describing 12 Models, on request.

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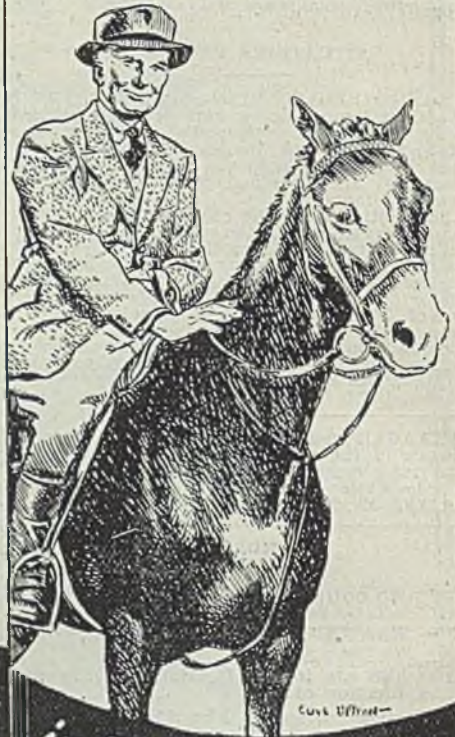
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NIFE

STEEL PLATE BATTERY



THE ELECTRICIAN

Established 1861. The Oldest Weekly Illustrated Journal of

Electrical Engineering, Industry, Science and Finance

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Telephone: Central 3212 (Ten Lines).

Midlands Office: Daimler House, Paradise Street, Birmingham. Telephone: Midland 0784.

Glasgow Office: 116, Hope Street, Glasgow, G.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. 3503. [Vol. ^{No. 3} CXXXV]

July 20, 1945

Annual Subscription 25s
Overseas 30s.

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Committee's suggestions, and when the new houses are completed it will be interesting to see how far the shortages of skilled labour and materials have permitted the electrical industry to react.

The fact that the Ministry of Health has given sanction to build is one thing, but the attitude of the Ministry of Labour and Board of Trade regarding manpower and materials is quite another; the latter is, however, the determining factor when the sanction to build will materialise. Assuming, however, that sooner or later our Government Departments will see reason enough to sanction not only building as an operation, but men and materials with which to carry it out—the stage seems set for the electrical industry to make good a little of the lee-way lost in the war years.

The findings of the Dudley Committee are unquestionably favourable to electricity, though its installation will doubtless be hotly contested by gas interests. The recommendations of the Committee are largely in agreement with those expressed by the industry's own committees which have considered the problems of electrical service as applied to housing, and the Committee view with favour the electrical arrangements which were carried out at St. Pancras some years ago.

It is understood that sanction to build the 16 000 houses in question has been granted to 325 local authorities, and so long as these bodies reasonably adhere to the Dudley Committee's recommendations we shall have little fault to find. Unfortunately, however, there are among the local authority housing committees, up and down the country, still some whose interest in electricity is confined to lighting, and until these have been

Electric Houses

SANCTION to build 16 000 permanent brick houses to the standards laid down by the Dudley Committee has been granted by the Ministry of Health, and their erection should, according to the Ministry, be well under way within three months.

The Dudley Committee, it will be remembered, made known their report on the design of dwellings just twelve months ago, and though the recommendations made are for the most part concerned with building details proper, there are others which are the direct responsibility of the electrical industry. The Committee, for instance, give their full support to the suggestion that more plugs and sockets should be installed, while they add their recommendations to those of the Electrical Installations Committee of the I.E.E. with respect to ring mains. Cooker design, refrigerators, lighting, wash-boilers and other appliances all fall within the scope of the

brought round to the right way of thinking, the industry must be on its guard.

Scottish Example

EVIDENCE to support the claims for all-electric housing is to be found in plenty, and the latest example of acceptance of those claims is in Scotland—where local councils are very much alive to their responsibilities for the health and general welfare of their future tenants—in the area served by the Clyde Valley Electrical Power Co., where of the 5 000 or so houses already passed for erection, over 3 000 will be of the all-electric type. As was pointed out only two weeks ago, it is apparently the intention of the Government at the moment to dispense its authority for house-building only among the municipalities, and though, as indicated above, there are some local committees appreciative of their duty to the public, there are others whose members would be better subjected to an intensive electrical campaign. Supply undertakings, both municipal and company-owned, are making remarkable headway on their own account, but not until the problem is dealt with from a more national point of view can the prospects of the electric house be expected to yield the best results.

Mechanisation and Coal Output

SOME indication of the spirit which exists in the coal industry was given last week by Mr. S. E. D. WILSON, vice-president of the Durham Coalowners' Association, when speaking of the machinery being installed in the local collieries, but not in many cases producing satisfactory results. We have for a long time advocated the mechanisation of the mines as a means of increasing the coal output, and we continue to do so. Mechanisation by itself, however, is not enough, for behind it must be the man-power willing to work it, and it is on this point that Mr. WILSON is most enlightening. The poor results so far obtained are not, he says, the fault of the machines. What is wanted is more enthusiasm and effort in the use of them. Since the war, some of the larger collieries in Durham have introduced machinery, costing many thousands of pounds. Up to the present, however, the result of these developments and the considerable outlay of money has been disappointing. Taking the county of Durham as a

whole, the production is, according to Mr. WILSON, the lowest for many years; and, in spite of increased mechanisation, in 1944 the national production of coal was less by 100 000 000 tons than it was in 1913. The plain fact is, says Mr. WILSON, that mechanisation alone is not the solution to the output problem, and without the co-operation of all the workers—which it is not getting at present—it cannot hope to be. For our part it has never occurred to us that by electrifying the mines, they would ever be expected to yield a bigger output without the co-operation of the miner, but given that co-operation the output per man-hour would be greater, and the coal industry would benefit in consequence.

Public Welcome to Street Lighting

ELECTRIC street lighting was welcomed in London on Sunday, by huge crowds, and in Piccadilly Circus the scenes resembled those associated with a Boat Race night. What might be called the show-piece was on a stretch of road between Acton and Southall in the area of Ealing electricity department, where some 160 or so mercury vapour discharge lamps have been converted to fluorescent daylight lamps of 400 W rating, and were switched on by Mr. T. KING, chairman of the Ealing Highways Committee. In Croydon, which before the war was claimed as one of the best lighted boroughs in southern England, crowds of people walked the streets to see over 7 000 lamps alight again. The provinces, the sea-side towns, all report enthusiastic scenes at the official ending of six years indifferent lighting, and the authorities and engineers who made it possible in these days of scarcity of labour and materials are deserving of every congratulation upon their efforts. Yet once more, electricity has taken the lead; yet again the adaptability of electricity in any circumstance has been proved.

The Watford Show

THOSE who visited the agricultural show, at Watford, last Saturday, must have been agreeably surprised at the number of people who displayed interest in the electrical exhibits and of the 10 000 who attended, many showed by their inquiries that the advantages offered by electrical service are becoming more and more generally well-known. It is reported that some 80 per cent. of the attendance was from the semi-urban

population of Hertfordshire and Middlesex, indicating thereby the interest which the general public is now taking in agricultural affairs. As to the more professional visitor, that is the farmer, for whom the show was primarily intended, the impression gained from our visit is to the effect that the agricultural world is more than willing to co-operate in the expansion of rural electrification and all it implies. There are, in some instances, doubts and a little hesitation in the acceptance of all of the claims for electrification on economic grounds, but broadly speaking the farming community already accepts electricity as something which is bound to reach all farms sooner or later, as something which will assist the agriculturist to hold his own against world competition. The Northmet Company and Watford Corporation, who jointly staged the electrical displays and demonstrations at Cassiobury Park, last Saturday, made a substantial contribution towards that condition.

Hams Hall B Station

OPERATING details which we give this week of the potential 300 000 kW generating plant at Hams Hall B, show that though the equipment installed has not yet reached more than a third of its ultimate capacity, the station is already commanding considerable interest. A point worth remembering is that whereas the station was designed in 1938 on the basis of an average coal price of 14s. per ton, the price per ton in 1944 had risen to 30s. 1½d., and now that coal conservation is becoming an increasingly important consideration, higher steam temperatures and pressures are likely to be employed in the future. Commenting on this point of view, Mr. F. W. LAWTON, chief engineer and manager at Birmingham, contends that even with present fuel prices, however, it is difficult to justify economically the use of higher steam conditions with the average load factor obtained throughout the life of the plant, owing chiefly to the additional costs in boiler plant involved, an expression of opinion which, if debated, would no doubt prove provocative, interesting and instructive. The lay-out of the station, as indicated in the photographs reproduced, is one of simplicity and clean lines, and it is anticipated that when the station is completed the operating personnel will not exceed one man per

1 000 kW of installed generating capacity. As to thermal performance, curves based on the operating conditions at the station, compared with the specification line, show that results are commendably near those anticipated at the time of design.

The Chester Exhibition

THE electrical exhibition being held at Chester this week, promises to be an even more popular show than it was when it made its premiere in Manchester. The exhibition, held under the title of Electricity Looks Forward, attracted 34 000 visitors when it was staged in Lancashire, and though the Chester show is fundamentally the same, certain features have given way to exhibits of special agricultural interest. The reason for this is not hard to seek, for Cheshire is among the most electrically-minded counties where rural areas are concerned. The touring exhibition as staged at Chester, supported as it is by six supply authorities, representing both municipal and company interests, appeals not only to the potential rural consumer, however, for among the items displayed are many for commercial application which are being shown to the general public in this way for the first time.

G.E.C. Earnings

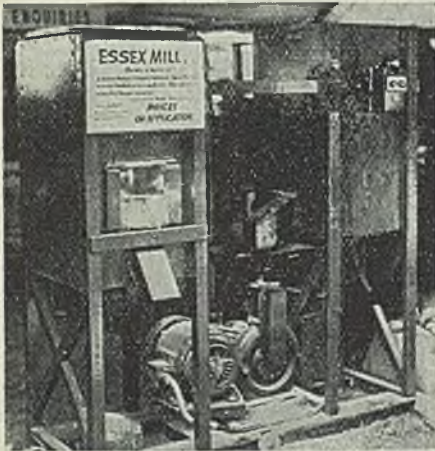
THE preliminary figures of the General Electric Co. Ltd., which we give this week, show that earnings have been well maintained during the past year, and the net profit of £1 880 700 is some £68 000 in advance of the previous level, and approaches within about £12 000 the record of 1940. It is hoped that in the forthcoming accounts SIR HARRY RAILING, chairman, may be able to give some details of the company's war activities, for the whole of the energies and resources of the organisation were concentrated upon making VE-Day as early as possible. The future has not, however, been left to fend for itself, for in his statement a year ago the Chairman even then drew attention to the fact that the post-war period and the overseas organisation of the company were constantly being kept in mind. The annual meeting of the company is to be held next Thursday, when possibly another peep behind the screen of the security "black-out," which the authorities have so rigidly imposed on electrical manufacturers, may be permitted.

Watford Agricultural Show

Electricity for the Farm and Home

THUNDERY weather conditions did not deter visitors, numbering some 10 000, from attending the Watford and

(Searles), in which the control of heat is so accurate that it is unaffected by variations in room temperature; and an egg grading machine (W. E. P., Ltd.) in which a maximum of 3 000 eggs can be graded per hour. The Essex mill (Christy and Norris, Ltd.) demonstrated a new method of grinding cattle food; this appliance grinds from 1 to 12 bushels per hour, unattended. Another interesting exhibit was the Mar-

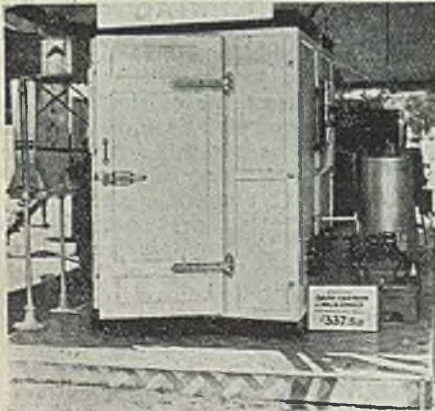


The Essex mill for grinding cattle food attracted considerable interest

District Agricultural Society's show in Cassiobury Park on July 14. Details of the electrical exhibits were given in our last issue, and as stated, these were arranged by the Watford electricity department in conjunction with the Northmet Power Company. Among the demonstrations of electrical equipment which were held throughout the day, may be mentioned the Helix tomato grader, fitted with an automatic self-feeding device (G. Munro, Ltd.); the M. and B. brooder unit



The poultry plucking machine demonstrations drew large crowds



Dairy cold room and milk cooler on show

coni moisture meter for the determination of moisture in grain.

On the general question of rural electrification, it may be mentioned that by 1939, supply was available in the majority of the rural districts embraced by the borough of Watford and the Northmet Co. At present these two undertakings afford supplies to well over 1 000 farms.

Recent developments of the service have comprised the connection of electrically-operated pumping plants for public water supplies. With regard to harvesting, we are informed that at present practically all the installations in the area are utilising electricity for motive power, one installation being electrically-operated throughout with heaters thermostatically-controlled and loaded to 175 kW.

Hams Hall "B" Station

Description of Plant—Operating Statistics and Costs

CONTINUING the story of how the supply industry fared during the war years, we are advised by Mr. F. W. Lawton, chief engineer and manager of the

1938 on the basis of an average coal price of 14s. per ton, which controlled the economic choice of heat cycle.

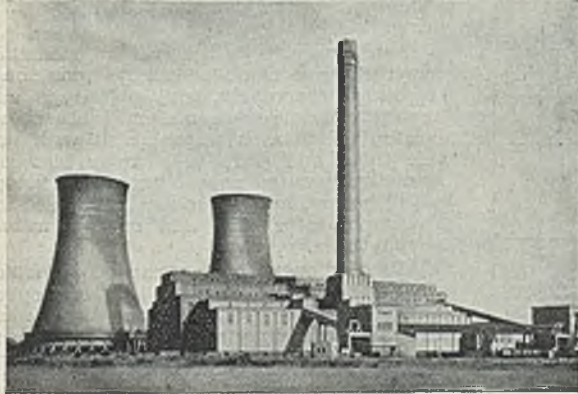
Experience has shown that with cooling towers the economic vacuum is 28.5 with atmospheric air at 60°F. and 80 per cent. humidity.

Regenerative feed water heating to the maximum, apart from increasing the heat efficiency, appreciably reduces the size of cooling tower equipment otherwise required.

Extreme simplicity has been attempted in the lay-out of the plant, and it is anticipated that when the station is completed the operating personnel will not exceed one man per 1 000 kW of installed generating capacity.

The main building was designed in accordance with the Electricity Commissioners' requirements for air raid precautions, which recommended brick walls 14 in. thick, segregation of main buildings from auxiliary buildings, and the absence of external windows below the level of the plant installed.

The foundations and superstructure are of ferro-concrete and all plant is supported from the ground independent of the main structure. Notwithstanding the limitations imposed by A.R.P. requirements, it has been possible to arrange satisfactory



General view of Hams Hall "B"

electricity department, that the major engineering project carried out by the Birmingham Corporation during this period was the construction of the first half of the Hams Hall "B" power station, with the main transmission lines to the city, at a cost approximating £5 450 000. This station was on load in April, 1942, and as indicated in our last issue was officially opened by the then Lord Mayor, Alderman W. S. Lewis, J.P., on July 23, 1943.

At present two 50 000 kW turbo-alternators generating at 33 000 V are in commission, and have already generated some 1 514 million units, largely for war industries. The station contains, it is claimed, the most efficient plant in Central England, and is operated by a staff of 19 engineers, assisted by 135 manual operatives. The commissioning of a third 50 000 kW set, in course of erection, will complete the first half of the station, and the second half is now under construction. When completed the total output capacity will be 300 000 kW, and the total cost, is estimated at £10 500 000, with a further £1 500 000 for transmission lines.

The station was designed in



The control room

natural lighting in both turbine room and boiler house, and to arrange the external windows so that it was unnecessary to black them out during the war; a system of ultra-violet lamps in fluorescent reflec-

boilers, two being spare. The boilers are of the tri-drum natural circulation type, fired by pulverised fuel, generating steam at a pressure of 670 lbs. per sq. in., and at a temperature of 845°F.

The fuel consumed is obtained from about 70 different collieries, and is of the bituminous type of widely varying characteristics. This fact, coupled with the area of land available for ash disposal, was responsible for the decision to employ p.f. firing.

Each boiler is fitted with automatic superheater control, steaming and non-steaming economisers, and plate-type air heaters with air re-circulation. The combustion chamber is water-cooled with fin side tubes and plain tube water screens. Manually-operated soot blowers are fitted on all boilers, and water lancing is used in the superheater zone and on the water screen tubes.

All boiler operations are carried out from the firing floor on the same level and open to the turbine floor, and the lay-out is such that all important motors are either on the basement or at firing floor level.

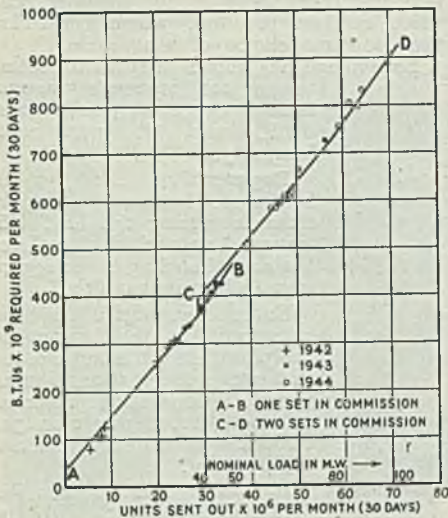
Three p.f. mills per boiler are installed, of the slow speed horizontal type, each mill supplying two burners and having a capacity of 10 tons per hour. The pulverised fuel is withdrawn from each mill and supplied to the burners by an exhaustor fan, two forced draught and two induced draught fans, driven by variable speed a.c. motors, being installed for each boiler unit.

Ash Disposal

The heavy ash from the hoppers below each boiler is deposited through ash doors direct into a gravity water trough, the sluicing water being purge water from the cooling towers. The fine dust caught by the electrostatic flue-gas cleaning plant which is on the unit system, is deposited from the hoppers below, and discharged by conveyors to the water sluice system; the water-ash is conveyed to a swirl pit, from which it is elevated 65 ft. by means of pumps having rubber lined impellers to an overhead trough, along which it flows by gravity to the disposal ground of 300 acres, some 800 yds. from the station. The electrostatic flue gas cleaning plant is operated by mechanical rectifiers at 60 000 V d.c. The i.d. fans are arranged on the outlet from the electrostatic flue-gas cleaning plant, which is therefore always under a negative pressure, thus minimising the escape of dust into the boiler house.

The i.d. fans discharge gases into a lined steel duct below, which conveys the gases to the base of a 400 ft. brick stack.

The turbines are of the two-cylinder tandem reaction type, running at 1 500 r.p.m.,



Actual thermal performance of the station under operating conditions as compared with the specified Parsons line

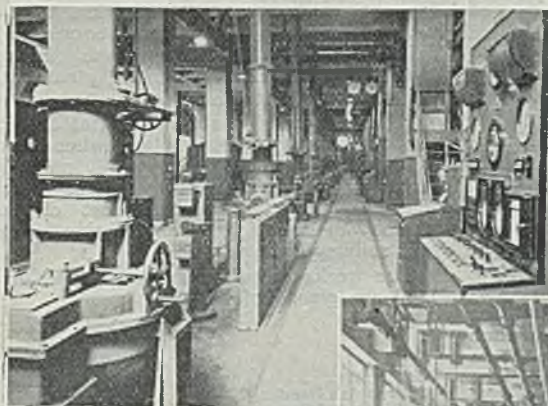
tors was installed, the average intensity of illumination being 0.02 f.c. with a maximum of 0.04 f.c. at operating positions.

The building is strictly functional and has no ornamental features borrowed from contemporary architecture; the general contour of the building being its only claim to architectural beauty.

Practically all coal used at the station is rail borne, and an extensive lay-out of gyrator sidings was adopted to enable a maximum of 8 000 tons of fuel per day to be handled. The coal is automatically tipped direct from the railway trucks, weighed and then elevated, either to the coal bunkers above the boilers, or alternatively to the coal store. There will eventually be three sets of duplicate inclined belt conveyors for the entire station, and each unit will be capable of handling coal at the rate of 120 tons per hour.

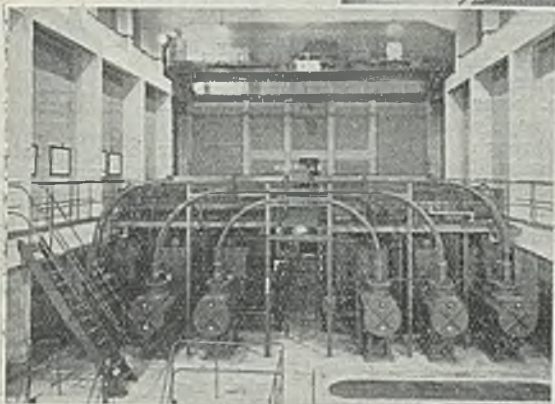
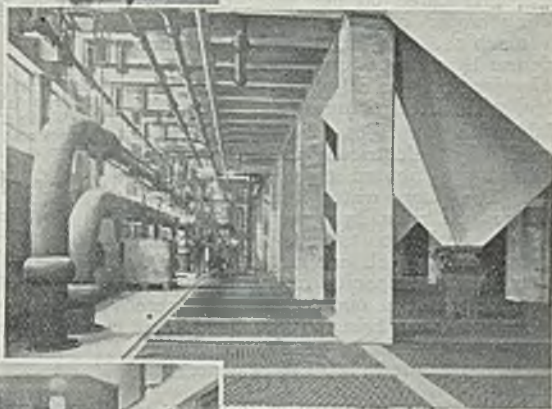
Coal is distributed over the coal stacking ground by a travelling transporter bridge with cross-traversing telfer; this plant, which will be duplicated in the second half of the station, being capable of reclaiming coal from stock at the rate of 120 tons per hour.

Two 320 000 lbs/hr. maximum continuous rating boilers are associated with each turbo-alternator, thus the station will be ultimately equipped with 12 such



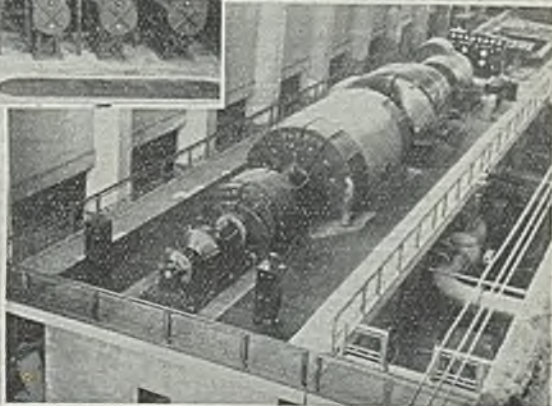
HAMS HALL "B"
IN
PICTURES

The spacious yet simple layout of the station will be appreciated from the views above and right



Left: The low oil content switchgear is a feature of the station

Right: One of the two 50 000 kW turbo-alternator sets now in commission



driving a main alternator of 50 000 kW output capacity at a voltage of 33 kV, and a direct-coupled auxiliary alternator of 3 500 kW, generating at 3.3 kV. The steam conditions at the turbine stop valve are 650 lbs. per sq. in. and 825° F. Four stages of feed heating are employed, giving a final feed temperature of 340° F., with a vacuum at the turbine exhaust of 28.5 Hg. The surface condenser is of the two-pass type and requires 40 000 gal. of circulating water per min. at 75° F. to obtain the above vacuum. The auxiliaries are on the unit system. Two 600 000 lbs./hr. feed pumps are installed, one steam and one motor-driven, and three 50 per cent. duty circulating water pumps are installed for each machine. Air is ejected from each condenser by a set of three two-stage steam jet air ejectors, two of which are sufficient to deal with the maximum load.

Make-up water from the River Tame is pumped by electrically-driven vertical spindle pumps, housed in a riverside pump house. The purge water from the cooling tower system runs by gravity from the overhead discharge troughs to the ash sluice system. Each cooling tower has a nominal cooling capacity of 5 million gal. per hour, and is of circular ferro-concrete construction, each being 209 ft. in dia. at the base, 310 ft. high, capable of cooling sufficient water for 75 000 kW of generating plant.

The works supply is generally taken from the direct-coupled auxiliary alternators at 3.3 kV, all motors above 100 h.p. being operated at this voltage. Standby supply at the same voltage is obtained through works transformers, one being associated with each turbo-alternator. Smaller motors operate at 400 V a.c.

The main 33 kV switchgear is installed in three separate houses, one for each 50 000 kW turbo-alternator, and is designed for a rupturing capacity of 1 500 MVA. It is of the small oil volume metal-clad type, the insulating medium being Freon gas. The busbars are arranged in the form of a ring with accommodation for the generator and seven outgoing 33 kV feeders. Isolators are interposed in the busbar between each circuit breaker to permit complete and independent isolation of any unit. The switchgear is normally controlled from the remote control room, but a duplicate control board in each switch-house provides for local control in emergency.

In the second half of the station all main switching will be carried out at 132 kV. Air-blast circuit breakers of 2 500 MVA rating will be employed with 132 kV transmission circuits to the city area.

The control room, circular in plan and remote from the main building, contains a

diagram type board with shadowgraph instruments, and desk type control panels for the generators. In addition to the usual indicating instruments required for electrical control, shadowgraph instruments indicate the boiler loads, steam and vacuum conditions in the station.

It is estimated that the capital cost of the first half of the station when completed will be approximately £30 per kW, inclusive of war-time increases. This figure includes the entire cost of the station, including civil engineering works and railway sidings.

The works costs for the years 1943 and 1944 are given below:—

	1943 Pence/ unit s.o.	1944 Pence/ unit s.o.
Coal	0.1862	0.2188
Coal and Ash Handling ...	0.0078	0.0099
Oil, Water and Stores ...	0.0018	0.0016
Salaries and Wages, Operation	0.0098	0.0090
Repairs and Maintenance ...	0.0070	0.0102
Total Works Cost ...	0.2126	0.2495
Coal consumed—tons ...	251 080	383 882
Price per ton	27s. 0d.	30s. 1½d.

As the use of pulverised fuel is one of the outstanding features of the station, details regarding operating and maintenance costs of the pulverising plant are given below:—

	Pence/ton.
Operation (Wages)	1.00
Repairs and Maintenance	3.86
Power (26 units/ton)	4.84
Total	9.70

The station has so far been operated under base load conditions and therefore the availability of the plant has not been restricted by external circumstances.

The following table gives the boiler availability expressed as a percentage of the total hours over which the plant has operated:—

Boiler.	Date Installed.	1943.		1944.	
		Includ- ing Survey Period.	Exclud- ing Survey Period.	Includ- ing Survey Period.	Exclud- ing Survey Period.
No. 1	24-4-42	78.1	86.6	71.5	86.2
No. 2	27-6-42	71.9	86.1	79.0	87.1
No. 3	3-4-43	79.6	79.6	68.6	89.5
No. 4	10-12-43	100.0	100.0	78.8	82.8

In a similar manner the following table gives the turbo-alternator availability:—

Turbo-alternator.	Date Installed.	1943.	1944.
No. 1	27-4-42	79.4%	89.5%
No. 2	19-6-43	87.8%	89.5%

It should be pointed out that the outage in the case of the turbo-alternators is not directly attributable to the main unit, but was in the main due to minor steam range leaks, switchgear, and other indirect causes.

The following table gives the principal

operating statistics for two years of operation:—

	1943.	1944.
Station Capacity (MW)...	53.3 (107.0 from June)	107
Units sent out	436 829 900	634 291 000
Units used in works ...	34 747 900	51 580 100
Units generated	471 573 800	685 871 100
Units generated used on works	7.35%	7.54%
Maximum demand sent out (kW)	104 000	103 100
Overall thermal efficiency	26.79%	26.70%
Coal consumed (tons) ...	251 080	383 882
Calorific value (B.Th.U's/lb.)	9 900	9 439
Average absolute pressure at turbine exhaust (lbs.sq. in.)	0.69%	0.72%
Average inlet temperature of cooling water ("F.)...	64.5	65.6
Average outlet temperature of cooling water ("F.)	76.4	77.3
Average outlet flue gas temperature ("F.)	262	278
Average feed water temperature to economiser ("F.)	347	345
Average steam temperature at boiler stop valve ("F.)	834	836
Average steam temperature at turbine stop valve ("F.)	821	822
Average steam pressure at boiler stop valve (lbs./sq. in. gauge)	652	657
Average steam pressure at turbine stop valve (lbs.-sq. in. gauge)	620	625
Total water evaporated (lbs.)	4 364 820 000	6 403 833 000
Make-up to water evaporated	3.9%	3.3%
Average CO ₂ in outlet flue gas	13.5%	13.5%

The price of fuel has more than doubled since this station was designed, and now that coal conservation is becoming an important consideration, higher steam temperatures and pressures are likely to be employed in future.

Not until the pioneer plants now installed in this country have been in service for at least two years are we, it is claimed, likely to have sufficient reliable operating data, however, on which to assess the practical and economic value of employing steam conditions higher than those used in the Hams Hall "B" station.

The chief contractors were: Sir Robert McAlpine & Sons (main building, switch-house and foundations); C. A. Parsons & Co., Ltd. (turbo-alternators); International Combustion, Ltd. (rollers and ash handling plant); Lodge-Cottrell, Ltd. (electrostatic flue gas cleansing plant); Fred Mitchell & Son, Ltd. (cooling towers); A. Reyrolle & Co., Ltd. (main switchgear); British Steel Constr. (B'ham), Ltd., and S. J. Smith & Co. (B'ford), Ltd. (control room building and river water pump-house building); Mitchell Engineering, Ltd. (coal handling plant); P. C. Richardson & Co. (Middlesbrough), Ltd. (main chimney stacks); Greenly Brothers (main drainage); Callenders Cable & Constr. Co., Ltd. (main and auxiliary cables); Stewarts & Lloyds, Ltd. (steam and feed piping); Simon-Carves, Ltd. (flue gas ducting); Laurence Scott, and Electromotors, Ltd. (variable speed motors); British Thomson-Houston Co., Ltd. (auxiliary motors); George Ellison, Ltd. (auxiliary switchgear); Gwynnes Pumps, Ltd. (river water pumps); Brightside Foundry & Eng. Co., Ltd. (circulating water piping); Vaughan Crane Co., Ltd. (auxiliaries crane); Herbert Morris, Ltd. (workshop

(crane); Sir William Arrol & Co., Ltd. (engine room crane); Adams Hydraulic, Ltd. (sewage disposal pumps); Mather & Platt, Ltd. (feed pumps); Metropolitan Vickers Electrical Co., Ltd., General Electric Co., Ltd., W. Lucy & Co., Ltd. (miscellaneous electrical supplies); Pyrotecnax, Ltd. (low voltage wiring); John T. Harris, Ltd. (telephone exchange building); Standard Telephones & Cables, Ltd. (telephones); Clifford & Snell, Ltd. (special telephone system); Sanders (Builders), Ltd. (transformer rafts); Worthington Simpson, Ltd. (air compressor and pipework); Whitaker Ellis, Ltd. (cast iron pipework and valves); Robert Stephenson & Hawthorns, Ltd. (locomotives); Stothert & Pitt & Co., Ltd. (capstans); Atlas Sprinkler Co., Ltd. (fire protection equipment); F. W. Brackett & Co., Ltd. (water screens); Tangyrs, Ltd. (pumps); A. E. Shaw, Ltd. (internal water service pipework); E. E. Jeavons & Co., Ltd. (external water pipework); Tudor Accumulator Co., Ltd. (station battery).

We are indebted to Mr. F. W. Lawton, chief engineer and manager, at Birmingham, for the information contained in this article.

TROPICAL PACKAGING CODE

In 1943 the British Standards Institution published B.S. 1133, the British Standard Packaging Code. Shortly afterwards, a further booklet (Section 3) was issued dealing with the preservation of metal parts prior to packaging. Experience in the Far East has shown that much higher standards of preservation and packaging are essential for equipment destined to the tropics and accordingly, at the request of the Anglo-American Packaging Committee of the Ministry of Production, the B.S.I. has now published the Supplement No. 2 to B.S.1133, with an explanatory sub-title "Recommendations for Preservation and Packaging for Tropical Theatres of War." The Packaging Code itself dealt with the problems of mechanical protection. The Supplement, which supersedes the interim Supplement No. 1 published late last year, deals specifically with the problems of the tropics, and while it has not been possible to cover every item of equipment and packaging of, it includes, among other things electrical and tele-communications stores. It is pointed out that the recommendations are not mandatory, and that the detailed instructions of Government Departments must at all time be followed. The supplement is obtainable from the British Standards Institution, 28, Victoria Street, London, S.W.1, price 5s. net, post free.

Passport to Peace.—The United Steel Companies Ltd., have prepared a booklet "Passport to Peace," which is to be issued to all members of the firm now serving in the Forces or the Merchant Marine. It has been the policy of this company throughout the war to plan for the re-instatement and rehabilitation of its members, on the most equitable and fair basis possible and their plan took shape long before legislation was introduced in the form of the Civil Employment Re-Instatement Act.

H.F. Heating and Special Woods

By H. SEYMOUR

MUCH progress has been made recently in the development and application of high frequency electrostatic heating, which, in its modern form, does not injure or cause changes in the substance or material thus exposed. With such heating a tremendous amount of heat is created by molecular friction and though the principle involved has been known for years, the design and construction of large-scale commercial equipment embodying the principle has not, until comparatively recently, been solved.

In order to determine the requirements for high frequency electrostatic heating, it is necessary to know the weight, specific heat of the substance, and the temperature rise required. With this information, it is simple to calculate the B.Th.U. required for the operation. Suitable instruments keep the operator informed of the energy and time involved, and the plant is equipped with adequate controls so that the operator may use any output desired, up to the maximum.

While this form of heating is being applied in many ways in industry, one of the most interesting is found in the new plywood materials, of which there are three types, namely plastic-bonded plywood, plastic-bonded laminated wood, and compressed wood. These three are already replacing metals in the manufacture of many articles—not because of war priorities and scarcity, but because the new woods do the job better, are stronger, last longer, and are cheaper. Plywood can not only be made in panels of almost any size and thickness, but large, complex shapes are attained by moulding plywood.

Aircraft Construction

Several aircraft companies are now producing airplanes made of plywood, and plans are being drawn up for large multimotored passenger and freight 'planes to be constructed of the material. Rivets which increase wind resistance and reduce speed are not required, and one aircraft authority has been quoted as saying, "part for part and man-hour for man-hour, a plywood 'plane can be built in a matter of hours where a metal 'plane requires days."

In the construction of both aircraft and gliders, high frequency electrostatic heating is of special importance. Propeller material composed of many layers of resin impregnated veneer, highly compressed and heated, are proving to have many advantages over metal propellers, and h.f. heating provides the most practical method

of uniformly and quickly bonding the veneers. Composite spars for both planes and gliders may be made to any dimension from many small pieces by the same process. Ribs of both solid web and truss construction made with h.f. heating as part of the process are found to have uniform, strong glue lines besides effecting a reduction in labour.

In bonding ribs to spars, and skin to all supporting structure, h.f. heating provides a simple and practical solution to an otherwise difficult and complicated problem.

Woods Used in Boat-building

For marine use, a new type life raft is made of laminated balsa wood with a plywood floor. Landing craft and lifeboats are made of plywood and laminated wood. Considerable quantities of plywood are used in the construction of the famous U.S. Navy P-T boats, and it is believed that soon the hulls and most structural work of several other types of naval craft will be made of plywood and laminated wood.

For example, complete full-length keels can be made in one operation—using boards of convenient size and low cost. Main frames or ribs can be formed from thin boards, the thickness depending on the radius of the bend. Resin-bonded ribs are superior to steam bent ribs, and when transom pieces, bulk-heads, planking, decking, etc., are fabricated by h.f. heating, the resulting members give test results superior to those of ordinary construction.

The use of plywood and laminated wood as a replacement material is almost unlimited. Some products now being made of plywood include washers, gunstocks, beer barrels, gears, gusset plates, one-piece oil drums, dies for forming metal, fan blades in cooling towers, truck bodies, vats and trays for the storage and handling of many chemicals.

High frequency heating equipment is also simple to operate in the manufacture of plywood panels and no mechanical or structural changes are necessary in the press equipment itself. Any conventional type of cold press can be easily used, thus the main advantage of this method is retained. With h.f. heating, however, the production of a constant volume of panels per unit of time, regardless of variance in the thickness or the area of the panels is possible. There is no redistribution of the moisture in the panel and no surface checking; nor is there danger of blistered or steam exploded panels. Con-

sequently, panels produced by this method have a low moisture content, remain flat, and are easy to finish.

In some panel plants the veneer drying equipment is often a bottleneck, because of the difficulty in removing the last few per cent. of moisture from the veneer, and in bonding with either the cold press or hot plate press methods, a dry veneer is essential.

In the cold press method, because of the extra water introduced with the necessarily excessive amount of glue, it is essential that the veneers themselves introduce practically no water to the assembly. Excess water in the glue is not a serious problem in the hot plate press method, but if the veneer contains an appreciable amount of moisture, exploded or blistered panels would result.

With h.f. heating, however, the output from the veneer dryer can be increased, because veneers having a much higher initial moisture content than is possible with either the cold press or hot plate press methods, can be accepted.

A new wood product receiving consideration is compregnated wood; also known as "high density plywood," this material goes a step farther than conventional veneer or laminated wood. The process of manufacture is similar to that of ply or laminated wood except that the wood layers are impregnated with plastic, then

compressed to 1 500 lbs. per sq. in. or more, and heated to about 300°F. It has been possible to make this high density product in hot plate presses, but due to the high temperature required, the thickness of the product has been limited; with h.f. heating, however, there is no limit to the thickness. Although compregnated wood is at present more costly to produce than plastic-bonded plywood, the product possesses a greater ultimate and compressive strength, and has in addition, the density, hardness, resistance to abrasion, moisture, swelling, shrinking, and corrosion of the best grades of moulded plastics. The combination of high pressure and heat makes the product more homogeneous than ply or laminated wood, and its strength can be more exactly predetermined.

While compregnated wood is, in the opinion of many, still in the experimental stage, discoveries are being made daily concerning its properties and already compregnated wood has been made with a surface hardness of up to 90 per cent. of that of plate glass. Moulded compregnated wood propellers are being tested for use in aircraft and because the wood is a non-conductor, many insulating pieces can be formed for use in all types of electrical equipment. To-day, cooling tower fan blades are being made of compregnated wood instead of aluminium or steel.

Cooling Tower Vapour Emission

Results of Experiment in Electrostatic Precipitation

THE lay Press has devoted considerable attention during the past few months to the cooling towers used for electric power stations. The cathedral cities of Lincoln, Durham and York have all been in the news due to proposals to instal cooling towers—"monstrous erections" as they have been termed—in connection with new power stations or extensions to existing units.

Consideration may also have to be given to the positioning of cooling towers in relation to other buildings, otherwise a claim may be made for infringement of right of light, which may result in the payment of a substantial sum of money if such claim is proved.

Another matter demanding careful attention is the emission of vapour from these towers, which may cause a nuisance in the vicinity of household property. During winter months trouble may also be experienced from ice formation on public roads, resulting in accidents. Further, where the make-up water is taken from a town's main, the annual water charges

would be fairly high, and for a station generating some 300 million units per annum might possibly be about £8 000 to £10 000.

With a view to reducing the emission of vapour to an economical and practical minimum, various provisions are made in tower design and construction, but nevertheless there still remains an appreciable discharge from the tower exit, which under certain conditions may cause a nuisance.

As is well known, electrostatic precipitation has been applied to flue gas cleaning and vapours resulting from various processes, and an attempt has been made to test the usefulness of electrostatic precipitation when applied to cooling tower vapour. An experimental set-up as shown in Fig. 1, was arranged which consisted of a 40 kV valve testing equipment normally used for pressure testing in the Bradford electricity department, together with a small chimney having a sheet tin lining in its upper end. An electrode was inserted in the centre of the chimney, and satisfactory results were obtained.

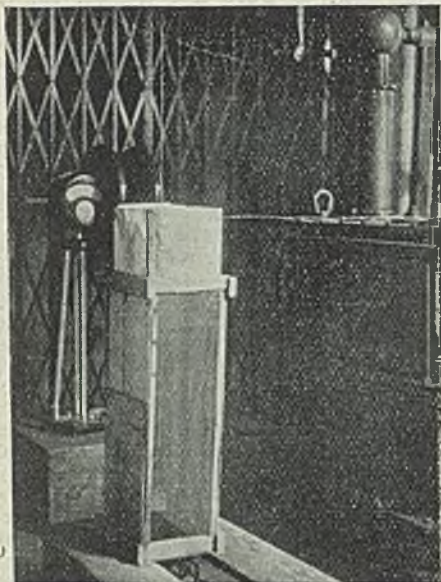


Fig. 1.

Applying this method to a cooling tower, Fig. 2, the arrangement would consist of a

It would appear that discharge electrodes, together with metal screens or cages of wire, would have to be supported within the tower, and by the application of a high voltage of the order of 40 kV, d.c., the vapour would be condensed within the shell of the tower.

Such arrangements could be applied to both reinforced concrete and wood water cooling towers.

The application of this equipment to water cooling towers would, it is believed, effect a considerable saving in cooling water make-up and prevent nuisance to adjacent property, as approximately 90 per cent. of the vapour is condensed within the shell. The cost of equipping the cooling towers with the appropriate electrostatic precipitation plant would be rather heavy, but taking into account the costs which might have to be incurred to overcome emission troubles, it may prove to be economically justifiable from this point of view alone.

Birkenhead.—The Central Electricity Board has intimated that it has decided to proceed with an extension of the power station by the provision of a third set of 50 000 kW to be commissioned in the autumn of 1949, and appropriate boilers of the same manufacture as the first two equipments, and that it will instruct

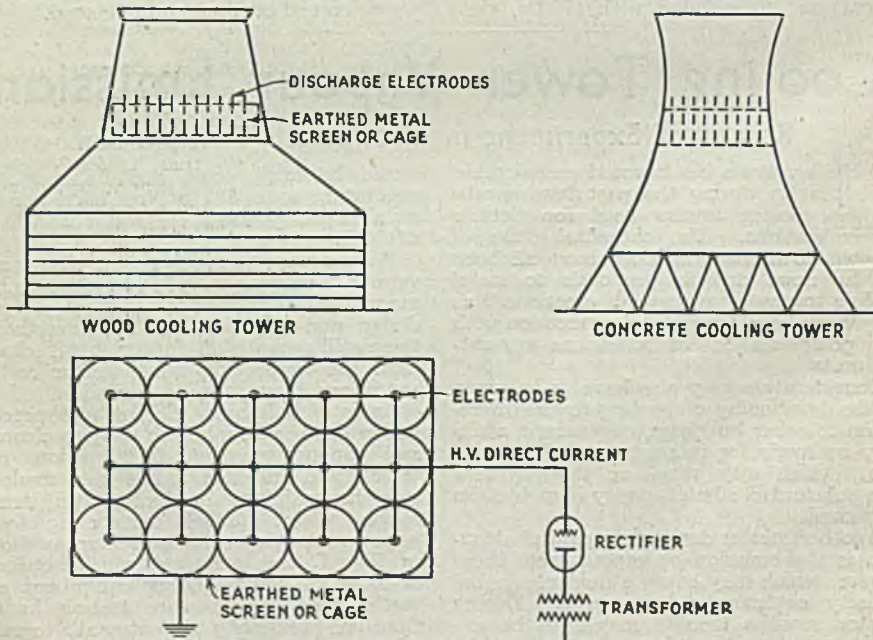


Fig. 2.

high voltage electrical discharge equipment inserted in the upper part of the tower.

Messrs. Merz and McLellan to prepare the necessary plans.

Electricity in France

More Farmers Turning to Power — Generation and Coal Shortage

OWING to the scarcity of liquid fuel during the last four or five years, French agriculture has been compelled to turn to electricity for power, with the result that there has been an intensification in the use of power driven machinery for threshing, while the absence of spare parts for mechanical machines and the decline in the horse population has encouraged the use of electricity for ploughing.

A Distribution Problem

Despite the expansion of the distribution network in France there are still many corners where, although served by electricity, there is not enough transformer capacity to permit of the service undertaking heavy work. The Government's policy, therefore, is to develop this side of electricity supply and a plan has been drawn up for the purpose. In those districts where it is possible to run small motors, of, say, less than 10 H.P., it has been decided to either increase the diameter of the cables without raising the voltage or to increase the voltage and up-rate the conductors. While it is easy enough to change the lines, it is pointed out that the 115/200 V supply used in the country, often drops below this value and this might have a serious effect on certain work being undertaken at the time. Secondly, substituting the lines by others of higher current-carrying capacity might prove too expensive. An increase in voltage, therefore, seems the most likely solution and the change will be from 115/200 to 230/400 V. This voltage is already being used in some districts but where it is not the step-up will involve a renewing of transformers and changing of consumers' apparatus. Both 115 and 230 V are likely to be used for a time, but where war damage to networks is serious enough to necessitate rebuilding, the higher tension will be installed.

Already plans are being drawn up for the manufacture of such domestic apparatus as cookers to be used on 230/400 V. The conditions imposed by the latter value of voltage will involve some study, for manufacturers are already anticipating some difficulty in the making of elements for 400 V, which will possess the same reliability of those made for 230 V. A hot-plate for 400 V has, however, been designed and it is believed that it will be satisfactory.

Finally, the Electricity Direction has given instruction for a tightening up in the insulation testing of all apparatus, as 400 V demands a higher standard of security. Lighting will continue to be fed at 230 V.

A campaign is to be undertaken among the peasantry for, in spite of the widespread use of electricity in farming there are still thousands of farms which use current for lighting only. Most of the ground has been covered already, of course; in 1919, for example, when the campaign first started, no more than 7 500 communes out of 38 013 used electricity, that is, about 20 per cent. Some 12 years later, in 1931, no more than 7 000 communes and small towns were without current, and in 1937 the figure was reduced to 1 500. Just before the outbreak of war in 1939, 98 per cent. of the communes were using electric current. The latest figures relate to 1943 when, in spite of the occupation, only 965 communes remained to be tied into the network.

Recent consumption statistics for rural areas are not available, but for 1942 the figure stood at 822 million kWh for communes with less than 2 000 people; 24.1 kWh were consumed per hectare of built-up or cultivated area; 33.6 kWh was used for domestic purposes, and 12.9 kWh for non-domestic purposes per capita. Altogether some 72 per cent. of the current was used for domestic purposes and 28 per cent. for non-domestic purposes.

Importations of Current

With respect to coal, this coming winter will probably be one of the hardest and most serious for France. To be able to dispense with coal altogether, at least twice as many hydro-electric generating plants would be necessary, and although plans for such expansion have been drawn up the construction programme will take years. The French are trying to overcome the problem by importing current from Switzerland and Germany, but negotiations are proving long and difficult. The Swiss are asking for coal in return for current, and the French, while willing to supply a certain amount of coal are not willing to export the quantities asked for by Switzerland.

The German problem is different. The French want to build a transmission line for importing current from Germany but before this can be attempted, agreement must be reached with the Inter-Allied Government, and though it appears that the Americans are willing to sanction the scheme, the British are not. It is, according to report, argued that both Belgium and Holland need more current to be imported from Germany, while the industry of the latter must, too, be put on its feet for economic reasons. It is this latter point which is apparently upsetting the French,

for it is, they say, too much to expect France to stand by while German industry is being developed, and they are determined to press for the construction of the new line.

Meanwhile, preparations are being made in Paris for a thin time. It is hoped that no further restrictions will be imposed, although, of course, rationing will continue. Manufacturers are, it is reported, attempting to place on the market a large number of appliances such as foot warmers, small water heaters and miniature radiators. During the war years, French industry was singularly successful in this, and in 1940 the population of Paris spent 30 million

francs on appliances of this type. The heaviest sales were 1 000 W hot-plates, 1 000 W radiators, foot warmers, and 200 to 300 W water heaters. Altogether some 125 000 pieces of equipment were manufactured in that year and, since 1940, 400 000 appliances have been sold. To meet the demand some 200 000 kW of generating plant was started up.

The coming winter off-peak supply will, it is hoped, help to relieve the situation, and about 100 000 special meters are being installed to enable radiators and water heaters to be used at economic rates. The C.P.D.E. is agitating for restrictions in shop window and street lighting.

Life in Occupied Guernsey

ALTHOUGH some descriptions have already appeared in the Press of experiences in the Channel Islands during the German occupation, the following communication from an electrical engineer who lives in Guernsey, is of personal, rather than technical interest. Space conditions make it impossible to publish the communication in full, but sufficient is given to indicate the hardships which had to be endured.

"The first contact with the Germans was on June 28, 1940, when aircraft bombed the harbour sheds and landings, killing 22 and badly wounding 33 people; the ambulance was attacked with machine-gun fire while taking victims to the hospital. As soon as the German military arrived they took possession of the local newspapers and started their 'propaganda'; they stated that if the islanders conformed with their regulations they would 'respect our persons and property.' Very soon they seemed to have forgotten their published promises and started to turn out thousands of people from their homes, giving in many cases only a few hours notice to quit, and frequently they would not allow the removal of furniture or even personal effects. (There was no excuse for this, since over 20 000 people had been evacuated to England and there were, therefore thousands of vacant houses available).

"The Germans made a house-to-house search for invested securities, bonds to bearer, etc., and made many people accompany them to their bank and open all their deed boxes, in order to annex anything they thought of value.

"Very soon food rations were reduced and became less and less until commodities vanished entirely and we lived on substitutes and vegetables. Prices soared steadily and soon became impossible. A half pound of China tea realised £9 at a public auction; tins of fruit 12s. to 16s. each; a packet of matches (12 boxes) £6; boot

laces 2s. 8d. a pair; butter as much as £3 per lb.; meat, when obtainable, anything from £1 to £2 per lb.; cigarettes were sold recently at over £1 each.

"Restrictions made fishing next to impossible and of what little was caught 60 per cent. went to the Germans and to the civilians, 40 per cent. Milk rations went down to $\frac{1}{4}$ pint of skimmed milk for two people per day (the Germans at this time received two quarts each per day), and meat, 3 ozs. each once a fortnight. No gas, electric light, coal, candles, matches, paraffin oil, soap, blacking, ink, or polish, in fact no household commodities whatever, even salt, were available.

"In the early stage of the 'occupation' some fishermen escaped from the island; the Germans, 'to punish us,' confiscated wireless sets, but after a time returned them; later they took the sets away again 'for military reasons.'

"After a time we longed to be in touch with England and so I made two crystal sets. The Germans searched the house but found nothing, my wife having hidden the set in a box of soot (used to fertilise the garden) about three days before the search. Afterwards, I made a secret partition in a piece of furniture to hide and house the set, for to be caught with wireless in the house would have meant imprisonment and a heavy fine.

"We have had a very thin time; my wife and self both went down to six stone, but since the arrival of the Red Cross ship 'Vega,' I am now 7 stone $4\frac{1}{2}$ lb., and my wife, 7 stone 8 lbs. The German plan was to slowly starve us, and I think they were successful in some cases. The Germans freely gave out that if they ever had to leave the Island, nothing would be left at all.

"This is only a very brief outline of all that has taken place, for a complete history would require a volume of considerable size."

News in Brief

Road Transport Proposal.—The Cardiff Transport Committee recommends seeking powers to run trolley buses on various routes.

Yugoslavia Telegraph Service.—The Post Office and Cable and Wireless Limited announce that the public telegraph with Yugoslavia has been restored.

Slough Social Centre.—Sciaky Electric Electric Welding Machines, Ltd., subscribed £59 17s. and Taylor's Electrical Instruments, Ltd., £59 10s. to the Slough Social Centre during the last financial year. Electric Welders, Ltd., paid £22 10s. and the Rheostatic Co., Ltd., £52 10s. to the fund under deeds of covenant.

Street Lighting Conversion.—The conversion of gas street lighting to electricity will be in operation by the winter at Church, Accrington.

Trolley-bus Scheme.—The South Shields T.C. is to spend £13 000 converting the last tram route to trolley buses and extending the present route from Mile End to The Lave.

Liverpool Telephone System.—The telephone system in Liverpool will be speeded up by the extended facilities which came into operation on July 9.

Manchester Hospitality.—The Manchester Electricity Committee has decided to provide hospitality to members of the Council of the I.M.E.A., when they visit Manchester on September 20-21.

Street Lighting Order.—The Government has asked local authorities who are not in a position to ensure that their street lighting will be kept extinguished during daylight, to defer the restoration of full-scale street lighting until the necessary labour and materials are available.

Burnley Resolution.—The Electricity Committee has passed a resolution urging the abolition of purchase tax on all domestic electrical equipment. Ald. Buchanan said they were all anxious that the hire-purchase system should be restored but the Committee would not do so unless in conjunction with the Gas Committee. He asked the Gas Committee to meet representatives of the Electricity Committee with this end in view.

Wireless Aerials Recommendation.—The Joint Committee of the Northants, C.C. on Rural Housing recommends that wireless aerials should be provided inside the roofs of all new houses with the necessary leads and plugs, in order to avoid the unsightly appearance caused by poles.

Dumbarton Engineering Consultant.—An electrical engineering consultant is to be appointed to advise the T.C. on proposals made by the Corporation and the Clyde Valley Power Co. for the supply of electric light and power in Dumbarton, also as to the advisability of the T.C. themselves operating the Dumbarton Electric Power Order.

Workers' Sick-pay Scheme.—Mr. R. H. Harral, borough electrical engineer, Blackburn, has been asked to report fully on a sick-pay scheme for electricity workers for the District Council of the Electricity Supply Industry.

Power Station Progress.—Foundations have been prepared for new cooling towers for the Kearsley station of the Lancashire Electric Power Co. It is expected that the extensions will take about three years to complete. Work has also started on extensions to the Back o' th' Bank generating station, Bolton.

Rush Wireless Service to Australia.—Rush reports of the play in the England-Australia test match have been reaching Australia over the Cable and Wireless routes within 2 minutes, and descriptive matter in 10 minutes. In order to provide this service, a special telegraph office was opened on Lord's ground, connected by tele-printer and telephone to the Australian beam wireless circuit in the company's London telegraph station.

Liverpool Technical College.—Students attending the technical and industrial courses at the Liverpool Central Technical College during the year just ended numbered 4 717, which is nearly double the number who attended when the war broke out. There was a shortage of accommodation for the preliminary courses in electrical and mechanical engineering which had to be distributed between three senior technical institutes.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN of July 16, 1920: *It is reported that some new submarines in the American Navy have been equipped with wireless apparatus for use when submerged. Messages are received satisfactorily from nearly the same distance as if they came through the air in the ordinary way, and they are capable of being sent over a radius of about 12 miles. The battleship "Iowa" has been commissioned for a series of experiments in wireless, including her steering and control from a station on shore.*

Persian Trade Prospects

Possible Opportunities for Electrical Development

IN a review of commercial conditions in Persia (Stationery Office, 6d. net), it is pointed out that though that country could not be considered highly industrialised before the war, considerable progress had been made in the development of a number of industries. The State, in addition to controlling the mines, forests and the cotton crop, owned many industrial undertakings concerned with the textile, food and other industries and these were in most cases well designed and capable of turning out products of good quality. Tehran, Shahi and Ispahan were the principal centres of manufacturing industry, while the country as a whole imported from the United Kingdom during 1938, electrical goods to the value of £196 000, and in 1939, equipment valued at £136 000.

Though none of the machinery required by public utility concerns is manufactured in Persia, a large power plant was erected at Teheran before the war and most of the towns have electric light and telephone service.

While Persia benefited financially from the large sums spent by the Allies during the European war, with the object of improving her communications and other public services, the internal economic situation deteriorated to such an extent that it became necessary towards the end of 1942 to take drastic measures to cope with the problem. As to the future, it seems certain that for a time Persia will be in the market for large quantities of both consumer and capital goods. The latter will be required in connection with the execution of various irrigation, water supply, electric power and other public works contracts, and industrial development schemes that have been receiving consideration during the last few years.

Indian and U.S.A. Competition

For a time control over the supply of civilian requirements will no doubt continue as now, for, since the severance of Persia's relations with Germany, consumer goods have been imported principally from the U.S.A., the United Kingdom and India, and it is likely that these countries will continue to be the chief sources of supply, at any rate in the initial stages of peace. Of these three the United Kingdom has, apart from the special requirements of the Anglo-Iranian Oil Co., recently taken third place as a supplier; with increased industrial capacity in both the U.S.A. and India, it may not be possible for the United Kingdom to improve her position much in com-

petition with them. In machinery, tele-communications equipment, metal goods and hardware, the United Kingdom may, however, be able to obtain a somewhat better proportion of Persia's import trade than she did before the war.

How far the U.S.S.R. will be able to regain its former hold on the Persian market it is impossible to say. Some years before the war the U.S.S.R. was Persia's principal source of imports, but her position was being challenged by Germany which rose to first place just before the war, and kept that position until the Allies occupied the country. Though German competition may not be very serious immediately after the war, it will undoubtedly have to be reckoned with again in the future.

Buyers of Persian Produce

Germany's position as the principal supplier of Persia's imports was helped by the fact that she was before the war (and up to the time of the Allied occupation) the leading buyer of Persian produce. Nearly 50 per cent. of Persia's commercial exports went annually to Germany. The United Kingdom on the other hand, has never been a large buyer of Persian products (other than mineral oil) and this aspect of the matter is important in considering Persia as a market. For a time after the war, while supplies remain short and difficult to obtain, there will no doubt continue to be a good demand for United Kingdom goods but, as trade becomes free again and controls are relaxed, Persia may possibly turn for her main supplies of imported goods to those countries that are prepared to buy fairly large supplies of her products other than mineral oil.

As regards public works schemes, considerable attention has been paid for some years to the necessity of improving irrigation in various parts of the country, with the object of assisting agricultural development. Persia has possessed a system of irrigation since the dawn of history but it is suitable only for comparatively small areas of land. One modern scheme, known as the Lar River scheme, designed to irrigate the Tehran plain and to augment the capital's water supply, is at present being investigated by a United Kingdom firm. Schemes for the provision of a piped water supply for Tehran have been receiving consideration for a number of years and several United Kingdom firms have shown interest in them. It seems probable that further attention will be given to this improvement after the war and, as water supply schemes for other parts of the country are also likely

to materialise, opportunities should occur for United Kingdom firms to interest themselves in their actual development.

Other projects which may be considered after the war concern hydro-electric development, as an aid to industry, mining and transport, extensions to the present railway system and the development of telecommunications. The expansion of the existing telephone and telegraph service is now being considered.

Before the war many of the technicians in Persian factories were German and, as a consequence, much of the machinery in use was of German manufacture. There is an opportunity now to assist Persian industrial development by providing United Kingdom technical assistance in the factories. It has been suggested, as an alternative that might perhaps prove more satisfactory in the long run, that young Persian engineers be given

technical training in this country under a scholarship system, afterwards returning to take up positions in Persian industry on the completion of their training. The appointment of additional British teachers to the technical colleges and institutes in Tehran and other centres has also been suggested as a practical means of spreading our influence in Persia.

To sum up, the Persian market for consumer goods is likely to offer increased opportunities for United Kingdom manufacturers temporarily in the immediate post-war period: but it seems unlikely that there will be any large permanent increase in the value of British exports to Persia. United Kingdom firms should be well placed to participate in Persian public works contracts and in this way to develop the demand for a range of capital goods of British make.

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

It has been intimated that **Lt.-Col. R. M'Creary**, general manager of the Belfast transport department who is expected home on demobilisation leave, will resume duty with that department on August 1. **Mr. S. Carlisle**, acting manager, has submitted to the Committee an agreement approved by the National Joint Industrial Council of the Road Passenger Transport Industry amending the conditions of service of employees in the industry, and has pointed out that this revision may entail an additional expenditure of £14 500 per annum.

The **Dowager Marchioness of Reading**, a former president of the E.A.W., has been appointed chairman of the Domestic Users' Panel appointed by the Minister of Works to advise him on matters relating to fittings, components and other internal arrangements in small houses from the standpoint of domestic convenience.

The Manchester Joint Research Council (which is representative of the Manchester University and the Manchester Chamber of Commerce) announces the appointment of **Mr. A. D. Butchart**, as an executive officer. Until a permanent office can be established, contact can be made, c/o the Manchester Joint Research Council, at the Manchester Chamber of Commerce, Ship Canal House, King Street, Manchester, 2.

Mr. Raymond Charles Maher has been appointed a director of Ward and Goldstone, Ltd.,

Mr. Arthur Hepburn, chief engineer at Straker and Love's group of collieries at Willington and Oakenshaw, who has been installed national president of the Association of Mining and Mechanical Engineers,

was formerly a teacher in electrical and mechanical engineering at Durham Johnston Technical School.

Mr. W. H. Gatty Saunt, Mr. M. A. Hassid and Mr. A. F. Gregg have been appointed directors of the Rothermel Corporation.

The marriage took place at Muswell Hill, on July 7, of **Surgeon Lieut. Anthony Andrade**, son of Prof. Andrade, F.R.S., and Mrs. K. B. Andrade, of Dummer, to **Miss Joan Pauline Bell**, daughter of Mr. and Mrs. E. H. Bell, of Muswell Hill.

Mr. A. J. King has been awarded the degree of Doctor of Science by Manchester University. He is the author and joint author of a number of papers on noise and vibration, having been engaged on this work in the Research Department of the Metropolitan Vickers Electrical Co. Ltd. for nearly 20 years. He has served on several B.S.I. and B.E.A.I.R.A. committees concerned with radio interference, noise measurement and lightning surges.

Col. H. J. Wellingham, Press liaison officer of Cable and Wireless, Ltd., has returned to London after a 20 000-mile tour covering Egypt, India and Ceylon, during which he discussed the re-establishment of telecommunications in the Far East, and the development of the phototelegraph circuits.

Estate of the gross value of £56 000 was left by the late **Sir Ambrose Fleming, F.R.S.**, Emeritus Professor of Electrical Engineering at University College, London.

Mr. J. C. Colquhoun, chairman and joint managing director of Manganese Bronze and Brass Co., Ltd., has joined the board of Lightalloys Ltd., and has been elected

chairman, and **Mr. W. S. Knight** has been appointed managing director, in place of the late **Mr. W. H. Grieve**, chairman and managing director.

Mr. John Holland, for six years assistant district engineer to Lancashire E. P. Co., is taking up a new post with the company in Ormskirk area.

At Oldham Town Council meeting on July 11, the appointment of **Mr. J. A. Ogden**, as deputy borough electrical engineer was confirmed.

Prof. Francis Gibson Baily, Emeritus Professor of Electrical Engineering at Heriot-Watt College, Edinburgh, left £21 213.

Mr. E. J. Fournace, sales manager, and **Mr. D. F. Brown**, assistant to the managing director, have been appointed to the board of directors of the Westinghouse Brake and Signal Co., Ltd.

Mr. J. D. Campbell, a director of Williams (Birmingham), and technical manager of the London Aluminium Co., has been appointed assistant controller of the aluminium fabrication industry in Germany.

At the annual general meeting of the Municipal Passenger Transport Association held in London, **Ald T. J. Gooding**, chairman of the Leicester City Transport Committee, was inducted president of the association. **Ald. Gooding** has been a member of the council for seven years, and serves as one of the representatives on the employers' side of the National Joint Industrial Council for the Road Passenger Transport Industry.

Hastings Electricity Committee has received 62 applications for the vacancy of borough electrical engineer and has recommended the appointment of **Mr. James Savage**, the deputy, pointing out that the matter will be reviewed after one year. **Mr. Savage** is at present suffering from defective hearing but the Committee understands that there is every prospect of him making a recovery.

Mr. E. B. Tuppen, who joined the B.T.H. Co. in 1903, retired on July 14. He was at first employed in the drawing office at Rugby, transferring shortly afterwards to the control gear engineers. **Mr. Tuppen** specialised on control gear design, particularly in those forms employed in traction service. Immediately preceding the war years he was engaged in developing fittings for the then new forms of street lighting.

Mr. and the Hon. Mrs. Leslie Gamage gave a dinner party at Claridge's Hotel, London, on July 12, in honour of the Premier of New South Wales and Mrs. McKell. Among the guests were: Sir Frederick and Lady Handley Page, Sir Harry and Lady Railing, Captain and Mrs. Nutcombe Hume, Mr. and Mrs. Ivan Spens, and Mrs. Christopherson.

Dr. E. W. Smith has been elected president of the Institute of Fuel for a third year of office.

Mr. Charles H. Powell, president of the American Institute of Electrical Engineers and an official of the Westinghouse Electrical and Manufacturing Company, will be chief of the electrical and radio branch of the United States Group Control Council for Germany.

Obituary

Mr. W. S. Clark, aged 68 years, chairman of the Oakham Gas and Electricity Co., Ltd.

Mr. George Edward Evans, electrical engineer of Orford Avenue, Warrington, Lancs., aged 72 years.

Mr. H. C. C. Tufnell, on July 6, aged 61 years. He was for many years, chief electrical inspector of the United Provinces, India.

Mr. J. E. Betts, on July 14, aged 70 years. He held the position of supervisor of purchases for the B.T.H. Co., Ltd., and was chairman of the A.E.I. Group Purchasing Committee. He received his education at the Bristol Grammar School, and at the Merchant Venturer's Technical College, Bristol. In Bristol, too, he served an engineering apprenticeship with Messrs. King, Mendham and Co. After holding engineering appointments in South Africa, **Mr. Betts** joined the outside construction staff of the B.T.H. Co., in July 1900, being first employed on the Bristol tramways electrification scheme, then on work in connection with the Glasgow tramways power station, Pinkston, the Ayr Corporation tramways, the Hamilton, Motherwell and Wishaw tramways, the Sheffield tramway power station at Kelham Island, and elsewhere. In 1902 he was transferred to the construction staff at Rugby Works, and later was appointed manager of the factory production, stores, and order departments. In 1918 he was appointed supervisor of Purchases, and in April, 1931, became chairman of the Group Purchasing Committee of Associated Electrical Industries Ltd. He held these appointments until his death. The funeral was at the Golders Green Crematorium on Tuesday.

Glasgow's Standard Kitchen.—A standard kitchen which will be used in all the permanent and temporary building of housing undertaken by the Corporation has been shown in the city housing department, Trongate. This kitchen is the work of **Mr. Green**, city housing department architect. The electrical equipment will incorporate a household type electrical refrigerator, an electric ironing point, concealed in the wall recess into which the board folds, and electric lighting.

New Equipment and Appliances

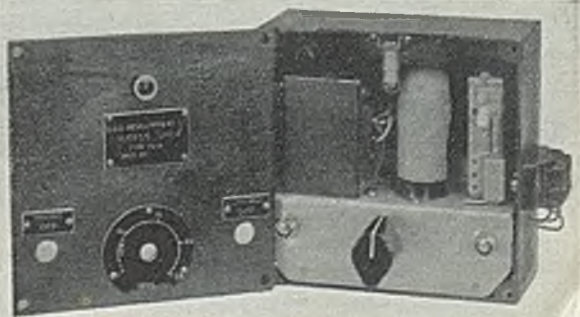
Testing of Pyrometers—Process Controller—Fuses and Holders

A NEW unit has been developed by **Wild-Barfield Electric Furnaces, Ltd.**, for testing thermocouples and pyrometer installations. The conditions of tests carried out in the furnace conform with the recommendations of the British Standard Code 1041, 1943, and with the addition of a suitable workshop potentiometer, a complete check of the individual components of a pyrometric installation may be made. The unit, designed for accuracy and convenience, is portable, and it is claimed, with the various types of container listed, it enables tests of thermocouples of all the more usual types to be carried out under the most favourable conditions.

The **G.G.C. Development Co.**, have put on the market a new control instrument. Primarily designed for the machine tool field, its uses are such that it is also of interest as well to the electrical industry. The instrument as designed, can, for instance, be used for the control of heating time in plastics or rubber moulding presses; the control by a time cycle of twisting machines for high tensile reinforcement for concrete; the automatic heat treatment of metals and materials; while in other fields, it can be used for the control of exposure time of a photographic enlarger, and can be applied to other methods of copying and printing. In general, well founded principles have been used in its design, and it has been made robust enough for normal production handling. Called an electronic timer, the instrument is a small self-contained device; only one valve is used and the controlling circuit can handle up to 5 A a.c. or 1 kW at 230 V, but larger contactors can be fitted to order. The control can be effected by setting the dial to the required time and switching on the control circuit, and by a special arrangement of relay contacts, the circuit can be made to function either as a time delay or a process timer. Since the control is continuously adjustable over its range, it can be used for applications needing any variable time control. The mains input is 200-250 V, 50 cycle; the standard timing range, 0.25 sec.; the accuracy is claimed to be within 5 per cent.; the weight is 10 lbs.; and the size of case 6 in. x 6 in. x 3 in.

The addition of a range of "Kantark" h.r.c. cartridge fuses to their products is announced by the **Midland Electric Manufacturing Co., Ltd.** These fuses, available in ratings from 5 to 200 A, have been thoroughly tested in accordance with B.S.S. 38, 1939, for the highest category of duty (440 a.c.) and proved to comply fully with the requirements of the specification. A range of special fuse handles to carry the cartridges has also been introduced, and these have been designed to be interchangeable with M.E.M. standard fuse handles of the rewirable type without modification to the fuse bases. This enables the change-over to h.r.c. fusing to be made by merely withdrawing the existing fuse handle and inserting a new cartridge carrier with the appropriate cartridge. Adaptor links are available to permit low rated cartridges to be inserted into large cartridge carriers where necessary. A comprehensive catalogue has been produced, giving details of the new fuses and fuse carriers, together with tables showing the results of the tests.

Fostering Industrial Research.—At a recent meeting of the F.B.I. Grand Council, under the chairmanship of the president, Sir Clive Baillieu, it was decided to convene in London a two-day conference on the subject of "Industry and Research." Special emphasis will be laid at the conference—to be called in the late autumn or early spring—on the practical means by which research can assist industry and promote industrial efficiency, exports, full employment and a higher standard of living. Members of the Committee include Dr. P. Dunsheath and Dr. C. C. Paterson, F.R.S.



The G.G.C. electronic timer

Chester Exhibition

Additional Features in "Electricity Looks Forward" Display

SIX electricity supply authorities (Chester Corporation, the Mersey Power Co., Ltd., the Mid-Cheshire E.S. Co., Ltd., Electricity Distribution of North Wales, Ltd., and the Oswestry and Mold Corporations) are this week sponsoring the "Electricity Looks Forward" exhibition in the Chester Town Hall.

This exhibition recently had a three weeks' premiere at Manchester where it attracted 34 000 visitors. All the main exhibits, including the series of model kitchens, were transferred to Chester and a number of additional electrical appliances were included. Some of the heavy electric baking equipment seen at Manchester was omitted, but the section devoted to farm equipment was considerably strengthened.

On view is equipment of various types collected from farms in the Chester rural area, including egg incubators, electric water heating systems, steam raisers (in actual use), pumps, drilling and workshop plant, compressors, and sterilising chests.

In canteen equipment is a cafeteria set loaned by Quaintways, Chester, one of the best equipped all-electric restaurants in the country. This set, installed in 1938, looks almost new.

New Exhibits

New equipment includes a set of three convectors of 2 and 3 kW rating, handsome in design and of attractive cream and chromium finish. They were made by Rowe Bros. and Co., Ltd., of Liverpool. This firm also show for the first time a range of three heating or drying cabinets. Rouses, of Oldham, show one of their new fish-frying ranges. Other firms which did not show at Manchester but are included in the Chester exhibition include the Imperial Machine Co., Ltd., Jacksons Boilers, Ltd., the Peerless Electrical Manufacturing Co., Ltd., Perrin Hughes and Co., Ltd., Vent-Axia, Ltd., and the Victor Manufacturing Co., Ltd.

The Deputy Mayor of Chester, Mrs. K. Clarke, who presided at the opening of the exhibition, recalled that an electrical exhibition was held at Chester as far back as 1906, when in nine days it was visited by 25 000 people. Of all the problems of the future, perhaps the major one was that of housing and there electricity would play an important part on the equipment side. The first temporary pre-fabricated houses to be provided in Chester would be electrically equipped. The exhibition had been

specially adapted to the needs of the locality and was designed to help women who had become much more electrically minded. Paying tribute to Mr. S. E. Britton, the engineer and manager, the Deputy Mayor mentioned that under his direction, the undertaking now had 23 000 consumers, sold 56 000 000 units per annum, maintained 325 miles of electric lines and had an income of £277 000. There were now 960 farms drawing electricity supplies. Last year, they consumed 4 638 000 units for which they paid £22 500. The Corporation supply area was one of the most intensively developed electrically in the whole of Great Britain. The municipal electricity showroom was visited by 100 000 people per annum. It was hoped at the conclusion of the Japanese war, when there would be victory celebrations, to have a season of floodlighting of historical buildings of the city.

The exhibition was declared open by the Lord Bishop of Chester.

Coal Wastage by Railways

Mr. Victor W. Dale, general manager of the British Electrical Development Association, said it was important that the public should have a wider conception of the application of electricity than the mere idea of a vacuum cleaner. Twenty-five years ago, when there were only 650 000 electricity consumers, it was stated they were only on the fringe of possibilities. To-day they were still only scratching the surface. The railways were wasting 10 000 000 tons of coal annually, much of which could be saved, but for the resistance to main line electrification.

After the exhibition closes at Chester tomorrow, Saturday, it will be transferred to Blackburn, then to Colwyn Bay, Bolton and Preston.

Witney (Oxon).—At the last meeting of the U.D.C., Mr. A. E. Keates, chairman of the Electricity Committee, reported that during the war the loan indebtedness had been reduced from £23 927 to £9 877 at the end of March last. Reductions in charges has saved consumers £2 453 during 1944/45. In 1939 the average price per unit was 1.7d. and in 1945 1.23d. The number of units sold in 1939 was 1 410 349, and for the year ending March 31, 1945, the undertaking sold 4 384 941 units. An alternative supply line would be working early next year.

Electricity Supply

Douglas (I.o.M.).—The Electricity Committee reports a surplus for the year of £15 851.

Barrow-in-Furness.—The Electricity Committee is to provide supply to the Tummerhill housing estate at £3 800.

Chesterfield.—The Electricity Committee is to seek power to provide supply in part of the Staveley U.D.C. area, and to several parishes.

Southport.—The Gas Committee has arranged for the electricity department to instal a.c. supply for the Whessoe detarrer at Crowlands works at a cost of £112.

Swindon.—The Electricity Committee has decided to purchase plant and equipment from the Ministry of Supply for £8 000. The plant was installed by the Ministry at the G.W.R. Works.

Burton-on-Trent.—The Electricity Committee is to provide supply to temporary bungalows at Woodville at a cost of £130; to Lount Farm, Anslow at £362; and to Lower Farm, Dunstal at £210.

Chesterfield.—In connection with the lighting of the trunk road, the Lighting Committee has arranged to make an inspection of the street lighting system in another town where remote control has been in operation for some time.

St. Pancras (London).—The Electricity Committee is to improve equipment at eight sub-stations at a cost of £43 916 and provide equipment for new sub-stations on housing estates at a cost of £13 755.

Enfield.—At a meeting of the Works Committee it was reported that the Northmet Power Co. had in connection with the restoration of street lighting, intimated that it would be necessary to increase the charges as from Jan. 1 next.

E.S.B. Charges Protest.—At a meeting of the Limerick Corporation, a resolution was received from the Tullamore U.D.C., protesting against the increase of 40 per cent. in the Electricity Supply Board charge for public lighting. Alderman Reidy said that they had contracted with the E.S.B. for the public lighting of the city at a cost of £4 000 per annum, but since then the E.S.B. had cut the public lighting by half, reduced the hours to between sunset and 1 a.m., and also in-

creased the cost. A committee was set up to go into the question of public lighting.

Rotherham.—The Electricity Committee is applying for authority to adjust the price of electricity to cover the cost of fuel to power consumers not at present subject to a coal clause.

West Hartlepool.—The T.C. is to spend over £14 000 on the distribution of electricity to the Challenger Road and Jesmond Gardens Estate, Stockton Road, Caledonian Road area, and the Park Square area.

Douglas (I.o.M.).—The work of earthing apparatus in consumers premises which was commenced in 1938 but abandoned in consequence of the war, is to be resumed. The Electrical Engineer estimates the cost at £3 300.

Bedford.—The Electricity Committee recommends an agreement for the provision of supply to Blunham, the terms being to supply 13 lamps each not exceeding 100 W per standard, the P.C. to pay 3d. per lamp per day for electricity consumed.

Middlesbrough.—In a report to the T.C., the Borough Electrical Engineer stated that since 1937 coal charges to the electricity undertaking had risen by £25 000, while electricity consumers were not paying a penny more. This one-sided



A stretch of the Uxbridge Road lit by fluorescent daylight lamps, installed by Ealing Electricity Department, and put into commission on Sunday

arrangement, said the Engineer, could not go on indefinitely.

Barrow-in-Furness.—At a meeting of the Electricity Committee the Electrical Engineer suggested the introduction of a two-part tariff for cinemas, shops and business

premises. The Committee discussed the matter but adjourned consideration until the next meeting.

Swansea.—In connection with the extension of the h.t. system to meet the potential demands of the new housing and trading estates, the Electricity Committee has agreed to ask the Housing Committee to make a contribution of £8 per house to supply 2 817 houses.

Northants.—The Joint Rural Housing Committee of the C.C. reports that in view of the possibility of electricity being available throughout the country within a short space of time, all new houses should be wired in order to provide for electric light and power points, even if not available in that particular district when the houses are erected.

Housing at Brighton.—The T.C. has confirmed the resolution of the Health and Housing Committee that in connection with the supply of either gas or electricity to the factory-made temporary houses the following be supplied:—

(1) Where gas only is available, gas; (2) where electricity only is available, electricity; and (3) where both gas and electricity are available, electricity.

Blackburn.—It was reported at a meeting of the T.C. that the Borough Electrical Engineer had prepared a scheme to provide electricity to farms and residences, at a cost of £4 322, on the Woodfold Park Estate. Application had been made for borrowing powers and authority had been given to the chairman and vice-chairman of the Electricity Committee to accept tenders for the necessary plant.

Southgate.—The General Purposes Committee has considered a report of a recent conference convened by the London and Home Counties J.E.A., of Local Authorities in No. 4 area of the authority owning purchase rights over the undertaking of the Northmet Power Co. The other authorities represented or invited to be represented at the conference were Enfield, Edmonton, Potters Bar, Tottenham and Wood Green. It is understood that the conferences have been convened by the J.E.A. at the request of the Electricity Commissioners and the Ministry of Fuel and Power in order that a post-war reconstruction scheme might be evolved and better distribution of electricity obtained.

Scarborough.—Mr. A. Wood, chairman, of the Electricity Committee, at a recent meeting of the T.C., said that but for the increased cost of coal, it might have been possible to reduce electricity charges in Scarborough during the coming year. The total income was £196 873 and working expenses £125 951, leaving a gross profit of £70 922. After paying £45 598

loan charges and £20 423 income-tax, there was a net profit of £4 901, but the income included £2 867 recovered in respect of income-tax for previous years, so the actual trading profit was £2 034.

Lincoln.—According to the Electrical Engineer's annual report for the year ended March 31 last, the sale of domestic units totalled 15.59 millions, as compared with 9.26 millions in 1940, power units sold numbered 32.99 millions (22.72 millions), the total number of units sold being 54.35 millions (36.49 millions). The maximum demand for 1945 was 14 893 kW, compared with 11 549 kW in 1940; the load factor was 43.09 (37.9), the average price per unit sold being .963 d. (.954 d.). The total number of consumers at March 31, 1945, was 17 346 after adjustments for disconnection of redundant services for A.R.P. and other services. The units generated during the year were 14 246 270, an increase of 15.4%, the balance required by the undertaking was imported from the Central Electricity Board. The total apparatus on hire at March 31 was cookers, 3 933; water heaters, 4 033; and radiators, 918.

Manchester.—The report of the Electricity Committee for the year ended March 31 shows a net surplus of £15 213. The total quantity of electricity sent out from the power stations was 954 million kWh of which 15.5 per cent. was exported to the Central Electricity Board. The total consumption of fuel was 691 411 tons and the average price 37s. 3d. per ton. The total revenue £2 698 437 showed a net increase of £213 743 or 8.60 per cent., compared with the previous year. The demand for hired motors showed an appreciable increase, the number now connected being 2 643, compared with 2 570 the year before. Many applications, particularly for cookers, had to be refused through lack of stocks.

Cheltenham.—At a meeting of the Electricity Committee the Electrical Engineer reported that since the war the capital and maintenance costs of water heaters and other electrical apparatus had considerably increased and was unlikely to fall to the level of pre-war prices for several years. It was desirable that the hire of such apparatus should be resumed, and he recommended that the purchase tax and costs exceeding 50 per cent. of pre-war prices be written off out of revenue and hire charges for new apparatus fixed at 50 per cent. above pre-war rates, the hirers entering into a 3-year agreement. He suggested that apparatus required for newly built houses, or houses converted into approved flats be dealt with on these lines and the hiring of appliances to other premises deferred until a more appropriate date. The recommendations were approved.

Industrial Information

"Research."—Under this title, the Advisory Bureau for Research, 70, Victoria Street, London, S.W.1, have issued a booklet—the first of a series—with the object of encouraging advanced study and helping individuals to that part of education just beyond the "examination stage." It is suggested that research can offer an interesting and useful occupation for leisure hours.

E.D.A. Bulletin.—Reference to post-war policy on cooker hire and hire-purchase, and the electrical exhibition, which is to be held at Dorland Hall, London, in October, is made in the current issue of the bulletin. There is also an article on the progress made in the development of an E.D.A. standard service unit. It is illustrated by photographs of the three-piece model in its latest form, mounted on a 24 in. by 18 in. board, with space for the largest prepayment meter.

Price Regulation.—Vidor Ltd. have received the approval of the Central Price Regulation Committee with respect to prices for two models of the Vidor electric breakfast cooker, viz. List No. CN. 763 1 000 W 200-220 V d.c. or a.c. and List No. CN. 764, 1 000 W 230-250 V d.c. or a.c. as follows: Manufacturer's selling price to wholesalers, £1 0s. 5d.; manufacturer's and wholesaler's selling price to retailers, £1 5s. 6d.; retailers' selling price, £1 14s. These prices are exclusive of Purchase Tax.

The Brown Boveri Review.—The January/February number deals with the progress and work of the company in 1943, generation of energy, power transmission, distribution and conversion, traction, high-frequency and communications engineering and marine installations. The March edition contains articles on the Verbois power station, Geneva outdoor circuit breakers under severe atmospheric conditions, the advantages of pumpless mutator plants in traction sub-stations, and the regenerative braking of single-phase locomotives and motor coaches.

Common Sense Costs.—McGowan, Perry and Partners, of 34, Birkdale Road, London, W.5, has published a booklet entitled Common Sense Costs, as a contribution to the re-invigoration of British trade. The booklet is one of a series and in it is outlined a method of costing, claimed to be free from the disadvantages of the older type of costs but offering prompt results, absolute control over every phase of the business in time for that control to be effective, and offering these things at a much lower clerical cost than any other type of costing system. As a

part of the service offered to British business by the firm, Messrs. McGowan, Perry and Partners, are from time to time, publishing further booklets covering other phases of commercial activity.

United Steel Products.—The full resources of the United Steel Companies Ltd. may not be generally known although they cover the requirements of practically every trade using iron, steel, coal, coke, coal derivatives, and ferrous alloys in almost any form, together with bricks and precast concrete products, etc. There has, therefore, been published, a list to provide an alphabetical reference of products with the names of the constituent companies from whom they can be obtained. Applications for copies to be addressed to the nearest sales office in Birmingham, Newcastle, Glasgow, Leeds London, Manchester and Sheffield.

Conference on Automatic Control.—The Institution of Chemical Engineers, the Institute of Physics and the Chemical Engineering Group of the Society of Chemical Industry announce that the one-day joint conference on Instruments for the Automatic Controlling and Recording of Chemical and Other Processes, which was postponed in September last, will take place in the Royal Institution, London, on October 19. Further particulars will be sent in September to those sending a request for them to the Organising Secretary, Joint Conference, c/o the Institution of Chemical Engineers, 56, Victoria Street, London, S.W.1. As there have been so many changes of address, those who have previously asked for particulars are requested to repeat their applications.

Arc Welding in Ship Construction.—Recommendations by the Admiralty Ship Welding Committee for the guidance of those engaged in the fabrication of ships, are contained in a booklet entitled "The Application of Electric Arc Welding to Ship Construction M2," published by the Stationery Office, price 1s. net. It is a reprint of an Admiralty ship welding memorandum. There are set out factors to which special consideration should be given in the welding of ships' structures, and particular emphasis is laid on the importance of establishing and maintaining a high standard of workmanship and the necessity for adequate and efficient supervision of all welding operations. A number of diagrams show correct methods of welding and those to be avoided.

Control of Mica.—The Control of Mica (No. 4) Order, 1945, which came into force on July 10, amends the Control of Mica

(No. 3) Order, 1944, so that built-up mica and mica splittings, other than book-form splittings, are exempt from control under Ministry of Supply Orders.

British Council Electrical Engineering Course.—A summer course in electrical engineering for British Council students has this week been held at the Queen Mary College. Its main objects were to introduce students to important sections of electrical engineering theory not usually dealt with in ordinary university courses, and to acquaint them with important sections of high voltage engineering practice.

Approval of Permitted Prices.—The Central Price Regulation Committee have approved the following prices exclusive of Purchase Tax for the "Rockman Baby" domestic iron manufactured by the Rockman Engineering Co., Ltd., of 16-18, Russell Street, Manchester: Manufacturers' selling price, 19s. 0d.; wholesale selling price, 23s. 9d.; retail selling price 31s. 9d.

Maintenance of Oil Circuit-Breakers.—J. G. Statter & Co. Ltd., have issued publication No. OCB2, entitled Maintenance Instructions for Oilbreak Circuit Breakers. A copy of this booklet is supplied with all the company's oilbreak circuit breakers of the types described, and it is the company's hope that users are thereby enabled to obtain the best possible service. Copies of the booklet are available to all existing users of Statter oilbreak circuit breakers on application, by quoting the serial number given on the rating plate of any existing breaker.

Mazda Lamp Ovens.—The British Thomson-Houston Co. Ltd., have published Bulletin No. 2, in their infra-red series of booklets, this latest dealing with some applications of this form of radiation. Some existing installations are described in detail and the results achieved are noted in each case. The booklet is well illustrated and includes 36 pages of instructive reading.

Ensign and E.K.C.O. Lamps.—E. K. Cole Ltd., announce that as from July 14, the prices of their single coil 100/130 V and 200/260 V lamps are as follows: Clear and pearl, 15 W, 25 W, 40 W, and 60 W, 1s. 3d., purchase tax 3½d.; 75 W clear and pearl, 1s. 7d., p.t. 4d.; 100 W clear and pearl, 1s. 9d., p.t. 4½d.; 150 W clear and pearl, 2s. 9d., p.t. 7d.; 200 W clear, 4s. 6d., p.t. 1s.; 300 W clear, 8s. The prices of coiled coil lamps will be announced later when the manufacture of the types at present prohibited by Government Order is permitted.

Electricity in New Housing Schemes.—That local Councils in Scotland are very much alive to their responsibilities for the health and general welfare of their future tenants is reflected in their outlook towards

the equipment of the houses in their new housing schemes. In the area served by the Clyde Valley Electrical Power Company, of more than 5 000 houses already passed for erection, over 3 000 will be of the "all-electric" type. These houses will be in the following districts:—Balloch, Barrhead, Baillieston, Clydebank, Coatbridge, Duntocher, Eddlewood, Eaglesham, Elderslie, Greengairs, Helensburgh, Kilbarchan, Linwood, Lochninnoch, Newton Mearns, Old Kilpatrick, Rutherglen, Shotts, Salsburgh Thornliebank, Twechar, and Waterside.

Lamp List.—Siemens Electric Lamps and Supplies Ltd., have issued list No. 976, giving particulars of the reduction in price of the company's lamps.

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.

Manchester City Council, July 20.—Manufacture, testing, delivery on site, and laying complete of 33 000 V and auxiliary power and telephone cables between Barton generating station and Benchill substation. Specification (No. 833) from Mr. R. A. S. Thwaites, Electricity Department, Town Hall, Manchester 2; deposit, £1 1s.

Lowestoft, July 26.—Supply and delivery of 1 t. 4 and 5 core p.i. l.s.s.-t.s. cable. Specifications from the Borough Electrical Engineer, Electricity Works, Norwich Road, Lowestoft.

Manchester City Council, July 30.—Manufacture testing and delivery at Stuart Street generating station of 33 000 V cable. Specification No. 832 from Mr. R. A. S. Thwaites, Electricity Department, Town Hall, Manchester, 2; deposit £1 1s.

Southampton T.C., August 1.—Supply and delivery during the period ended March 31, of (a) p.i. cables up to 11 kV, and (b) domestic electric apparatus, including cookers, kettles, thermal storage tanks, circulators and wash-boilers. Specification from Mr. W. G. Turner, Civic Centre, Southampton; deposit £1 1s. each.

Belfast Electricity Department, August 3.—Supply, delivery and erection of (a) carbon dioxide extinguishing equipments for electrical sub-stations (Spec. G. 49), and (b) replating regulating cells of storage battery (Spec. G. 51). Forms of tender from the City Electrical Engineer and General Manager, East Bridge Street, Belfast.

Company News

BRISTOL TRAMWAYS AND CARRIAGE CO., LTD.—Intm. div. 5% (same).

MIRRELES WATSON CO., LTD.—Fst. and fin. div. 8% on ord. (same).

POWER CORPORATION OF CANADA.—Intm. 20cts. per sh. on com. (same).

E. AND H. P. SMITH, LTD.—Fin. div. 7½% (same), mkg. 12½% (same).

BURMA ELECTRIC SUPPLY.—Pft. to July 31, 1944, £122, fwd. £1 627 (£1 050).

E. K. COLE, LTD.—Intm. div. on ord. 8% (same) payable Aug. 8 to holders reg. July 20.

TELLUS SUPER VACUUM CLEANER, LTD.—Net pft. 1944 £241 (£225), reducg. debit blee. to £17 007.

LIGHT PRODUCTION CO., LTD.—Fin. on ord. 15% (same) and bonus 5% (same) mkg. 30% (same).

WELLMAN SMITH OWEN ENG. CORP. LTD.—Fin. div. on ord. 7½% (5% and bonus 2½%), mkg. 12½% (same).

YORKTOWN (CAMBERLEY) GAS AND ELECTRICITY CO., LTD.—Div. on 5% stand. consd. ord. 5½%, payable Aug. 1.

ASSOCIATED BELTING COS., LTD.—Div. 2½% (same), and bonus 1% (nil), mkg. 3½%, less tax, for year to June 30.

CRYSTALATE, LTD.—A petition is to be heard in the High Court for confirmation of the capital reduction from £375 000 to £221 250.

DAVIS AND TIMMINS, LTD.—Sanction for dealings has been granted in respect of 20 000 5s. shs. which have bn. placed privately at 25s. 6d. each.

TELEPHONE MANUFACTURING CO. LTD.—Net pft. for yr. ended Dec. 31, £217 719 (£274 083). To gen. res. £14 376, and after writing off £9 376 in respect of A.R.P. expend. there remains the sum of £125 000 to the credit of res. acct. (£120 000).

ALUMINIUM and fully-owned subsidiaries.—Pft. 1944 (in Can. dollars) \$81 160 165 (\$96 826 010), deprecn. and depletn. \$6 838 285 (\$5 810 223), specl. deprecn. \$51 787 341 (\$64 555 491), inc. and excess pfts. taxes \$10 779 672 (\$14 003 494), lvg. pft. \$11 004 867 (\$11 706 885).

ELECTRICAL SWITCHGEAR AND ASSOCIATED MANUFACTURERS LTD.—Divs., etc., to Mar. 31, £35 675 (£35 584). To dirs.' fees £700, tax £15 970 (£17 744), exes. £1 126 (£1 200), lvg. net pft. £17 878 (£16 820), pref. div. £2 875 (same), ord. div. 20% £13 750 (same), fwd. £16 435 (£15 182).

A.B.C. COUPLER AND ENGINEERING CO., LTD.—Tradg. pft. and div. to Sept. 30, £33 588 (£33 436). To dirs.' fees £1 760 (£1 893), defd. repairs £3 000 (nil), tax and contings. £22 294 (£24 768), leavg. net pft. £6 534 (£6 775). Pref. div. £1 373

(£1 316), to gen. res. £4 000 (same), ord. div. £1 450 (£1 258), fwd. £1 510 (£1 799).

ENGLISH ELECTRIC CO. OF CANADA.—Operatng. pft. 1944 \$359 843 from investmts. \$5 859, less legal fees \$3 272, dirs.' fees \$880, executive officers' remun. \$41 200, loss on disposal of cap. equipmt. \$624, deprecn. \$197 263, inc. tax and E.P.T. \$48 000, net pfts. \$74 462, Div. on class "A" shs. \$1. Earned surplus \$194 222 (£162 156).

UNITED FLEXIBLE METALLIC TUBING CO., LTD.—Gross tradg. pft. and divs. 1944 £198 267 (£228 027). To exes. £48 426 (£53 481), dirs.' fees £3 423 (same), property deprecn. £1 124 (£1 162), plant deprecn. £3 750 (£3 563), lvg. net pft. £141 544 (£166 398), plus E.P.T. and inc. tax recoverable in connectn. with price adjust. 1943 £41 497 (nil). Fwd. £27 223 (£27 277).

MEXICAN LIGHT AND POWER (TORONTO).—Net inc. 1944 \$1 698 122 (\$2 945 314). To fst. mtge. bond service \$376 217 (\$901 758), pft. not distributable \$37 411 (\$32 931), interest on second. mtge. bonds and debts. \$410 012 (\$460 879), addit. fst. mtge. sinkg. fund \$967 320 (\$450 000), int. on inc. debts. \$711 036 (same), lvg. debit \$1 229 053 (credit \$454 510) increasg. debit blee. to \$6 886 522.

PALESTINE ELECTRIC CORPN., LTD.—Accts. for 1944 (in Palestine currency) show operatng., etc., pft. (after deprecn. £140 180) was £427 449 (£351 248). To dirs.' fees £3 500 (same), pref. sinkg. fund £18 066 (£17 307), cap. amortisatn. £9 754 (same), tax £247 000 (£175 000), defd. maintnce. £30 000 (£20 000), lvg. net pft. £119 129 (£125 687). Pref. div. £22 097 (£22 419), ord. and "A" ord. div. 5% £86 881 (same), fwd. £113 809 (£103 658).

ELECTRIC CONSTRUCTION CO., LTD.—Gross pft. to Mar. 31 £253 396 (£264 569). To deb. int. £4 518 (same) genl. chges. £67 846 (£64 177), war damage £2 278 (£6 188), pensions £8 705 (£8 552), fees £2 870 (£2 223), main. £11 441 (£9 791) deprecn. £20 000 (same), E.P.T. £49 250 (£59 000), lvg. net pft. £86 488 (£90 120). To pref. div. £3 500 (same), inc.-tax £42 500 (£41 000), to genl. res. £20 000 (£15 000), ord. div. 12½% £18 750 (same), fwd. £40 149 (£38 411).

ULTRA ELECTRIC (HOLDINGS).—Operatng. co's. tradg. pft. for yr. to Mar. 31, £53 050 (£64 140), to bank int. £3 598 (£3 318), depreciation. £7 507 (£8 202), pensions £1 810 (£1 343), dirs.' fees £200 (£141), cap. inc. costs £252 (nil), provn. for N.D.C. and inc. tax £19 034 (£25 148), net pft.

£20 649 (£25 988), div. to parent co. £13 500 (£12 000) net, fwd. £32 375 (£25 226). Holding co.'s net surplus £12 893 (£10 587), to fst. and fin. div. 10% less tax (same), £12 500 (£10 000), fwd. £1 408 (£1 014).

GENERAL ELECTRIC CO., LTD.—Earnings. to Mar. 31 £1 880 697, or £68 288 higher than last year. Accts. show that there has bn. deducted for deprecn. £458 588 (£460 699), dirs.' fees £3 000 (£4 335) and for pension fund contributn. £115 990 (£106 645), leavng. net pft. of £1 303 119 (£1 240 730). Dirs. have again appropriated £700 000 as prov. for inc.-tax on yr's. pfts. "A" and "B" pref. again absorb £126 000 "C" pref. takes £10 625 for three mos. to date, while ord. div. and bonus maintained at 17½% requires £367 358. Carry-fwd. is increased by £99 136 to £964 270.

RUSTON AND HORNSBY LTD.—The annual meeting was held in London on July 13. Mr. G. R. Sharpley, the chairman in the course of his speech said that in the consolidated statement the reserves amounted to practically one and a quarter million pounds. The total profit for the year of the company and its wholly owned subsidiaries amounted to £310 910. Adding thereto the following gross dividends: Ransomes Sims and Jefferies, Ltd., £22 500; Ruston-Bueyrus, Ltd., £32 000; and Aveling-Barford, Ltd., £7 150, gives a total profit of £372 560, an increase of approximately £10 000 over the previous year. The company's net profit, before income-tax, amounted to £302 904 (£292 485). From this amount is deducted £149 751 for income tax, £15 000 pension provision and £50 000 to post-war contingencies reserve, bringing this latter reserve in the aggregate, up to £300 000.

Commercial Information

Mortgages and Charges

NOTE.—The Companies Act of 1908 provides that every Mortgage or Charge shall be registered within 21 days after its creation, and that every company shall, in its annual summary, specify the total amount of debt due from it in respect of mortgages or charges. The following mortgages and charges have been registered. The total debt prior to the present creation, as shown in the annual summary, is given—marked with an *—followed by the date of the summary, but such total may have been reduced.

WILLIAM KENT (PORCELAINS) LTD., Burslem—June 20, mort., to District Bank Ltd. securing all moneys due or to become due to the bank; charged on Novelty Works, Burslem, and general charge.

Satisfaction

HOWARD PNEUMATIC ENGINEERING CO. LTD., Eastbourne.—Satisfaction June 29, £4 000; reg. Oct. 4, 1938.

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.

DAVIS, JIM, 19, Rotunda Terrace, Cheltenham, radio electrician. £22 18s. 10d. May 25.

LAMBERT, FRANK H., Walton House Lodge, Ashchurch Road, Tewkesbury, plastic engineering contractor. £214 14s. 3d. Apl. 27.

POTHECARY, GEO., 96a, Frankwell, Shrewsbury, wireless electrical mechanic. £17 6s. 1d. May 28.

B. AND B. BATTERIES LTD., 61, Caxton Road, Wimbledon. £123 15s. 3d. Apl. 27.

B. AND B. BATTERIES LTD., 61, Caxton Road, Wimbledon. £95 1s. 7d. May 11.

SIBLEY, CHAS. W., 18, Sassoon House, St. Marys Road, Peckham, radio engineer. £19 9s. 9d. Apl. 25.

WILSON, ARTHUR J., 237, Addiscombe Road, Croydon, electrical engineer. £23 7s. 2d. May 29.

Metal Prices

	Monday, July 16.		
	Price.	Inc. Dec.	
Copper—			
Best Selected (nom.) per ton	£60 10 0	—	—
Electro Wirebars	£62 0 0	—	—
H.C. Wires, basis ... per lb.	9 ³ / ₄ d.	—	—
Sheet	11 ³ / ₄ d.	—	—
Phosphor Bronze—			
Wire(Telephone)basis ..	1s. 0 ⁷ / ₈ d.	—	—
Brass (60/40)—			
Rod, basis	—	—	—
Sheet "	—	—	—
Wire "	11 ¹ / ₄ d.	—	—
Iron and Steel—			
Pig Iron (E. Coast Hematite No. 1)... per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.	£28 5 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	£31 10 0	—	—
Foreign or Colonial ..	£30 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity)	£303 10 0	—	—
Wire, basis... .. per lb.	3s. 10d.	—	—
Aluminium Ingots ... per ton	£85 0 0	—	—
Spelter... ..	£31 5 0	—	—
Mercury (spot) Ware-house per bott.	£69 15 0	—	—

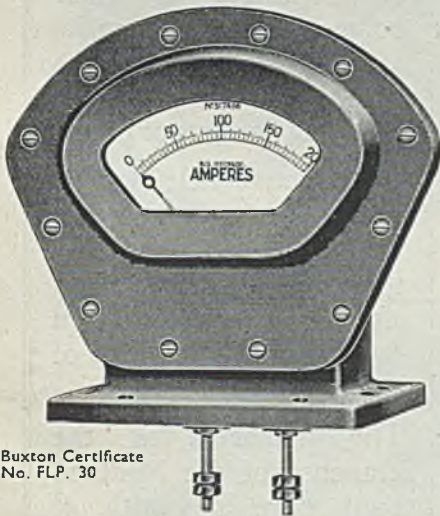
Prices of galvanised steel wire and steel tape supplied by the C.M.A. Other metal prices by B.I. Cables Ltd.

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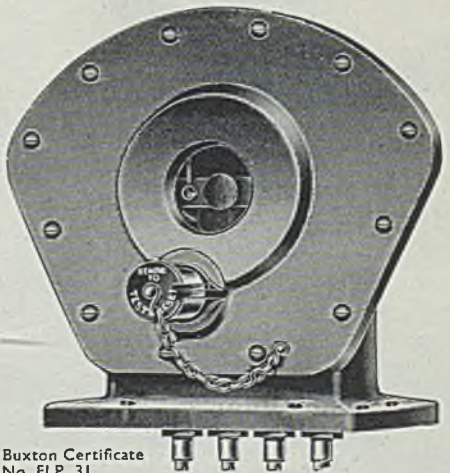
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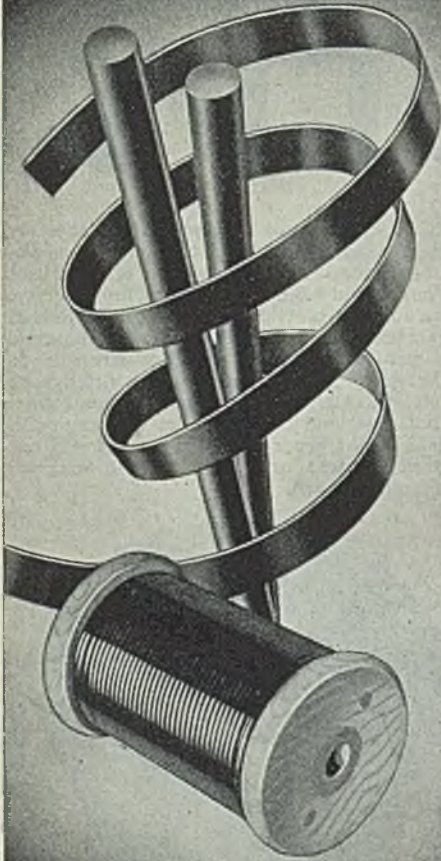
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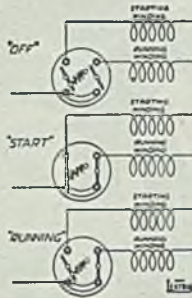
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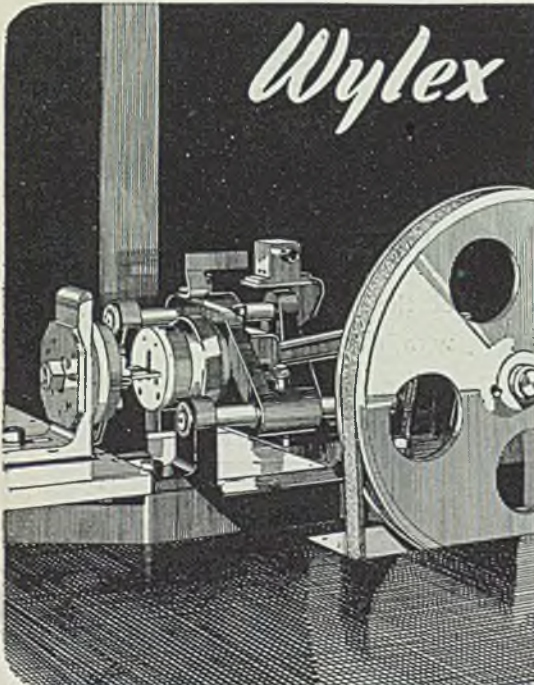
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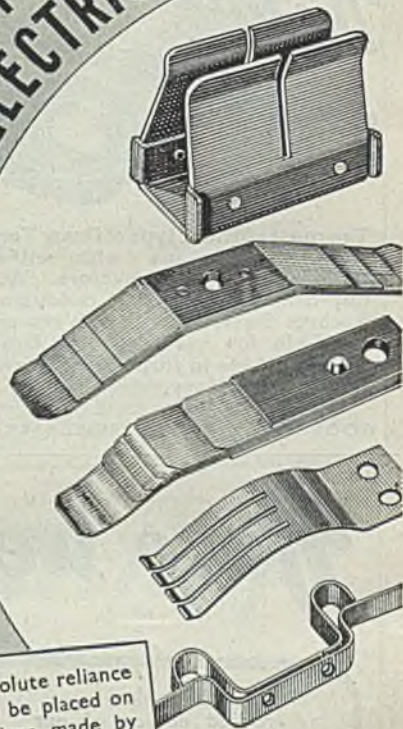
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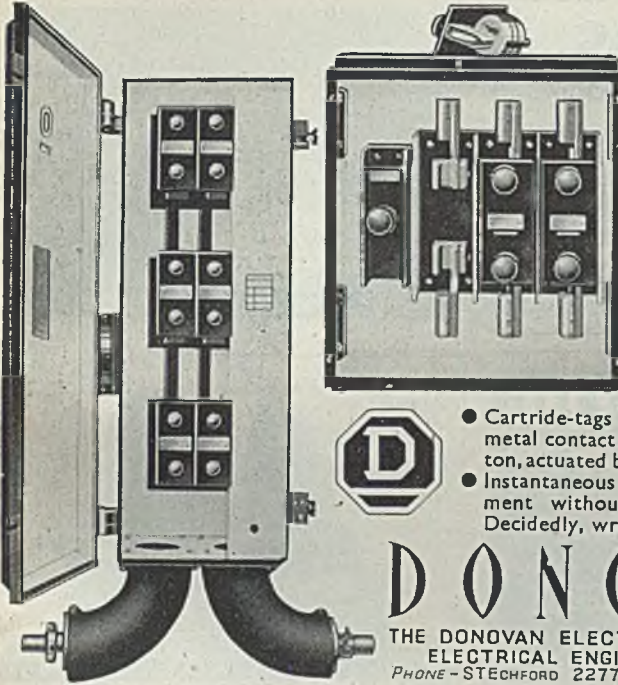


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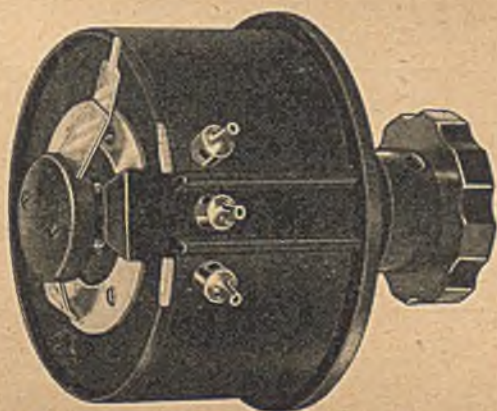
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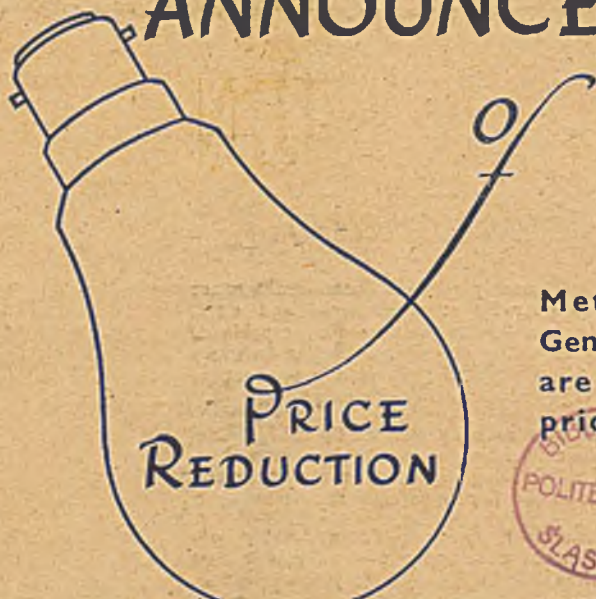


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