THE
ELECTRICIAN

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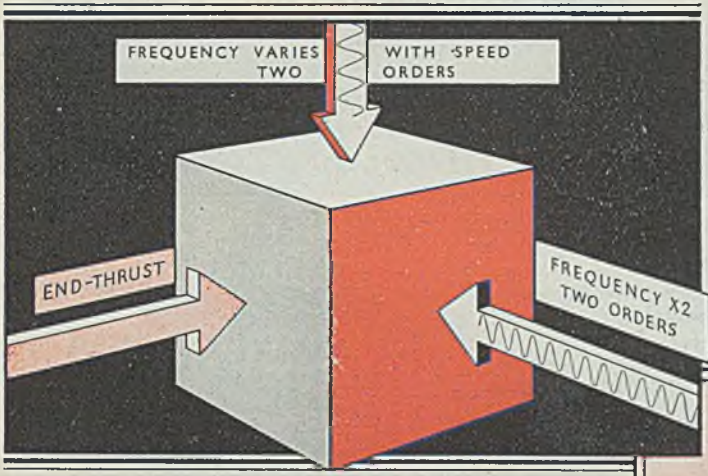

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Vibration problems are rarely simple; here is a typical one. A Diesel-engine-driven generator set, mounted in a vehicle, produced vibrations damaging to pipe work and mechanical connections, and extremely irritating to the occupants of the vehicle.

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The 'Cross'-type anti-vibration Mounting; ingenious construction gives equal areas of rubber-to-metal weld on both elements. Used for a great variety of frequencies and sizes, and for loads ranging from 1 lb. to 1 ton.

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The standard package of jointing materials for a HENLEY straight through joint contains everything the jointer wants except the box compounds.

The paper separator, paper binder, rolls of paper-cotton tape and cotton tape are all impregnated ready for use and packed in a hermetically sealed tin.

The lead sleeve is complete with two caps for the filling holes. "Grip" type jointing sleeves, solder and plumber's metal are also included.

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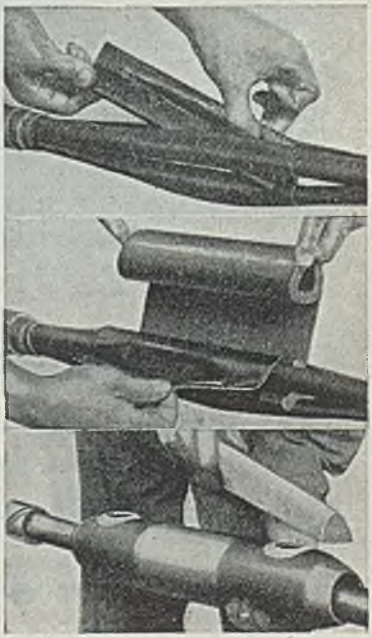
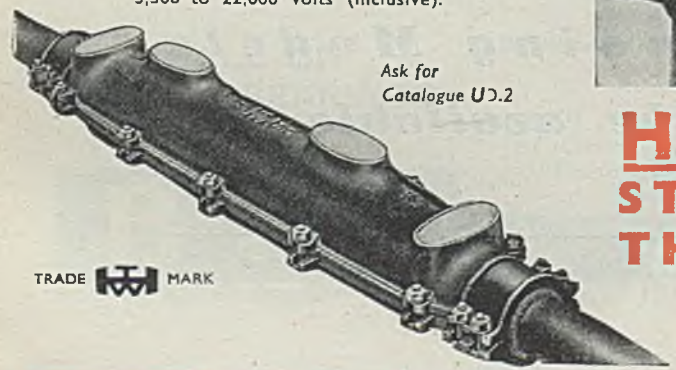
Suitable for working pressures from 3,300 to 22,000 volts (inclusive).





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In standard voltages, 100 to 130v. and 200 to 260v.

Watts.					REDUCED PRICE LIST	PURCHASE TAX
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In standard voltages, 200 to 260v.*

40	Pearl	...	...	1/6	*5d.*
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*Available as soon as possible

Details of reduced prices of other types available on application to suppliers

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ELECTRIC LAMP MANUFACTURERS' ASSOCIATION
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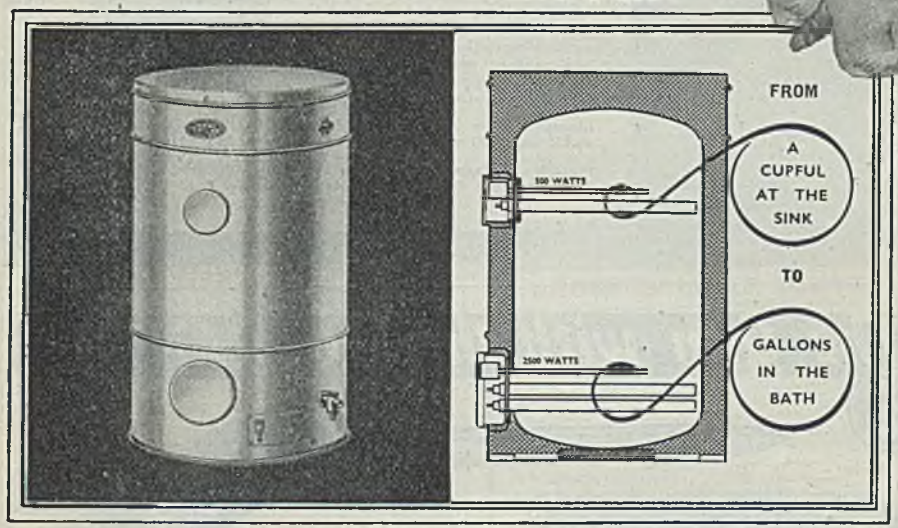
THE Charlton 'TWIN'

"We need lots of hot water"

DUAL-PURPOSE HEATER



Questions and Answers. WHAT SIZES WILL BE MANUFACTURED? Two sizes—15 and 20 gallons. WHAT IS THE LOADING? There are two heating units (a) 500 watts at the top of the heater and (b) 2,500 watts for the lower. IS IT AUTOMATIC? Yes. Both heating units are thermostatically controlled, but a kick switch at the base of the heater allows the 2,500 unit to be brought into circuit at will for baths, making 3,000 watts in all. IS HOT WATER ALWAYS AVAILABLE? Yes, for the 500 watt unit is permanently in circuit. WILL THE "TWIN" WORK WITH A SOLID FUEL SYSTEM? Yes. Connect the cold water inlet of the "TWIN" to the hot water outlet of the solid fuel system—perfectly straightforward.

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The Charlton "TWIN" was designed during the war, and will be available SOON.

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Employees pay their own Income Tax, which is markedly lower than in this country.

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Write, quoting D.1292XA, to the Ministry of Labour and National Service, Appointments Department, A.9, Room 670, York House, Kingsway, London, W.C.2, for application form, which must be returned completed by 31st July, 1945.

SALES ENGINEER required by old-established concern of electrical condenser manufacturers, to take charge of industrial sales, particularly condensers for Power Factor correction. Full details of commercial and technical qualifications and experience, age, salary required, etc., to Box L.P.N., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

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Session begins—Monday, 8th October.

In view of National Service and Ministry of Labour requirements, intending students should make application for enrolment at an early date.

J. CAMERON SMAIL,
Principal.

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

LEATHER FINGER STALLS.—Made of Chrome Hide. Very strong and hard wearing. Length 3 in. Price 4s. per doz. Prompt delivery. Sample on application.—Willson Brothers, Industrial Clothing Manufacturers, Epsom, Surrey.

THE ELECTRICIAN

Established 1861. *The Oldest Weekly Illustrated Journal of*

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Glasgow Office: 116, Hope Street, Glasgow, C.2. Telephone: Central 3970.

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

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CHIEF CONTENTS OF THIS ISSUE

Future of Supply

THE fact that the electricity supply industry was made one of the issues in the General Election campaign, suggests that the industry may continue to be looked upon as fair sport when the new Government, whatever its colour, comes into power, and the danger of an officially sponsored plan for reorganisation must not be overlooked. We have on other occasions referred to the need of the industry to present a united front on the question of post-war policy, and because we believe the matter to be urgent, we make no excuse for doing so again. Indeed, the authors of the various recommendations which have been submitted to the Ministry of Fuel and Power, in fact agree in the urgency of the problem, but unfortunately, no one organisation seems willing to accept any suggestion but its own as the correct answer. An attitude of mind admittedly difficult to overcome and one which is not likely to make the path of progress easier to travel.

It is not within the scope of this journal to take sides in the matter, but it is, we feel, in the interest of the industry that we remind all concerned that the only satisfactory approach to the problem of reorganisation is that which takes into account the needs of the consumer, what is best for the consumer, and what will satisfy the consumer. All other considerations are of secondary importance, in that without the consumer there would be no supply industry.

It must not be overlooked that the industry is now responsible to a permanent Ministry and in presenting its views on the subject of future policy, electricity supply has gone dangerously near to telling that Ministry that the industry is divided against itself, inviting thereby the sponsoring of some official policy, possibly unacceptable to all sections of the industry but against which there may be no appeal. On the other side of the fence stands the gas industry united and with one plan, conceived and accepted by all interests.

Rumours of the differences of opinion in the supply industry compared with gas, may possibly have been responsible for the disparaging remarks which were broadcast in the General Election addresses, and unless something is done to keep the arguments within our own domestic circle, those who will make up the new Government may be encouraged to continue besmudging the industry with a view to making it a political football for all to kick around. In efficiency and public service the industry is second to none; in technical ability and generating achievement it leads the world; in the last six years it has accomplished feats no other industry in this country

or elsewhere, has been called upon to perform. To risk such a reputation for the sake of what is no more than a domestic issue, seems hardly worth while. Admitting that there is in the industry as in every other, much which might be improved, we submit that it is the business of the industry to bring about such improvement by its own effort; to reorganise, if that be necessary, by the united action of all sections. The industry is too full of individualists to expect total agreement, but with goodwill and a desire to give the consumer the best that electricity has to offer, there is no reason why a scheme supported by the industry as a whole should not be agreed upon. To admit otherwise is to invite legislation conceived by those who have little knowledge of the industry; no experience of its difficulties; and no understanding of its technical possibilities.

Eclipse of the Sun

IN the world of physics, Monday was something of a red letter day, for elaborate arrangements were made for making observations of the effect of the total eclipse of the sun on radio, and the behaviour of the ionosphere. All British radio services, military, as well as civil, joined in so far as operational conditions permitted, while the N.P.L. sent special apparatus to the North of Scotland. Monday was not, however, the only day on which observations were made for the radio organisations throughout the country have been operating to this end for seven days, of which eclipse day was the centre. It is, as yet, too early to give a full account of the results of these various observations, but, as was expected, there was a marked effect on both radio transmission and reception as observed at the Radio Research Station at Slough, on frequencies covering the short and medium wavelength bands. From the data so far obtained, those who conducted the experiments believe that a good deal of success attended the observations, though how soon the information may be made public is dependent upon national security.

A Report on Results?

THE reason for this not too obvious caution is to be found in the fact that a good deal of the apparatus used in the experiments is related to that employed in our radio-location systems, details of which are still withheld from publication, even to the extent of those given in the Kelvin Lecture last April. It is known, however, that the N.P.L. equipment sent to Scotland included a transmitter, and the electrical condition of the upper atmosphere was studied by observing the echoes of its radiations by the reflecting layers; in other words, the behaviour of the layers was observed by radio in much the same way as was done before the war with apparatus from which the present radio-location systems were developed. We understand from Mr. W.R. PIGGOTT, of the Radio Research Station, that there is a possibility of the results of the experiments being published at some later date as a D.S.I.R. Report, and until then we must, presumably, be patient.

Lamp Price Reductions

THE announcements this week of filament lamp price reductions over a wide range, will be read by the trade with special interest, for with the reversion to British Summer Time the public will soon feel the need for more light. The long evenings of the past few weeks have done little to assist the cause of better domestic lighting, but with the loss of an extra hour of daylight, the domestic world will be moved to renew old lamps in some cases and to substitute lamps of higher wattages in others, with a consequent increase in sales for the lamp stockist. The brighter days, the removal of the "black-out" and the freedom from aerial dangers, all tend to create a desire for more and more light, and with the price reductions now announced the desire may be satisfied at an even smaller expenditure than before. The announcements are also encouraging in other ways, for the increased sales which will result are indicative of the fact that the lamp makers are switching-over at least a little more of their manufacturing capacity to meeting the needs of peace-time trade. Surely a healthy sign.

Resumption of Street Lighting

THE reversion to B.S.T. will also bring into operation full street lighting in those areas where fittings have been overhauled, and where cables have not been too badly damaged during aerial attacks. With what success lighting authorities will be able to satisfy the public will depend upon what labour and materials

will have been made available to them, while another qualification is the need for fuel economy. The Ministry of Fuel and Power has already issued a warning in this respect and so far as the electricity supply industry is concerned full street lighting will represent a substantial load, at a time when the much needed overhaul of generating plant is in progress. That there will be a reasonable amount of public lighting is not in doubt, but whether it will be possible with the dwindling coal supplies to continue it indefinitely, is well worth the consideration of the Ministry of Fuel. Any shortcomings in lighting due to this cause will be the sole responsibility of the Ministry and the public should be reminded of it; otherwise the blame will be laid at the feet of the electricity supply industry.

The Watford Agricultural Show

THOUGH, perhaps, not of major importance to all the problems attaching to rural electrification throughout the country as a whole, the electrical exhibits at the Watford Agricultural Show which opens to-morrow, Saturday, go a long way towards demonstrating how electricity may be used in country areas. From the information received, it is obvious that the Northmet Company and Watford Corporation have between them made all the arrangements for a very instructive exhibit, supported by a representative body of manufacturers, and their efforts deserve success. Comprehensive exhibitions for the benefit of those who live in rural areas are all too few in these days of scarcity of equipment, but since the supply industry is faced with the problem of finding a solution to the difficulties of extending its services to the rural areas, the good relationship which it is possible to establish between electricity and agriculture at exhibitions devoted exclusively to rural dwellers, should be fostered at every opportunity. The supply industry has great hopes of increasing its service in the agricultural areas in the near future and the Watford Show is, we anticipate, the first of many post-war exhibitions to be opened in areas of similar type.

A Power Station Problem

AS urgent as is the labour position with respect to development, it is no less so in the sphere of generation, for as long ago as last September, one London borough had, it is reported, reason to seriously consider the position at the local station. Since that date correspondence has been exchanged between the Ministry of Labour, the Electricity Commissioners and the Central Board and as a result of pressure brought to bear, there was for a time an improvement in the number of men submitted; the position has, however, again deteriorated to such an extent that No. 1 boiler unit has had to be shut down for the past 10 weeks, and the full demands of the Central Board have not in consequence been met. Sickness has been abnormal during the past winter, and it is undesirable to resort to heavy overtime as most of the men have worked throughout the war and are suffering from mental as well as physical strain.

Officialdom's Unassisting Attitude

IT is, says the Borough, imperative that these men should have annual holidays, but no assurance can be given in this respect unless additional labour is forthcoming. The Ministry of Labour resorted to direction in a number of cases, but the men are constantly seeking their release on medical or personal grounds, and the position is having a serious reaction on the shift, charge and boiler house engineers. During the past four months, out of many interviews only eight men were found suitable for employment at the station, while in the same period fourteen were released by the national service officer. A number of applications for release are pending. On the maintenance side, routine summer overhaul has commenced but it is already behind schedule due to labour difficulties, and twenty-six additional men are required if the anticipated requirements of the Central Electricity Board are to be satisfied.

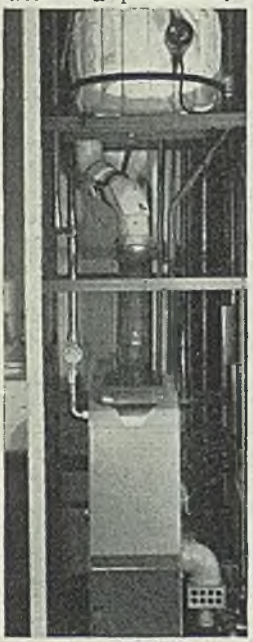
The Hams Hall "B" Station

FROM the brief details given elsewhere of the Hams Hall "B" power station of Birmingham Corporation, it will be appreciated that the station is one of more than usual interest. It is claimed by Mr. F. W. LAWTON, chief engineer and manager, that the station contains the most efficient plant in Central England and some particulars of its operation with statistics will be given at greater length in our next issue.

House Temperature Control

Complete Automatic System for Small Dwellings

IN our last issue reference was made to the system of automatic temperature control which is to be installed in four of the twenty-two "Howard" type of prefabricated permanent houses now in the course of erection at Woolwich for the Ministry of Works. Last Monday, by the courtesy of the Rheostatic Co., Ltd., a representative of THE ELECTRICIAN was able to see in a "Howard" house at Datchet, a prototype installation representing something of the experimental work that company has undertaken recently in the development of automatic control of small house heating. The installation provides continuous warmth throughout the house at 60°F. during the day and at 50°F. at night.



The hopper boiler, showing on the right the automatic damper. The thermostat is just behind this. The valve controlling the flow of water is on the pipe at the side

The boiler, fuelled on the hopper principle, and designed by Mr. L. Satchwell, managing director and chairman of the company, circulates hot water to radiators varying in size according to the area of each room. The temperature of the boiler water is held constant and the consumption of fuel is regulated by a thermostat, which opens or closes the air damper, while the flow of hot water to the radiators is regulated through a valve opened and closed electrically by a room thermostat. The latter can be set to any desired temperature within the range of 50°F. and 70°F. The boiler, which is situated in the kitchen, is also fitted with a thermometer and temperature adjuster knob. It burns anthracite or coke by natural draught and has a thermal efficiency between 65 and 75 per cent., dependent upon its size. The fire having been lit, in the usual way, is capable of being left to itself, without attention, other than the filling of the hopper once a day and the removal of clinker every 24 or 48 hours, according to the weather and the demand for hot water.

The background heating at 60°F. is arranged to give bare comfort conditions only, thus avoiding stuffiness and also discomfort to the housewife while engaged on active domestic duties. When greater warmth is required in the form of radiant heat, this is provided by an electric fire.

The domestic hot water supply is taken from an indirect cylinder heated from the same boiler. This is fitted with an immersion heater and thermostat integral with it, so that in the summer months, when it is desirable to keep the kitchen cool, the boiler can be switched off and allowed to cool, the heating of the water in the cylinder being taken over by electricity.

A Hot Air System

In another prototype house, at Frimley, the company have a different system of space heating in which hot air is employed, and radiators in the rooms are not required. The boiler and temperature controls are the same, and the air is heated as it is drawn up between a pair of heat exchangers, or radiators, in a duct in the centre wall to the space between the ceilings of the lower rooms and the bedroom floors; here it fans out to the right and left, returning by a duct in each of the outer walls to the space under the ground floor. Thus there is a closed circuit through which flows a continuous stream of hot air, warmth being radiated from the ceilings of the lower rooms and the bedroom floors, as well as from the ground floor. The domestic hot water supply is provided in the same manner as in the house at Datchet.

Mr. T. N. Flight, the assistant managing director, told our representative that in the year before the war, the company were exporting thousands of thermostats for the control of house temperature in many parts of Europe. There was, he said, no reason why British families, too, should not have warm houses in the winter, and save fuel.

When the business started in 1921, four people were engaged in making the resistances which gave the company its name. In 1927 the firm commenced to make thermostats and were among the first in that field in this country. To-day their production rate in thermostats alone is 30 000 instruments a month, and this will increase shortly.

Locating Ignition Faults

Novel Instrument Developed by English Electric Co., Ltd.

IN THE ELECTRICIAN of June 1, brief details were given of an ignition tester which was exhibited to the public for the first time at an exhibition arranged by D. Napier and Son Ltd., and as this instrument is manufactured by the English Electric Co., Ltd., we have now received from that company further information as to its purpose and operation.

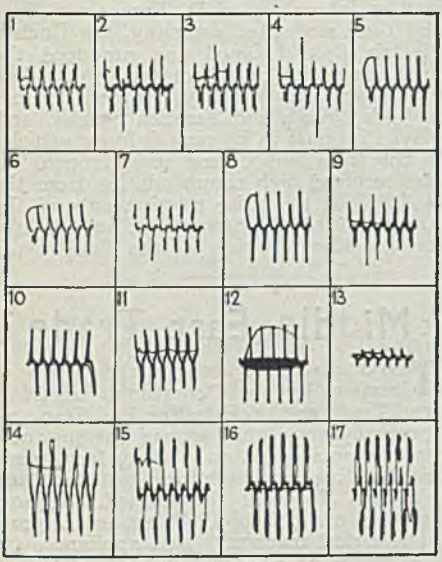


Fig. 1

1. Normal picture; no ignition defects. 2. Plugs 4 and 11 misfiring. Attenuator control at zero. 3. Plug 2: Short-circuited. Plugs 5 and 8: Wide gaps. Plug 10: Narrow gap. Attenuator control at zero. 4. As (3) attenuator control in position 2. Plugs 5 and 8 now misfiring. 5. As (3) attenuator control in position 5. All normal plugs misfiring; 2 and 10 are either firing or short-circuited. 6. As (3) attenuator control in position 6. All plugs except 2 are misfiring; 2 is short-circuited. 7. Plugs 4 and 9 carboned or oiled up. Attenuator control at zero. 8. As (7) attenuator control in position 6. All plugs misfiring. Smaller figures for 4 and 9 indicate leaky plugs. 9. Open-circuited condenser. 10. Partly short-circuited condenser. 11. Contact breaker points stuck open. 12. Open-circuited magneto secondary winding. (The picture height is reduced from normal.) 13. Short-circuited magneto secondary winding. 14. Contact breaker gap normal. 15. Contact breaker gap too large. 16. Contact breaker gap too small. 17. Weak rocker spring.

Note.—For numbers 13-17 the "Picture Height" control is turned to maximum.

The tester displays the ignition performance of the engine pictorially on a screen while the engine is running. No access to the engine is needed if a socket is provided for the connection, and the ignition is not affected by the instrument. The picture consists of a row of peaked figures, one for each sparking plug, arranged in the firing order of the engine, starting from a selected cylinder. Perfect ignition gives a steady row of identical figures, but any fault anywhere in the ignition system alters the shape of the figures in a characteristic manner. A faulty plug affects the corresponding figure, and can be identified from its position in the row, while a defect in the magneto or the distributor alters the shape of the whole row of figures. Intermittent defects cause the figures affected to flicker in step with the defect.

No experience is necessary in order to locate a faulty plug, and the diagnosis of the nature of the defect is greatly aided by the fact that the shape of the figure is suggestive of the defect itself. Referring to the illustrations, Fig 1, which are photographs taken from the instrument in operation, it may be seen that, for example, an excessive spark gap gives a high figure and a short-circuited gap gives a low figure. An occasional miss, which is a common trouble, gives a corresponding flickering up of the figure, which is instantly obvious. Among more complicated faults, a weak rocker spring, which causes the contacts to bounce above a certain speed, makes the row of figures dance as the engine is speeded up, in a way suggestive of the cause of the trouble.

The valuable feature of the instrument, the fact that direct access to the engine is not necessary, is explained below.

The electrical pulses which trace the figures on the cathode-ray tube are obtained from the primary side of the magneto or coil, instead of from the secondary side which supplies the sparks. The primary and secondary windings of any magneto or coil constitute a transformer whose primary is open-circuited when the primary contact breaker opens to form the spark on the secondary. Under this condition any alteration in the secondary load, i.e., the sparking plug, alters the wave-form of the primary voltage peak. By observing this wave-form on a cathode-ray oscillograph, the nature of the secondary load, i.e., the condition of the sparking plug, can be inferred. The primary voltage wave-form is available at the magneto switch, or, in the case of battery ignition, at the l.t. terminal of the coil. The instrument can either be connected to these points, or, since the connection does not

affect the ignition, a permanent socket can be installed at a convenient point.

The fixing of the row of figures in firing order, starting from a selected cylinder, is attained by triggering the cathode-ray with a tiny fraction of the voltage tapped from one of the plugs. The ray then traverses the screen, tracing out the row of figures once for every two revolutions of the engine, always starting from the trigger plug, the remainder following automatically in the firing order of the cylinders. No connection or access to the rest of the plugs is necessary. The trigger connection does not affect the spark at the plug, consequently it can be made permanently to the l.t. socket. Alternatively it can be made by hooking a connector on to the plug selected, if no socket is provided.

English Electric ignition tester

The instrument also enables an estimate of the quality of the magneto and plugs to be made, and possible breakdown forestalled, irrespective of whether the ignition is performing correctly or not. For this purpose the instrument has an attenuator dial which consists of a stepped resistance which shunts the primary current in increasing amounts as the dial is operated.

A photograph of a fully tropicalised instrument is reproduced. It is of about the same dimensions as a portable typewriter, and is arranged to take its power supply either from 220 V a.c. mains, or from a 6, 12 or 24 V accumulator, as desired. It can be used on the vehicle or aircraft while in motion, if necessary. It can be easily adapted as a switchboard instrument for the routine supervision of a group of engines, as in a multi-engined aircraft or boat, or in an engine test house.

The instrument owes its inception to an approach to the ignition department of D. Napier and Son, makers of the Sabre engine, from the Department of Tank Design, during the European war, for something which would locate faulty plugs on tank engines without the long delay attending the removal of each plug from its usually inaccessible position. The old garage method of applying a screw driver, or a neon pencil to the plug was useless because the ignition was completely screened, and all efforts to produce an alternative method of test had failed.

The experimental model was built in the ignition laboratory of D. Napier and Son, and their associated company, the English Electric Co., designed and produced the final production model for the Army. The model was subsequently adapted for use in both British and American tanks, and played its part in keeping fighting vehicles in the front line during the advance. It also received high commendation from the R.A.F. but the prior requirements of the Army limited the number of instruments for the other Services at the time.

Middle East Trade

TWO recent reports in the series of reviews by the Department of Overseas Trade are on Palestine and Iraq, respectively show that among the products now manufactured on a fairly large scale in Palestine are electric batteries and plastics. In 1939 the United Kingdom supplied one half of all Palestine's imports of electrical machinery and appliances (to the value of £173 000 out of £347 000) and there should be increased openings for these goods in the near future. The total value of electrical machinery, apparatus and parts imported into Iraq in 1938 was £242 000, of which the United Kingdom supplied goods to the value of £44 000, the U.S.A. £131 000, Germany £32 000, Holland £14 000, and Japan £4 000. A number of schemes for improving the electricity supply in various parts of the country are under urgent consideration by the Ministry of the Interior. Several existing power plants are already overloaded, and important extensions are contemplated by the Mosul Water and Electricity Board, and the Bagdad Light and Power Company. Development of electricity and water services will certainly figure largely in a post-war public works programme, predicts the report. Modern amenities make a strong and growing appeal to the more wealthy Iraqis, who will strive to obtain radio sets, motor cars, refrigerators and air-conditioning units. Private consumers will also require electrical fittings and wire for household installations.

Watford Agricultural Show

Electrical Features to be Seen at Cassiobury Park

THE Watford and District Agricultural Socity is staging a show at Cassiobury Park, tomorrow, July 14, and in conjunction with Watford electricity department, the Northmet Power Company is exhibiting a comprehensive display of electrical equipment for the farm and home.

There will, for instance, be dairy exhibits made up of milk coolers, cold rooms, milking machines, sterilisers, churn stools, bottle-washers, electric milk prams, storage water heaters and immersion heaters for sterilisers. For reasons of space representative examples of the complete range of equipment will be shown, and those taking part will include the Pressed Steel Co., Ltd., Gascoignes (Reading), Ltd., the General Electric Co., Ltd., J. W. Woolley & Co., Ltd., Messrs. John Steel, T. H. Lewis Ltd., and the Hotpoint Electric Appliance Co., Ltd.

In the farm machinery section will be shown an Adelphi mixer by W. L. Holland, Ltd.; a root cutter and grinding and crushing mill by E. H. Bentall & Co., Ltd.; an Essex mill by Christy and Norris, Ltd.; a sheep shearer by the Wolseley Sheep Shearing Machine Co., Ltd.; a model of grain drying and storage plant by Geo. W. King, Ltd.

Poultry Exhibits

Poultry equipment will include an incubator by Lawrence G. Western (Incubators), Ltd.; a Visi-Sunray brooder by the Visi-Chick Brooder Co., Ltd.; an egg grader by W.E.P., Ltd.,; egg testers by the General Electric Co., Ltd. and W.E.P., Ltd.; poultry house lighting fittings by Benjamin Electric, Ltd.; and a poultry plucker by Bingham Appliances, Ltd.

In a section devoted to pumping, James Beresford & Son, Ltd. will show a Beresford Stork unit and submersible borehole pump; while Messrs. John Steel will show a self-priming pump.

Horticultural interests will be covered by portable spraying plant and a nursery circulating pump by Fredk. A. Pullen & Co.; soil heating cable, a plant irradiator and greenhouse heating by the General Electric Co., Ltd.; a tomato grader and cultivator by Geo. Monro, Ltd.; and a forced draught fan for horticultural boilers by Keith Blackman, Ltd.

Among general farm equipment will be seen a bench grinder and portable electric drills by S. Wolf & Co., Ltd.; welding plant by Meritus (Barnet), Ltd., and Johnson & Phillips, Ltd.; and a battery charger by Meritus (Barnet), Ltd.

Features exhibited for home interest will include cookers, by the Carron Company, the General Electric Co., Ltd., the Jackson Electric Stove Co., Ltd., and the Revo Electric Co., Ltd.; water heaters by Aidas Electric, Ltd.; washboilers and a washing machine by the Universal Boilers & Engineering Co., Ltd. who will also show a kitchen unit; refrigerators by the Pressed Steel Co., Ltd.; vacuum cleaners by Hoover, Ltd.; and kettles by Bulpitt, Ltd.

Demonstrations of the equipment will be given throughout the period of the show.

Engineering Society

The annual general meeting of the 1939-1940 session of the English Electric (Stafford Works) Engineering Society (delayed through the European war) was held recently, Mr. A. D. Sloan, chief engineer occupying the chair, supported by Mr. J. Rogers, general manager of works.

The Chairman conveyed to the meeting a message that had been received from Sir George Nelson, chairman and managing director of the company which expressed pleasure at the society's activities starting up again after a lapse of five years.

The hon. secretary, Mr. H. Stanier, reported that although 1 001 members had handed in their names for membership a number had since joined the Forces and that the actual paid-up membership had reached the figure of 920.

Mr. K. Love, treasurer, presented the balance sheet which was approved and Mr. F. L. Smith, the society's librarian, gave his report which dealt with the use of the library during the war period. A résumé of the ensuing sessions programme shows that the past high standards achieved will be maintained.

The officials appointed for the 1945-1946 session are: President, Sir G. H. Nelson; Vice-Presidents: Messrs. E. B. Banks, J. K. Brown, J. E. Calverley, H. S. Carnegie, F. Caunce, J. W. C. Milligan, J. Rogers, A. D. Sloan. Committee: Messrs. S. Drage, A. Elliott, S. C. Fudge, J. Howorth, W. P. Leech, A. R. Mowl, F. L. Smith. Hon. treasurer, Mr. K. Love; Hon. secretary, Mr. H. Stanier.

Bolton.—The Electricity Committee has obtained sanction to borrow £600 000 on account of the application for £655 373 for extensions at the power station.

Logical Explanation of the Calculus

By C. TURNBULL, M.I.E.E.

ENGINEERS were told by Perry and S. P. Thompson to use the calculus as you would use a watch, without bothering to understand how it works ; engineers, however, prefer to see how the wheels go round, and below is a logical explanation of how the calculus works ; it also bears some relation to Newton's method of combining geometry with analysis. Consider the curve $y=x^2$, origin at O and move the origin to P, with co-ors X, Y, when the $=ve$ becomes $y=2Xx+x^2$; $y=2Xx$ is the tangent at P as it is a straight line through P and the curve is separated from it at other points by the distance x^2. We have thus found the $=ve$ to the tangent without using infinitesimals, and the same procedure applies to $y=xn$.

We may write $y/x=2X$ which becomes $dy/dx=2X$ when x, y are very small. Also, using the convention that a very short portion of the curve coincides with the tangent at the point of contact, we may say that dy/dx is the slope of the curve itself. This gets rid of the explanation of Weierstrass that dy/dx approaches $2X$ to any standard of approximation, which, after all, leaves us in the dilemma that $dy/dx=2X$ exactly, only when dy/dx are both zero.

We may deal with dy/dx more clearly by using Newton's microscope and magnifying it, say a million times from a text-book diagram, when a short portion of the curve becomes indistinguishable from a straight line and, humanly speaking, it coincides exactly with the tangent and has the same slope. Mathematically this is the same as diminishing the x and y to infinitesimals, but it gets rid of the mystery. Differentiation, in fact, substitutes the tangent for the curve at the point of contact and this reduces calculations to those dealing with straight lines ; it is this that gives the method its power and operates by moving the origin along the curve.

It may be developed. With $y=x^2$, $OA=X$ and $AP=Y=X^2$, with respect to the origin at O ; *w.r.t.* origin at P, the $=ve$ to the tangent PT is $y=2Xx$, whence $AP=2Xx$ and as this also $=X^2$, we have $2Xx=X^2$, so that $x=\frac{1}{2}X$, or $AT=\frac{1}{2}AO$. To graph the tangent make $AT=\frac{1}{2}AO$ and join TP. If $y=x^n$, $AT=AO/n$. In differentiating, we keep in touch with the primitive origin at O and this enables us to recover the primitive equation by integration. Obvious, but clarifying to the student.

Without abandoning dy and dx, this means of approach shows us how they work and it eliminates a great deal of the literature which has grown up since Bishop Berkeley called them the "ghosts of departed quantities." We do not abandon dx^2 because it is small but we select dx because it refers to the tangent. We ignore dx^2, etc., because they do not refer to the tangent.

Convergency in certain infinite series may also be explained without the esoteric discussion sometimes given. Consider the series $\frac{1}{2}+\frac{1}{4}+\ +\ +$, why do they not add up to 1 ? The reason is simple ; add $\frac{1}{2}$ to $\frac{1}{2}$

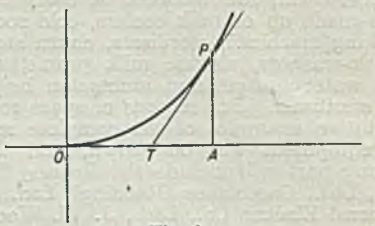


Fig. 1.

and we get 1, but we only add $\frac{1}{4}$. Add $\frac{1}{4}$ and we get 1, but we only add $\frac{1}{8}$, and so forth. Each time we have a chance to arrive at the goal we reduce the added fraction to half the required amount and hence we never reach finality. This method may be developed for other series. Similarly, the problem of instantaneous speed may be deprived of its mystery. If we are travelling in a car and wish to know the speed at any point, we may keep the speed constant, say, for a mile, and if this takes one minute we say that the speed is 60 m.p.h. Having got this result we may say that the speed at any instant during the test is 60 m.p.h. We may use a very short distance if we have the necessary apparatus, but the object of such short distance is to ensure that the speed does not alter during the experiment. If we make a graph of time and distance, with varying speed this will be curved, but from the instant that the test begins the graph will become tangent to the curve. Such an illustration saves a great deal of discussion. One authority says, "all attempts to formulate a good definition of instantaneous speed without involving the limit concept have failed to be satisfactory," but, I suggest, the above explanation makes the matter clear. Zeno's paradox also ceases to require the esoteric explanations given by eminent experts.

A further example may be useful ; when a player drives a golf ball it leaves the club at a speed $=ds/dt$. The player may not know what this is but he knows that from the effort in his drive he can estimate the flight of the ball through a considerable distance. This is analogous to finding the integral when the derivative is given. Mathematicians may ask if it is really necessary to make the subject as clear as that ? It is, a

man should be able to use the calculus as he uses a machine tool, certainly needing skill but also understanding what he is doing.

I hope the day will come when apprentices in the workshop will think in terms of the calculus for it will help to clear their minds. The foggy profundity of many descriptions of how the calculus works must be done away with. I think it is credited to Lagrange that one has not said the last word about a theory until one can express it in a few words to the man in the street, while Heaviside declared that the best result of mathematics is to be able to do without it.

There are two branches of mathematics, one which enables experts to solve problems by skilled use of mathematical functions, and the other, ultimately not less important, the feeling in terms of mathematical methods which enables one to think of a problem clearly. Many of the difficulties of the calculus disappear when mathematical methods are set out with pictorial clarity, and Kelvin and Clerk Maxwell made full use of models for this purpose; one may add, too, Dr. Drysdales' "Foundations of Alternate Current Theory," which would be of immense help to engineers if it was used as it deserves to be.

Though pure mathematicians often despise engineers' mathematics, the latter are, after all, entitled to their own views on the subject. Some pure mathematicians delight in geometry which not only has no figures but does not permit the student to imagine them; while engineers admire the skill which has perfected this, it is not for them. Engineers are expected to produce machines which the world needs and they should be allowed to work in their own way; neither should they be debarred from getting their degrees at universities because they use the mathematics which serves their purposes best.

My own experience is that many mathematicians say that while these methods may serve for students who do not sufficiently appreciate text-book meanings, they are only crutches and the aim of the teacher should be to make the student understand the correct methods. The explanations of the text-books, however, are not in my view satisfactory and it is necessary that they should be replaced by others more logical and mathematical.

It is time that mathematical teachers and professors investigated methods for a progressive system of teaching for the text-books have become static. It is time that we used the art of a Disney to show how the graphs of $y=ax^3+bx^2+cx+d$ and such functions develop when various coefficients change. Science has provided the cinema and it is time that science got a proper share of its powers.

Failure of Reactors

By T. H. CARR, A.M.I.C.E., M.I.Mech.E., A.M.I.E.E.

DURING the European war, barrage balloons were responsible for the interruption of electricity supplies on a number of occasions, and in the case under review a fugitive barrage balloon was responsible for causing faults on a 33 kV overhead line system, which formed the interconnection between the two power stations, A and B, in Fig. 1.

The overhead line circuits were automatically tripped at both ends by the functioning of a parallel feeder, and overcurrent and earth leakage protective relays in one or more phases.

The No. 1 earthing reactor Buckholz relay operated causing the alarm circuit to be closed; the relay was then reset but it operated again. On making an investigation at the transforming station it was found that a large quantity of oil had been displaced from the earthing reactor tank. No. 1 main transformer was isolated on both sides and the voltage transformers withdrawn. The faulty earthing reactor was then disconnected from the main transformer and the leads of the restricted earth leakage current transformer in the reactor neutral shorted, and the Buchholz relay circuit disconnected.

Examination of the reactor revealed that (1) the three-phase side of the tank had bulged about 1 inch between the stiffening angles; (2) the explosion vent (relief pipe) glass had broken; (3) some 30-40 gall. of oil (230 gall. normal) had been displaced from the tank; (4) an i.r. test with a 500 V "Megger" showed no leakage to earth; and (5) the oil was very much discoloured and carbonised, and a pronounced smell of burnt insulation was present.

The No. 1 earthing resistor showed signs of a flash-over having taken place over the surface of the liquid to the conductor via the insulating sleeve, and both the latter and the tank insulator were damaged beyond repair; the liquid level was correct.

The trouble originated, apparently, owing to a balloon cable fouling the red phase and earth wire line conductors. That the duration of the fault(s) was short is confirmed by the fact that the overhead conductors affected were still intact.

The flashing-over of the earthing resistor would subject the earthing reactor to a

heavy instantaneous fault current, even allowing for the immediate clearing of the fault by the feeder protective gear. The reactance of the reactor is practically negligible in so far as it affects the magnitude of the fault current, and to all intents and purposes the magnitude of the earth fault

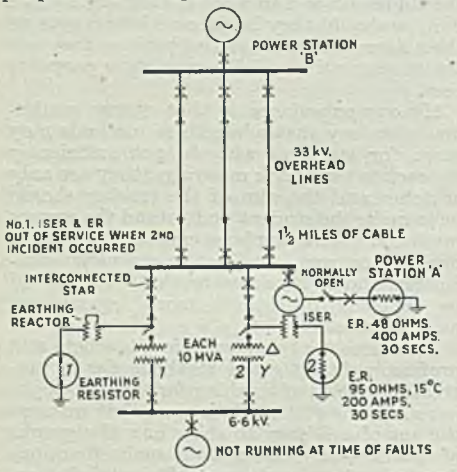


Fig. 1.

current is limited by the ohmic value of the resistor. Another factor to be kept in mind is that the single-phase short-circuit fault current flowing in the windings connected to delta connected systems are not necessarily equal in all phases when a line to earth fault occurs and when the neutral is earthed through a resistor.

As far as could be ascertained it appeared that during the system fault conditions a heavy fault occurred in No. 1 earthing reactor resulting in the production of a large quantity of gas. The volume of gas generated necessitated the displacement of a corresponding volume of oil and since the tank was bulged it may be assumed that the increase in gas formation must have been very rapid.

In view of the fact that the main transformer circuit-breaker did not trip after the earthing reactor had failed, it indicated that whatever the cause of the gas formation the fault must have cleared itself electrically.

Another failure occurred when a severe thunder-storm, accompanied by an exceptionally heavy wind, broke over the district and the transformer station, situated near some trees, was subjected to a bombardment of wind-swept twigs. One of the trees was apparently, struck by lightning and this aggravated matters. The bare copper connections (33 kV) between the No. 2 main transformer and its associated earthing reactor were shorted by branches and twigs.

The control engineer reported a heavy surge on the system; Nos. 1 and 2 feeders tripped on overcurrent at the " B " station end and the Nos. 1 and 2 main transformers tripped on overcurrent on the 33 kV side. An attempt was made to re-establish supply by closing the No. 2 main transformer 33 kV circuit breaker but it again tripped. After examination of the switchboard, a second attempt was made with success.

Two of the three-phase connections between No. 2 main transformer and the earthing reactor showed that shorting had taken place, and the three-phase compound filled porcelain insulators on the latter were damaged beyond repair. It was not clear whether the initial short-circuit had caused the damage to the earthing reactor phase terminal porcelain. Possibly the branches which had originally caused short-circuiting fell on top of the earthing reactor tank, and on reclosing the 33 kV circuit breaker resulted in a three-phase short to earth via the arcing horns. This apparently cleared the fault.

Only the overcurrent relays operated under these fault conditions but it should be mentioned that the restricted earth leakage relay had been disconnected due to a defective solenoid coil, and this was the only relay arranged for inter-tripping the 33 kV and 6.6 kV sides of the main transformer.

The protective equipment on the main transformers and earthing reactor circuits normally included two-pole overcurrent and one-pole unrestricted earth leakage relay, and one-pole restricted earth relay, together with Buchholz relays for alarm indication only. The relay settings were as follows:—

2 pole overcurrent P.B. relay 150 per cent. 0.3 T.S.M., 3-200/5 C.T.s; 1 pole unrestricted earth leakage relay, 30 per cent., 1.0 T.S.M., 3-200/5 C.T.s; 1 pole restricted earth leakage relay, 20 per cent., 0.1 T.S.M., 4 C.T.s.

The i.r. test was satisfactory and apart from damage to the three porcelain insulators and terminals the reactor had suffered no further damage.

Effect Upon Design

As a matter of interest it may be recorded that considerable trouble had been experienced with liquid resistors on other undertakings, so much so that manufacturers modified the design. A much smaller current-carrying capacity per square inch of electrode and smaller voltage drop per inch of liquid have been adopted. In a number of installations flash-over had resulted in the destruction of the associated earthing reactor or earthing transformer.

Earthing transformers have now been designed to withstand such onerous short-circuit conditions.

Electrical Notes from Colombo

Progress of the Hydro-Electric Scheme—Future Developments

CONSTRUCTIONAL work at Norton and Maskeliya, in Ceylon, in connection with the Hydro-Electric Scheme, which was mooted a number of years ago, is to be accelerated in order that the laying of the transmission lines may be started two years hence, and a commencement made in the supply of power about 1948. Certain new appointments have been made with the object of accelerating the work on the civil engineering side and the labour force of 400 now engaged, is to be doubled.

Mr. C. Elliot, who succeeded Mr. C. R. Dickinson, as chief resident engineer, is leaving owing to ill-health, and his place is to be filled by Mr. C. Maconochie.

A new appointment is that of Mr. L. C. Phillips, as assistant resident engineer, and another is that of Mr. H. Blackburn, as mechanical superintendent erector. This officer is expected to supervise the work on the power house building.

Result of War Conditions

From the time the contract for the construction of the civil engineering works by the Hindustan Construction Co. was terminated in October, 1942, the work has continued without a stoppage under departmental administration, but the progress made has been slow. In the meantime tenders have been called and accepted for the laying of the pipelines, the electrical and mechanical plant and machinery, and the transmission lines, but the contracts have been held in suspense owing to war conditions.

One of the main handicaps to the progress of the work has been the difficulty of attracting adequate labour to work on the scheme. Mr. J. L. Kotalawala, Minister of Communications and Works, has now overcome the difficulty by offering special facilities to both skilled and unskilled labourers. One is the establishment of canteens and another is to supply the labourers with water-proof clothing, the labourers having complained of working under conditions of cold and wet.

In order that the progress of the work may not be held up for want of material, the Minister has made representations to the Secretary of State for the Colonies asking for the highest priority possible for the material for the pipe-lines, the electrical and mechanical plant and machinery and transmission lines. The earlier allocation of 70 tons of cement per month for constructional work has now been raised to about 250 tons per month. It is hoped to get the allocation doubled to 500 tons a month when the labour force and supervisory staff are strengthened. The machinery and other equipment contracted for are expected to arrive in the island in about two years time.

Mr. S. V. Ramamurthi, Adviser to the Governor of Madras, accompanied by Rao Bahadur N. Govindaraja Ayyangar, chief engineer, visited recently the Periyar Lake to investigate the possibilities of a hydro-electric project, beneficial to both Madras and Travancore, and the construction of a reservoir on the river Vaigai, some miles up the Parenni Anicut. The reservoir would impound 4 000 million cu. ft. of water, and would bring under cultivation 23 000 acres.

A schedule of heavy power equipment required by India as soon as possible after the cessation of hostilities has been prepared and steps have been taken to reserve for India the necessary manufacturing capacity. The total capacity reserved comes to over 850 MW at an estimated cost of Rs. 50 crores approximately. The aggregate of new capacity represented by these schedules comes to nearly 65 per cent. of India's existing installed capacity.

The Government of India have constituted a Technical Power Board. Besides the Chairman, the Board will initially have two full-time members and three part-time members. The Government have appointed Mr. Mathews, Electrical Commissioner of the Government of India, as the chairman and have obtained the services of Mr. W. L. Voorduin from the United States as another member of the board. Before he went to India, Mr. Voorduin was employed as a project officer of the Tennessee Valley Authority. India is to follow, albeit cautiously and gradually, the programme on which the Central Electricity Board in the United Kingdom have worked, and it is the hope that if such a scheme of regional development is adopted in India the boon of electricity may be brought to the door of everyone, high or low.

Ottawa.—The Dominion Water and Power Bureau's annual review of hydro-electric progress in the Dominion reveals that war-time expansion in hydro-electric facilities has been virtually completed. New installations in 1944 totalled nearly 69 000 H.P. to bring Canada's total hydraulic development to over 10 000 000 H.P. There were also improvements in transmission networks and sub-station facilities as well as extension of electric services to certain rural areas.

Fluorescent Lamps

Future Prospects—E.L.M.A. Statement on New Types

IT is impossible to over-estimate the importance of the fluorescent lamp as a war-winning factor in the field of munitions production, for the up-grading of pre-war factory lighting to the standard required by war conditions could not have been effected without it.

It was not only a question of the improved quality of the lighting provided by such lamps but it was also true that only by the use of fluorescent lamps could the desired quantitative increase in lighting be achieved without a considerable rise in peak demand, and the use of larger cables and other transmission equipment.

The lamp was, it will be remembered, invented and developed in the research laboratories of E.L.M.A. members shortly before the outbreak of war, and a 5 ft. 80 W size had been perfected and was already in limited use in shops, factories, offices, and so on.

When war came manufacturers, realising the urgent need for better industrial lighting, placed at the disposal of the Government the whole of their fluorescent lamp research and production facilities, and restricted supplies of these lamps to the war factories which most needed them.

Following this, the Government set up a special organisation for dealing with the improvement of industrial lighting and co-operated with the electrical industry in ensuring the effective and economical use of fluorescent lighting. None could be used for other than essential war purposes, and the only size allowed to be manufactured was the 5 ft. 80 W lamp, because it was the easiest to produce in large numbers.

Wider Range of Lamp Sizes

It is obvious that the fluorescent lamp may, during the next few years, revolutionise both lighting standards and lighting methods in every field of artificial illumination. It is also obvious that the single size which satisfied the needs of war-time industry will by no means suffice for the decorative and utilitarian requirements of peace-time lighting. However, many war-time limitations in materials, machinery and labour still remain, and although the makers of the lamps are alive to the future possibilities, and have in fact developed and produced experimentally a variety of new lamps, they are not yet in a position to make any definite statement on marketing dates and prices.

In the belief that those concerned with post-war planning will welcome whatever prior information is available on the subject, however, the E.L.M.A. have announced that the future fluorescent range will include the following:—

ALL AVAILABLE IN DAYLIGHT AND WARM-WHITE. VOLTAGES: 200/250 A.C.

Length, ft.	Dia., ins.	Voltage.	Nominal Watts.	Cap.
4	1½	200/250	40	Bi-Pin
3	1	200/250	30	,,
2*	1½	100/130	20	,,
2	1	200/250	20	,,
1½*	1	100/130	15	,,

* These lamps operate 2 in series (i.e., 2-20-W or 2-15-W) on 200/250 V a.c. mains, or singly on 100/130 V mains.

All the new lamps will be fitted with Bi-Pin caps of American type and will be interchangeable with their American counterparts—of the utmost importance in connection with export business. 80 W lamps will continue to have B.C. caps for the present, but they will be made in due course with Bi-Pin caps.

Lamp Prices

WITH the ending of double summer time the members of the Electric Lamp Manufacturers' Association announce that the prices of tungsten filament lamps will be reduced on and from July 16 as follows:—

Single Coil for 100 to 130 V and 200 to 260 V.

Watts.			Reduced Price.	Purchase Tax.
			s. d.	s. d.
15, 25, 40 and 60	Pearl and Clear	...	1 3	4
75	,,	,, ...	1 7	5
100	,,	,, ...	1 9	6
150	,,	,, ...	2 9	8
200	Clear	— ...	4 6	1 2
300	,,	— ...	8 0	—
500	,,	— ...	10 6	—
Coiled Coil for 200 to 260 V.				
40	Pearl	... ...	1 6	5
60*	,,	... ...	1 6	5
75*	,,	... ...	1 8	5
100*	,,	... ...	1 10	6

* Available as soon as possible.

Details of reduced prices of other types are available, on application to the member firms.

* * *

Thorn Electrical Industries, Ltd., announce that with effect on and from July 12, the retail prices of Atlas incandescent lamps are being reduced. The 15 to 60 W types, single coil, clear and pearl are being listed at 1s. 3d., and the 100 W at 1s. 9d., plus purchase tax. The new coiled-coil prices for the equivalent wattages are 1s. 6d. and 1s. 10d. respectively, plus purchase tax.

Aerodrome Lighting* III

By G. A. T. BURDETT, A.M.I.I.A.

ELECTRICITY supply to aerodromes must be one hundred per cent reliable, and this may be ensured by either duplicating the supply, preferably from separate undertakings, or by the installation of emergency stand-by generating plant. When an aerodrome is situated on or near the boundary of two supply authorities' areas, the provision of two independent supplies is practicable, but otherwise two h.t. tappings from one authority have to suffice. In addition, it is an advantage, and often essential, to maintain portable lighting equipment which is either available at short notice or is laid in position on the aerodrome just before dusk.

Central Control

Aerodrome lighting, including boundary lighting, should be controlled at one central point, preferably in the control tower where it can be operated as circumstances demand. Other lighting, such as obstruction lights not in the immediate vicinity of the airfield may be controlled by regional authorities under the direct or indirect control of the Air Ministry.

Although the aerodrome installation may be planned well in advance, there will usually arise, due to specific local conditions and requirements, a number of points which can only be settled on the site. It is therefore, advisable to ensure that all these points are finally settled before the actual work is commenced and if possible, even before a tender for the work is submitted. While the contractor may have recommendations to make which, from his experience of lighting and installation work, he knows would be of technical advantage, he should always bear in mind that what may appear satisfactory on the ground may not always be so from a flying point of view. On the other hand, the flying man may have proposals to put forward, also of a technical nature, but he may not appreciate that some of them are impracticable. Close collaboration between the engineering and flying personnel should, therefore, at all times be exercised.

Where cables are used, and since any other form of servicing may be regarded as a potential obstruction to aircraft such cables should be employed wherever practicable, they should be laid as early as possible after the commencement of construction. Once concrete runways, taxi tracks and grass surfaces are laid they should not be disturbed if the efficiency of the aerodrome is not to be impaired, and the contractor who has not installed his cables by the time these surfaces are made may find that he must then run his cables along circuitous routes, and thereby raise his costs. It is in fact, always advisable to lay a number of empty conduits where there is a likelihood of subsequent additions or alterations, especially at intersections of runways and lanes leading off taxi-ing tracks to hangars and other points of dispersal.

Owing to the size of even the smallest aerodrome, wiring is a large item of cost, particularly where boundary lighting is installed. A little forethought may, however, save several miles of cable. Since such saving in cable has always been a serious consideration in aerodrome lighting installations, boundary lights installed before the war were usually wired in series, the fittings being specially designed to ensure that should they be damaged by an aircraft, the series circuit would not be interrupted.

Series lighting may not, however, be practicable in the future, in that lighting policy may be completely changed as a result of the need for more powerful illumination.

Of greater importance than saving in wiring costs is, of course, the obstruction factor and if overhead lines are likely to cause obstruction they must be ruled out. Aerodrome installations, once completed, may be regarded as permanent, and it would, therefore, be cheaper and more satisfactory if all servicing was laid underground, even in those areas where root crops and deep ploughing require those cables which cross neighbouring fields to be laid deeper than normally.

Flexibility of Installations

An essential feature of good aerodrome lighting practice is flexibility, in the sense that the aerodrome authorities may operate their flying services in exceptional circumstances. For instance, the quick circulation tracks for taxi-ing to enable large numbers of aircraft to land in a short space of time, necessitate some measure of local and flexible control. The unsettled weather conditions which are a notable feature in Great Britain, may result in the landing of many times the normal traffic at an aerodrome, because fog and low cloud prevent their landing at the aerodromes to which they were originally directed.

All types and sizes of aircraft may, therefore, have to be handled simultaneously. Where quick circulation tracks are pro-

* Parts I and II, THE ELECTRICIAN, June 22 and 29.

vided so that aircraft which do not require the full length of the runway for landing can turn off as early as possible, and so clear the runway for the next, the illuminated circulation tracks should be locally controlled at the points where they are fed from the main lighting system so that they are operated only when circumstances require; that is, they may be switched on just prior to the aircraft landing and switched off again when normal conditions are resumed. Although the initial wiring would need to be of a larger capacity than required to supply the main installation, it would ultimately be cheaper than wiring at a later date direct from the main distribution point.

Types of Fitting

Before the war there was an increasing tendency to use flush-mounted lighting fittings, so that aircraft could run over them without damage to either machine or fitting. Since these have in the past stood up to most forms of abuse, and since transport aircraft will in the future tend to be heavy in type, it is anticipated that flush-mounted fittings will be adopted as standard, with pedestal series fittings falling into disuse. Flush fittings are normally housed in concrete blocks, placed in position during the construction of a runway on the aerodrome sub-surface, and although every care may be exercised in placing these so that the fittings will be flush when the top surface is laid, it is often difficult to ascertain the level of the final surface. The result is that the fittings are recessed and the efficiency of the lighting lowered. Provided the fittings are not potential obstructions or likely to damage the tyres of aircraft, it is a good rule to fit them so that when the final surface has consolidated they will be, if anything slightly "proud." Once the blocks have "settled" and the runways or aerodrome surface has consolidated, the asphalt may be "topped" up around each fitting to provide a "flush" installation.

Good maintenance is essential and as aerodrome lighting is a specialist job, everyone connected with it should be specially trained to ensure that he is fully conversant with every aspect of the installation and equipment. Daily inspection should be carried out thoroughly, and each morning every light should be examined for serviceability so that repairs may be completed before dark; just before dusk the installation should be inspected again. With runway aerodromes, grass or concrete, each flare path should be inspected, and not only that in use at the time; this is necessary in case the direction of the wind should change during the night and another flarepath be put into service. In no circumstances should lamps be allowed to burn out, but each should be replaced at the end of its estimated life. A system of lamp changing, e.g., records, should be devised to ensure that this is carried out. Although lighting engineers have always impressed upon users the desirability of changing lamps before they burn out, this is of special importance in regard to aerodrome lighting, in that faulty lamps may result in an error of judgment on the part of a pilot, while decreased light output from inefficient lamps during bad weather may make it impossible for a pilot to land his aircraft where otherwise he would be able.

Apart from periodic inspection and small repairs, servicing work connected with aerodrome lighting and its ancillaries should not be heavy, provided the inspections are carried out frequently and methodically. Further, if small repairs are carried out at once, few, if any, major faults should occur, that is, provided the installation is well designed and installed. The maintenance staffs may therefore be comparatively small in number. Twenty-four hours servicing is, however, essential.

Since operational efficiency of an aerodrome at night is dependent upon the speed at which electrical repairs are carried out (upon which factor the lives of passengers and crews may depend), every facility should, be given to servicing personnel. For example, those on duty should be provided with quick methods of transport. Post-war aerodromes will probably have runways up to two miles long, which means that the taxi track or effective perimeter of such an aerodrome may be of the order of six miles in length.

Although it is not possible to envisage at this stage more than the general characteristics of civil aerodromes of the post-war period, there is no doubt that some research is necessary to ensure that British aerodromes are at least well and adequately illuminated.

HAMS HALL "B" STATION

Mention was made at a meeting of Birmingham City Council on July 3, that the first half of the new Hams Hall "B" power station was officially opened by the then Lord Mayor, Ald. W. S. Lewis, on July 23, 1943. At present two 50 000 kW turbo-alternators are in commission and have already generated about 1 514 000 000 units, largely for war industries. The cost together with the main transmission lines was £5 450 000. 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 capacity will be 300 000 kW and the total cost, together with transmission lines, is estimated at £12 000 000.

Electrical Personalities

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

Mr. J. R. Hawes, power station superintendent at Rotherham, is to retire in August.

Mr. D. B. Hoseason has been appointed assistant managing director of the Brush Electrical Engineering Co., Ltd.

Mr. R. G. Golding, deputy borough electrical engineer of Yarmouth, has been appointed borough electrical engineer at Wallasey.

Mr. J. A. Hunn has retired from the board of Laurence Scott and Electromotors Ltd., and his position as a director in charge of marine sales will be taken by **Mr. P. Clarke.**

Dr. E. W. Smith has been re-elected President of the Institute of Fuel for the year ending October, 1946. This will be his third year of office. **Mr. J. F. Ronca**, a member of Council has been elected honorary secretary.

The Midland Electric Manufacturing Co., Ltd., have just completed their 1945 sales conference. In pre-war years this was an annual event. The photograph, reproduced on this page, is of the gathering of representatives and head office staff.

Bradford Electricity Committee has reported that **Mr. T. H. Carr**, electrical engineer and manager, had received an invitation to act as a technical adviser to the Allied Control Commission for Germany, but the Committee could not permit him to accept the appointment.

Forty of the technical assistants from the Rotax Laboratories recently saw a performance of the Tommy Trinder show, "Happy and Glorious," at the Palladium. This was followed by a dinner at the Ariston Grill.

Blackburn Electricity Committee has placed on record appreciation of the services of **Mr. F. Barrell**, deputy electrical engineer, recently appointed to a similar position at Leeds. In view of the difficulties of obtaining skilled replacement staff, the Ministry of Labour and the Electricity Commissioners are to be informed that the release of Mr. Barrell can only be agreed upon subject to a satisfactory substitute being engaged.

Consequent upon the death of **Mr. W. A. Pearman**, the general manager and secretary, **Sir Leonard Pearce**, the engineer-in-chief, will, for the time being, undertake the managerial duties of the London Power Co., Ltd., and he becomes the chief executive officer. **Mr. Bernard Higgins**, assistant secretary, has been appointed secretary of the company. **Miss Janet E. Hocking** has been appointed assistant secretary.

Mr. Duncan W. Low, announces that he has resigned his position as director of British National Electrics Ltd., Archibald Low Electrics Ltd., and the J. P. Tubular Heater Co. Ltd. He has floated a new company, to be known as Duncan Low Ltd., 299, Bell Street, Glasgow, C.4, the activities of which will be devoted to the manufacture of electric water heaters, electric oil heaters, etc. It is not expected that the company will be in production until the late autumn.

Group taken at the M.E.M. first sales conference since 1939, on June 25 and 26. Mr. W. L. Barber, founder and chairman of the company is seen with representatives and members of the executive staff. Yorkshire readers will recognise Lt.-Comdr. J. C. Turnbull, peace-time representative for that territory and now serving with the Royal Navy, who, together with Lieut. A. J. Gardner, of the London area, obtained special leave to attend the conference

On July 7, the Willesden works of the British Thomson-Houston Co., Ltd., saw the revival of Apprentices' Parents Day, a function which had taken place annually since 1929 until the war caused its postponement. On arrival, the parents, in small parties, were conducted round the works by apprentices. After tea, the chair was taken by Mr. T. Hands, manager of the Willesden works, who welcomed the visitors and spoke of the purpose of the visit and matters affecting the apprenticeship schemes. Mr. H. Trencham gave a review of the annual essay competition, the prize winners in which were: 1st year, V. G. Johnston; 3rd year, D. L. Harris; 4th year, P. A. Johnson; and 5th year, J. L. W. Hope, who also won the medal for the best essay of the year. Mr. R. C. Snewing, apprentice supervisor, gave the drawing office examination results, which enable trade apprentices to transfer to the drawing office course. Mr. C. Grad, chairman of the Apprenticeship Committee spoke on the general policy of the company as it affected apprentices. There was an exhibition of hobbies and models made by apprentices.

The **Marquis of Reading,,** and **Mr. G. Bradlaw** have been appointed directors to fill vacancies on the board of the Palestine Electric Corporation, Ltd. **Mr. James de Rothschild,** who had resigned from the board on his appointment as Joint Parliamentary Secretary to the Ministry of Supply in the late Government, has been reappointed director. Mr. G. Bradlaw is continuing as director and secretary.

I.E.E. Council have awarded the Kelvin Premium to Mr. G. F. Shotter; the John Hopkinson Premium to Mr. R. J. Halsey; Non-Section Premiums to Messrs. H. Frohlich, (Ayrton Premium), G. A. Juhlin and R. Pohl (Llewellyn B. Atkinson Premium), Installations Section Premiums to Messrs. R. O. Ackerley (Crompton Premium), R. T. Lythall (Swan Premium), and L. S. Atkinson (Extra Premium); Measurements Section Premiums to Messrs. L. Hartshorn, and W. Wilson, (Silvanus Thompson Premium), Mr. D. J. Desmond, Mr. H. J. Josephs (Extra Premium); Radio Section Premiums to Prof. Willis Jackson, and Mr. J. S. A. Forsyth (Duddell Premium), Mr. K. R. Sturley (Ambrose Fleming Premium), and Mr. D. G. Fink (Extra Premium); Transmission Section Premiums to Mr. D. B. Irving, (Sebastian de Ferranti Premium), Messrs. W. Kidd and E. M. S. McWhirter (John Snell Premium), Messrs. R. C. Hatton and J. McCombe (Extra Premium), and Mr. J. L. Carr, (Extra Premium); Fahie Premium to Messrs. R. B. Armstrong, and J. A. Smale; Paris Exhibition, 1881, Premium to Messrs. L. J. C. Connoll, O. W. Humphreys, and J. L. Rycroft; Overseas Premium (For Senior Members) to Mr. R. H. Paul; Students' Premiums (value £10) to Messrs. W. M. Butler, G. B. Downham, J. R. Hanchett, J. Willis, Lt. L. B. Knowles, R.N.V.R.; Students' Premiums (value £5) to Messrs. J. Banks, H. Burton, T. E. Calverley, J. B. Higham, A. C. Robb, W. B. Robertshaw.

Obituary

Mr. J. D. Lindsay of Lindsay and Ward, Newcastle-on-Tyne, on July 5, aged 66 years, following an operation. He was well known in electrical and mining circles in the North-Eastern district. Mr. Lindsay had represented Bruce Peebles and Co., Ltd., as their agent in that area since 1912. He had also represented Switchgear and Cowans, Ltd., for a long period, and in the mining machinery sphere, Walker Brothers (Wigan), Ltd., and Wilson Forge.

Struggle for Freedom

THE relationship between the long struggle of the British people for freedom and the issues at the recent General Election was emphasised by Sir Ernest Benn, at Bradford last week, in a speech supporting the candidature for Bradford North of his son, Major John Benn, in the National Conservative interest.

Sir Ernest said that for ten centuries the British had carried on a consistent struggle for freedom from authority, always pushing responsibility downwards, just as was done in business, until the lowest was made to feel that he as an individual counted for something.

The Socialists wanted to abolish the foundation on which this country was built and substitute State control. Nobody, anywhere, was to be responsible for anything.

Pursuing the struggle against control, we had produced in our thickly populated island the highest standard of living ever known to man in any country at any time. It was certainly not done by organisation, and no Government had anything to do with it. It could only be explained by the sterling quality of the individual people of Britain, not to foster the disease of Government, but to get rid of it.

Of controls, Sir Ernest said no one could be so foolish as to imagine they could all go at once. The Prime Minister, in 1940, had said in the House of Commons: "Parliament stands custodian of those surrendered liberties, and its most sacred duty will be to restore them in their fulness when victory has crowned our exertions and our perseverance."

News in Brief

Public Address Inquiry.—Bexhill Corporation is to inquire into the cost and time of delivery of a public address and amplifying equipment.

Electric Food Conveyors.—The Middlesex C.C. Health Committee is to provide 22 electrically-propelled pre-heated food conveyors and five containers, with necessary wiring, for the Northern County Hospital at an estimated cost of £1 645.

Telephone Employees' Gift.—An additional donation of £150 to the Lord Mayor of Liverpool's War Fund has been made by employees of the Automatic Telephone and Electric Co., Ltd.

All-Electric Kitchen.—The Wessex Electricity Co. are exhibiting an all-electric kitchen at the Town Hall, Hungerford, Berks, from July 17 to 21.

Poulaphouca Scheme.—The final turbine for the Poulaphouca Falls hydro-electric scheme on the Liffey is due to arrive at Dublin shortly.

College Bakery Equipment. — At a meeting of the Cardiff Electricity Committee the Electrical Engineer suggested that up-to-date equipment should be provided for the bakeries at the Technical College, and it was decided to ask the college committee to specify the requirements so that further consideration could be given to the matter.

Electrification of Pumping Station.—The Watford Corporation Water Committee is to consider the electrification of one of the pumping stations where the plant is 30 years old, and which the water engineer states is by no means as efficient as modern electrical plant.

London Borough Street Lighting.—St. Marylebone Works Committee reports that the restoration of full public lighting will call for an annual increase in the consumption of coal of about 4 700 tons. As it has been advised that the type of coal used is not suitable for domestic use, the Committee does not propose postponing the putting of such lighting into effect.

Lighting Installations. — Following a questionnaire submitted to housing applicants, the Billingham-on-Tees U.C. has decided to instal electricity for all purposes in 300 temporary houses. The Pangbourne Parish Council has approved a scheme submitted by the Wessex Electricity Co. for installing mercury-filled lamps in the district.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of July 9, 1920: Among the recent connections to the electric supply department of Manchester Corporation are the gas offices, which have been wired for electric lighting.*

New Power Station Laboratory.—Sanction has been received by Leeds Corporation for the borrowing from the Electricity Commissioners of £16 500 for the provision of a chemical laboratory and workshops at Kirkstall power station.

Chester Exhibition.—An "Electricity Looks Forward" exhibition was opened in the Chester Town Hall, yesterday, July 12. It is a joint venture in which the Chester electricity undertaking, the Mersey Power Co., the Mid-Cheshire Electricity Co. Ltd., Electricity Distribution of North Wales Ltd., Oswestry, and Mold electricity undertakings are interesting themselves.

Electricity versus Gas.—The Housing Committee of the Marlow U.D.C. has recommended that electricity be adopted for council houses in preference to gas. The houses will be wired for electric lighting, wash boiler, refrigerator and immersion heater in the hot water tank. Electric cookers will be supplied on the hire-purchase basis.

Radio Licences.—There are 9 710 850 holders of wireless receiving licences in Great Britain and Northern Ireland, an increase of about 250 000 over the figure for the same date last year.

Liverpool's E.R.A. Subscription.—Liverpool Electric Power and Lighting Committee has approved the payment of £1 061, as annual subscription to the British Electrical and Allied Industries Research Association.

Kitchen Units.—St. Marylebone Housing Committee has appointed a sub-committee to make arrangements for standardised kitchen units in connection with the erection of flats at the Barrow Hill and Church Street Estates.

Wages in Contracting Industry.—In accordance with the Wages (War Adjustment) Agreement as from the third pay day in July, the Cost of Living (War) Addition is to be 5d. per hour, such addition to remain current up to and including the second pay day in October next.

Social Item.—The Wessex Electricity Company's social and sports clubs at Wallingford, recently held their first annual sports day on the ground of the local grammar school. Members from the Mortimer and Pangbourne branches were present, and the prizes were distributed by Mrs. Morgan, the district manager's wife.

Colour as Factor in Production

Lighting in Relation to Brightness of Surroundings

BY now the influence of lighting on production is widely appreciated and the standards of lighting intensity in the modern factories are far in advance of the pre-war levels. The studies of the Industrial Health Research Board on industrial health and its relation to light, ventilation and warmth have been examined by industrialists concerned with the problems of output and fatigue.

These researches have shown the primary importance of good lighting and have made clear to many people exactly what is meant by the term " good lighting." It is now realised that the general brightness of a factory affects the morale and the feelings of those working there. A dimly lit factory is depressing: good lighting makes workers feel cheerful and induces a constructive and energetic mood.

Apart from this general effect, there is the effect of special local illumination " on the job," the use of very high intensities on fine work and the greater efficiencies which come from less spoilage, fewer accidents and higher standards of cleanliness. But these are not all. More and more, attention is being directed to the effects of colour in lighting: for instance, light colours act to prevent glare which commonly arises from the contrast of a very bright light seen against a dark background. Bad lighting—and this may mean a high intensity causing glare and subsequent eye fatigue—ignores the values of colour. Studies of eye fatigue show that tiredness of the eye muscles becomes rapidly communicated to other parts of the body: a worker soon develops tiredness " all over " and slows down his output.

Eye Fatigue

It appears that the commonest causes of eye fatigue are unnecessary movement, tension and constant adjustment in the movements of the seven muscles which operate the eyeball. These factors can be mitigated by the right use of colour. Gazing at a long, monotonous grey machine the eye wanders a long way without having anything to hold it still at any specific place. Again, if the colour of a fabric is very similar to the colour of a machine, the effort needed to distinguish between the two becomes a source of eyestrain. Similarly, violent contrasts force rapid adjustments of the eyes. A worker receives these contrasts if he has to look up from a light-coloured machine to a dark wall or from a dark-coloured machine to a light wall.

Investigations into ways of improving such conditions as these have been made in this country and in the U.S.A. by lighting engineers and paint manufacturers, until certain principles have been established and definite schemes and arrangements of colours have been applied to machines and their background. In the U.S.A. the Pittsburgh Plate Glass Company and the du Pont de Nemours Company are leaders in this new field. In Great Britain, and Imperial Chemical Industries, Ltd., W. & J. Leigh, Ltd., of Bolton, and the Lighting Service Bureau have contributed to studies and were associated with other firms last autumn in a technical display of light and colour. This display featured modern electric lighting and the application of colour to mill interiors and machinery, and was organised by the Recruitment and Training Department of the Cotton Board at Manchester.

Colour Dynamics

While each firm in this field is developing its own technique, there is a certain similarity in method. We may take, as an illustration of method, the " Colour Dynamics " system of the Pittsburgh Plate Glass Company. In the painting of a machine, the first essential is to separate the critical from the non-critical parts. The critical or operating parts should be given a colour which comes quickly to the eye in strong contrast to the non-critical or stationary parts. This is termed a " focal colour," since it focuses the worker's attention exactly where it ought to be and cuts down the unnecessary wandering of his eyes which takes place when the entire machine is painted a dull, monotonous grey.

The critical parts of the machine should be brought forward into the field of vision by the proper use of colour and the non-critical parts should be dropped back. What is generally called " machine grey " does partially achieve this effect, but it has the defect of being depressing. A great improvement is secured by using a soft green as the " receding " colour for the body of the machine: no other colour has such a restful and relaxing effect on the human eye as green—it is Nature's most widely used tone.

The focal colour must be in sharp contrast with the non-critical parts of the machine and, also, with the material being manufactured. Evidently, a focal colour of grey would be useless for aluminium working as there would be continuous eyestrain in trying to distinguish between material and machine. Where, however,

the double contrast of colour is obtained, eye travel is discouraged and tension is reduced.

The psychological effects of colour are as important as the physiological effects, for colours can be disturbing, depressing, uplifting, restful or cheerful. In how many factories, for instance, the walls and ceilings are so drab that they suggest a cloudy and damp autumn evening! People are open to suggestion in their environment and the effects of changing a drab surrounding to colours which suggest sunlight are apparent immediately in the general feeling of the workers. Again, in workshops where temperatures remain high owing to the processes involved, cool colours can be applied, such as blue and white. In contrast, where low temperatures must be maintained, the warm colours can be used to create an atmosphere of " warmth in the mind."

Eyes focussed on a job need restful surfaces to relax on. The walls in the worker's field of vision must not be in such contrast with his machine that he has to make rapid adjustments every time he glances from one to the other. All surfaces on which the eyes rest should have practically the same general tone of colour (though not necessarily the same colour) as that which the worker sees while concentrating on his job. It is well known that the human eye, after seeing an excess of one colour, compensates by seeing the complementary shade of that colour when the eye moves its gaze to another light-coloured surface. As an illustration: if a worker has been working on a strong red material, when he glances at a white wall, he will see green for a few seconds. To avoid this confusing effect it is helpful to paint the wall in a complementary colour such as green.

Sense of Space

The effects of surfaces and machinery, pipes, etc., on the sense of space is important. A ceiling cluttered up with pipes, wires, cross-beams, etc., often has the effect of weighing down on those working beneath it. This can be counterbalanced by using a colour which makes these surfaces recede from the vision. Where direct lighting is employed, a soft greeny-blue shade produces the receding feeling and enlarges the apparent space.

These points are borne out by factory experience. In the " Mill Lighting and Colour " pamphlet describing the exhibition held at Manchester last autumn, a good example of what happens is quoted: " A well-illuminated room in a factory had white walls. There were complaints of fatigue and eye-strain while working at the machines. Nervousness and tension were noted in the tendency of the employees to leave their work frequently and to be fidgety and irritable. Study revealed that the walls and pillars caused glare and distraction. In glancing up, the eye was saturated with brightness. When it returned to its task there was a temporary " blind " period, during which the operative had to wait for her vision to adjust itself to the darker working areas. After painting the walls a soft bluish-green, greater visibility was effected. In glancing up, the subdued surroundings were restful and relaxing. When attention was again directed to the work, there were no blind or halt periods."

Grading of Colour

Colours may be classified and graded according to character and significance. For instance, there are focal colours, restful colours, stimulating colours and identification colours. The focal groups are " anti-camouflage " colours, vivid yellows, blues and reds, etc., which attract attention and give emphasis to things. They are used to highlight the critical parts of a machine and to mark dangerous projections or sharp differences in floor level which might cause injury. Restful colours, as noted, have the function of soothing the eye and are pastel in tint. Stimulating colours are gay and lively and are generally best used in canteens and recreation rooms since they tend to be too distracting in workshops. Identification colours are strong colours for identifying pipes, conduits, ducts and cables in buildings. The British Standards Institution has specified a list for specific purposes: air, white; electricity, orange; steam, crimson; water, central heating, turquoise blue; water, fire, red, etc.

In factories especially, colour codes for safety measures are important. It has always been customary to associate red with danger and green with safety, but many people are colour blind and cannot easily distinguish between the two, both of which assume a brownish or greyish hue. This point has induced colour authorities to develop a new code of colours. It retains green as the safety colour but uses orange for the warning colour. In the U.S.A. an attempt has been made to evolve a standard safety code of colour identification throughout all textile mills. This specification which is sponsored by the du Pont de Nemours organisation states: colour, why chosen, safety purpose and application. This scheme has valuable potentialities for industrial safety work.

The du Pont code uses yellow, orange, green, red, blue and white for primary indications: " Yellow, chosen for highest visibility under nearly all lighting conditions: safety purpose, to mark objects and surfaces that, if not seen, can injure people who may strike against them, or trip, fall, or stumble because of them. Applica-

tion: aisle obstructions, curbings, chain-hoist blocks, changes in floor elevation, low beams, protruding parts, railings and trucking equipment."

Messages by Colour

"Orange, chosen for best attention value. Safety purpose: to mark hazards requiring alertness, such as dangerous parts of machines or equipment that might injure a worker. Application: exposed machine parts, etc. Green, chosen as regularly associated with safety and medical equipment. Safety purpose: to identify all equipment used for first aid, rescue and medical treatment. . . . Red, chosen as having wide recognition in identifying fire-fighting equipment. Safety purpose: to denote fire-protection equipment exclusively. . . . Blue, chosen as tending to stimulate thoughtfulness and caution. Safety purpose: to mark all equipment that is down, or being serviced, and that should not be moved, used or started. Application: boilers, compressors, electrical controls, ovens, valves, etc. White, traditionally associated with orderliness and cleanliness. Safety purposes: for traffic markings and to obtain good-housekeeping. Application: aisle markings, storage areas, waste receptacles, unsanitary floor corners, etc.

Clearly, colour in industry constitutes a special study and it can be used intelligently to reduce fatigue, improve the working atmosphere, stimulate cheerfulness, enhance safety and raise standards of cleanliness and order. Factory managers in the U.S.A., especially, have found that the wise use of colour has increased production. The Thompson Aircraft Products, for example, obtained such good results from a try-out of colour in the tool-room that they arranged this year to have the entire lay-out of 2 000 machines painted. The tool bases are green, the upper portions are silhouetted in buff, and moving parts are painted coral red. Lift trucks are also coral red, and the combination is used for walls, traffic zone marks, etc.

Use of Colour Harmonies

These arrangements differ from the general colour plan of the Pittsburgh Plate Glass Co., but different manufacturers vary in their use of background and focal tints. The du Pont firm prefers light grey for bases and buff or light green for the upper portions. The Sherwin-Williams organisation has produced a list of 17 colour harmonies, with machine bases in turquoise, green, grey, brown, beige or blue, combined with these or other colours for upper parts and danger points.

There is no doubt that the proper combination of light and colour can do a great deal to make a worker's surroundings pleasant and more efficient as a production workshop. Employees in textile mills where colour techniques have been applied have expressed their appreciation of the change both as individuals and in their increased production. This is the experience of such organisations as the Avondale Mills at Lafayette, Alabama, of the Calloway Mills, La Grange, Georgia and other similar mills. The experience of the Melbourne Technical College, Australia, which studied latest American practice in this field, has also been satisfactory.

Industrialists in Great Britain will do well to keep in touch with the developments in this new field. It is certainly new, for serious attention to the application of colour in industry dates from about 1941. One should mention the pioneer paper on this subject presented before the War-time Lighting Conference of the Illuminating Engineering Society of U.S.A., at St. Louis, Missouri, in September, 1941. This paper was entitled, "Improved Vision in Machine Tool Operations by Colour Contrasts," and was given by Arthur A. Brainerd of the Philadelphia Electric Company and Matt Denning of the du Pont de Nemours Company of Delaware. Since then, progress has been considerable in the U.S.A. and the work is developing in Great Britain.

Book Review

Radio Service Test Gear. by W. H. Gazaly (Pitman, London). Pp. v + 90. 6s. net.

Commencing with some sound advice to amateur constructors, the author proceeds to give an outline of the principles upon which radio receiver test and measuring instruments operate, dealing with performance, and covering in successive chapters such a wide field as standard signal generators and test oscillators, output meters and attenuators, valve voltmeters, testers and bridges at a.f. for inductance and capacitance, electrolytic condenser testing and inductance and capacitance at r.f., beat frequency oscillators, valve testers, and multivibrators. For the reader who desires to construct his own instrument the book forms a useful introduction to the subject, and it will help the amateur to understand the fundamental a.c. and radio theory and principles necessary for the design of effective apparatus, however simple.

BOOKS RECEIVED

Science Abstracts. Secs. A and B. Vol. 48. No. 566. February. Issued by the I.E.E. (London: Spon). Single Nos. 3s. 6d. An. Sub. 35s. or 60s. for both sections.

Industrial Information

Change in Telephone Number.—The new telephone number of S. D. Sullam Ltd., manufacturers and distributors of electrical components is Gerrard 9372/3.

New Factory.—A factory of 50 000 sq. ft. has been allocated to the West Tool Engineering Co., Ltd., for the manufacture of coil winding machinery and electrical goods. Employment for 500 is expected.

Lectrodryer Equipment.—Birlec Ltd., have issued a brochure dealing with the applications of the Lectrodryer equipment in the drying of air and most other gases.

Cheerful Rationing.—The July issue of this popular publication of the E.A.W. gives a number of recipes for light dishes, together with a list of household hints for holiday makers.

Rebuilding of Works Approval.—Erskine, Heap and Co. announce that they have now received the official licence for the immediate rebuilding of the main part of their works which was destroyed by enemy action.

Pyrometer Testing Furnace.—Details of a pyrometer testing furnace for works and laboratories are given in a leaflet issued by Wild-Barfield Electric Furnaces, Ltd. The complete testing equipment is compact and portable.

English Electric Journal.—The contents of the current issue includes among other articles, details of the company's magnetic slip coupling for boiler house fan drives; torsional vibration in internal combustion engines; and notes on the design and operation of superchargers.

" Sandwich " Type Cables.—British Insulated Cables, Ltd., have issued a new descriptive list, N.S.C. 13 (replacing N.S.C. 10) dealing with their " standard " type cables, which are particularly suitable for industrial, colliery and other indoor work because, it is claimed, they are non-bleeding, even up to a conductor temperature of 180°F.

Elements and Spirals.—A comprehensive illustrated list of replacement elements and spirals with specifications and prices, has been issued by Metway Electrical Industries, Ltd. There are 20 pages dealing with the various types of elements for electric irons, fires, kettles, saucepans, wash-boilers, hair dryers, etc., and boiling ring refractories.

Electrical Recorders.—A completely revised edition of List 812, dealing with the latest developments of their electrical recorders for heat economy and control measurements for temperature, humidity, gas analysis, and so on, has been published by Elliott Brothers (London) Ltd. The new " S " type, or small recorder is smaller and cheaper than the standard " L " types.

Industrial Reflectors.—A new publication giving specifications of standard types of industrial reflectors for use with tungsten and mercury discharge lamps, has been issued by the lamp and lighting department of the British Thomson-Houston Co., Ltd. There is a wide range to fill varying requirements.

E.I.B.A. Acknowledgments.—Among the contributions received by the Electrical Industries' Benevolent Association during the period January to June, inclusive, are the following items:—The British Power and Light Corporation, £100; The Cable Makers' Association, £105; Callenders Cable and Construction Co., £50; Central Electricity Board, £500; Chloride Electrical Storage Co., £65; Edmundson Corporation, £200; Electric Construction Co., Ltd., £75; Electrical Contractors' Association of Scotland, £60; Electrical Power Engineers' Association, £100; G. Ellison (Birmingham), Ltd., £50; Mr. S. Garcke, £50; Incorporated Municipal Electric Association, £105; Lancashire Electric Power Co., £105; Midland Counties Electric Supply Co., £262 10s.; M. K. Electric, Ltd., £50; Mullard Wireless Service Co., Ltd., £50; Newcastle and District Electric Light Co., £50; North Eastern Electric Supply Co., £100; Northmet Power Co., £105; Philips Lamps Ltd., £100; C. A. Parsons and Co., Ltd., £87 10s.; A. Reyrolle and Co., Ltd., £177 1s. 8d.; Tufnol Ltd., £50.

Profit-Sharing Scheme.—A profit sharing scheme on rather unusual lines has been introduced by Hirst, Ibbetson and Taylor Ltd., electrical and wireless wholesalers, of Manchester, Liverpool and Blackpool. The scheme differs from the generally accepted methods of profit-sharing in that the employees are not merely to accept a share of profits but have also voluntarily agreed to accept a share of the risks of any losses that might possibly occur. The employees have agreed to accept a 25 per cent. reduction in salaries in return for which a percentage of profits, estimated to pay a dividend of 50 per cent. on salaries, is set aside for their benefit. This has the effect of making earnings two-thirds fixed and one-third dependent on profits. Dividends are paid monthly on estimated profits and at the end of the financial year a thirteenth dividend is paid to adjust any balance that may be due. This scheme, introduced in April, 1944, and made retrospective to February 1, 1944, has been in operation rather more than twelve months and shows every indication of being highly

successful. The ready acceptance by the employees of a scheme of which a substantial reduction in salaries is an integral part is a measure of their confidence in the firm and its future prospects. For the first year, ending January 31, 1945, dividends amounting to no less than 11s. in the £ for the Manchester branch and 15s. in the £ for the Liverpool branch have already been paid and there is every prospect of a substantial 13th dividend to be paid when the year's accounts have been completed. In introducing the scheme the directors hoped it would act as an incentive and promote a personal interest on the part of their employees in the activities and progress of the firm and their hopes have been fully realised.

Correspondence

The Editor welcomes the free expression in these columns of genuine opinions on matters of public interest, although he disclaims responsibility alike for the opinions themselves and the manner of their expression.

Earth Leakage Trips

[To the Editor]

Sir,—In reply to Mr. S. Cooper, my insistence upon voltage is in line with the B.S.S., and I would point out that in connection with voltmeters, no account is taken of amp-turns, although these are obviously responsible for the needle deflection. Surely voltage-operated coils may be considered in the same way?

I would reaffirm that, in my view, the separate electrode used in connection with leakage trips has a decided advantage over any conventional form of electrode. Take the extreme case, in which a heavy earth fault has raised the voltage of conduits and water pipes to some level above earth; how can a trip operate if both ends of its trip coil are connected to objects substantially at the same potential? A steel-framed building may easily become charged to a high potential, with no chance of isolation unless the trip coil be connected to a separate electrode. The Continental concerns who were responsible for the devising and adoption of the voltage method of leakage protection invariably use separate electrodes.

In addition, the flow of fault current into an installation from a supply network fault must not be left out of account, and has a definite bearing upon the separate electrode question. Attention has been drawn to this possibility by the Home Office.

I do not accept Mr. Cooper's figures for coil resistance, as a good class device should not represent more than 200 ohms resistance. At 50 cycles reactance may represent another 200 ohms, but even so the total impedance is something under 300 ohms. I do not think that omission of a line has done the compilers of the Report any injustice, as the matter discussed was the visualisation of a form of fault, and not the likelihood or otherwise of its occurrence.

Even though a fault arises in the manner described by Mr. Cooper, by the tracking by carbonisation over insulating material, it may still be stated that at the moment of contact between phase and earth the voltage upon the earthed metal casing will approach, or equal, the full supply voltage. As soon as current commences to flow, however, then this leakage voltage will fall, and I do not think that any instance can be quoted in which this would not be the case.

I do not think that the paragraph from a previous article, and quoted by Mr. Cooper, can be construed as agreement that voltage rises from a low value to a higher. If a voltage has appeared upon earth-connected metal and has later fallen to some lower value, the final level still represents a rise above zero potential.

Yours faithfully,

"Supervisor."

July 7, 1945.

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.

Birkenhead Electricity Department, July 16.—Supply of 300 kVA and 500 kVA transformers. Particulars from the Borough Electrical Engineer, Craven Street, Birkenhead.

Birmingham Electric Supply Department, July 20.—Supply of cast-iron circulating water pipe and valves, alternatively, steel pipe work. Particulars from Mr. F. W. Lawton, 14, Dale End, Birmingham; deposit, £2.

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.

Littleborough U.D.C., July 23.—Supply and delivery of one e.h.t. ring main unit, 11 000 V, and l.t. switchgear. Specifications from Mr. G. Hill, Council Offices, Littleborough.

Electricity Supply

Lichfield.—Sanction to borrow £5 465 for extensions has been obtained by the Electricity Committee.

Barrow-in-Furness. — The Electricity Committee has obtained sanction to borrow £1 500 for hire apparatus.

Cardiff.—The Electricity Committee is to provide supply to the Fairwater housing estate at a cost of £3 761.

Darlington.—The T.C. is seeking loan sanction for £1 020 for the supply of electricity meters for new houses.

Manchester.—The Electricity Committee has obtained sanction to borrow £12 000 for increased transformer capacity at Denton sub-station.

Workington.—The Electricity Committee is seeking sanction to borrow £3 890 for cables, sub-station and equipment at Fleet Street and £4 837 for extensions in the Poole Road area.

Clitheroe.—The Electricity Committee has approved an application from Gisburn Park Estate for a supply to Gisburn Hall, Deer House Farm, Law Mill and Ellenthorpe and Coppice farms, the owner offering £133 towards the cost of laying of the cable.

Workington.—At a recent meeting of the Electricity Committee, in connection with electricity charges at Harrington, it was reported that the Mid-Cumberland Electricity Co. was not charging the maximum prices authorised by its special order in those parts of the borough for which it was the undertaker.

Middlesbrough.—The T.C. has made an agreement to supply electricity to the Teesside Railless Traction Board. The cost will be £1 000 and application is being made to the Electricity Commissioners to borrow this amount. Energy will be supplied at .75d. per unit. The agreement will last approximately 10 years. The Board will erect its own sub-station.

Rothesay.—Under an agreement providing for the comprehensive use of electricity within the burgh, and a general reduction in the present scale of charges by the autumn of 1947, the T.C. has agreed to transfer the electricity undertaking to the North of Scotland Hydro-Electric Board on May 15, 1946, subject to the approval of the Electricity Commissioners.

Oldham.—Reduced sales of electrical energy were reported at a meeting of the Electricity Committee. The units sold during May for lighting and power totalled 7 899 192 and for traction 90 370, representing a decrease of 1 628 567 compared with the sales during the corresponding period of last year. The drop in coal consumption was about 25 per cent.

Electricity in Sweden.—Recently published statistics show that the production of electrical energy in Sweden reached a new peak during 1944, amounting to 12 300 million kWh, or about 1 300 million more than during the preceding year. The increase related mainly to the latter part of the year, when several new power plants were taken into use.

Hampstead.—The statement of accounts of the Hampstead electricity department for the year 1944-45 shows a net income of £241 213, compared with £223 502 in the previous year, and a net profit of £7 390, as against £17 164 in 1943-44. Sales of current brought in £231 746, as against £208 465, while the total working expenses increased from £202 016 in 1943-44 to £229 665 last year.

Carlisle.—At a meeting of the City Council, Mr. J. R. Potts, chairman of the Electricity Committee, referred to coal charges for the electricity undertaking. He stated that if the undertaking had been run on a purely commercial basis, it would have been necessary to increase electricity charges two or three years ago. It had been possible to stave this off and the increase in domestic charges was hardly noticeable. If, however, there was another increase in the exorbitant price of coal, electricity charges would have to be increased.

Birmingham.—The annual report of the electricity undertaking for the year ended March 31, shows a surplus of £33 130. The quantity of electrical energy sold within the undertaking was approximately 1 261 million units. In addition, 357 milloin units were supplied to the C.E.B. for use in other parts of the country. The revenue for the year was £4 703 820 and the trading expenditure amounted to £3 803 279. The total capital raised to date for the undertaking is £23 768 912, of which £10 659 685 has been redeemed.

Liverpool.—Owing to recent increases in the cost of coal, electricity at .3d. and .4d. per unit is being sold at less than the coal cost. This was stated at a recent meeting of the City Council which approved increases in certain electricity tariffs. It has been decided to bring all unit charges up to .5d. per unit. The tariff most affected is one applying to private houses in which the charge is 12½ per cent. of the net rateable value for the first 750 units per quarter and .3d. for the remainder. In future, consumers will pay ½d. per unit all round. Any special flat rate tariff with a unit charge of less than .5d. per unit will, in future, be charged at .5d. per unit.

Company News

HOOVER LTD.—Intm. on ord. 3¼%, payable Aug. 9 (same).

BENNIS COMBUSTION, LTD.—Fin. div. 5%, mkg 10% (same).

GOODYEAR TYRE AND RUBBER (U.S.).—Qtrly. 50 cents (same).

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO. LTD.—Intm. div. 5% (same).

SWAN HUNTER AND WIGHAM RICHARDSON, LTD.—Intm. div. 4%, less tax (same), on ord.

DELHI ELECTRIC SUPPLY AND TRACTION CO. LTD.—Fin. div. 5% (same), mkg. 9% tax free (same).

BROADCAST RELAY SERVICE.—Fin. div. on ord. 3½% (same) mkg. 7% (same), for yr. to Mar. 31 last.

HICK HARGREAVES AND CO., LTD.—Net pft. to Mar. 31, £38 571 (£40 169). Fin. div. 8% (same), mkg. 10%.

GEORGE KENT, LTD.—Net pft. to Mar. 31, £29 743 (£32 944). Fin. 7% (same), plus bonus 2½%, mkg. 12½% (same).

BRUSH ELECTRICAL ENGINEERING CO., LTD.—Co. has acquired Oil Engines (Coventry), Ltd., from Lagonda, Ltd.

A.B.C. COUPLER AND ENGINEERING CO., LTD.—Div. on ord. for yr. endg. Sept. 30, 1944, 15% (12½%). Net pft. is stated as £6 534 (£6 775).

RADIO RENTALS, LTD.—Dirs. are offering 34 000 5s. ord. shs. at 22s. 6d. each in proportn. of one for every twelve ord. held on June 27 last. Lists will close on July 18.

PALESTINE ELECTRIC CORPORATION LTD.—Div. on ord. and "A" ord. 5% tax free (same). Net pft. is stated as £119 129 (£125 687) after taxation, and £30 000 to defd. maintenance (£20 000) to war res.).

THE GREAT NORTHERN TELEGRAPH CO., LTD. (OF DENMARK).—An announcement regarding the first interim dividend on account of the year 1945 will be made simultaneously with the announcement of the financial results for the year 1944.

TELEPHONE MANUFACTURING CO., LTD.—Gross tradg. pft. for 1944, £373 120, £112 623 decrease. With other income of £6 234 (£6 604), pft. total is £112 993 lower at £379 354. Net pft. £217 719, £56 364 decrease. Carry-fwd. £10 010 (£10 065).

REVO ELECTRIC CO. LTD.—Pft. Mar. 31 (after deprecn.) £249 266 (£201 446). Tax £164 045 (£125 586), fees, provsns., etc., £15 100 (£9 015), leavg. £70 121 (£66 845). Div. and bonus 17½% £32 156 (same), to gen. res. £25 000 (same), stock contings. res. £10 000 (plant deprecn. £5 000), fwd. £83 166 (£80 201).

ENFIELD ROLLING MILLS LTD.—Pft. 1944 (incldg. tax refund) £102 875 (£113 921). To deprecn. £39 152 (£45 055), interest £4 385 (£3 773), deb. int. £7 896 (£8 040), fees, war damage, etc., £8 671 (£13 619), obsolescence £1 872 (£10 260), tax £28 500 (£8 000), div. 5% £14 000 (same), fwd. £121 457 (£123 058).

FOLKESTONE ELECTRICITY SUPPLY CO. LTD. (subsid. of County of London Electric Supply).— Rev. 1944 £141 245 (£115 402), less chges. and fees £89 318 (£75 256), lvg. £51 927 (£40 146). To deprecn., etc., £25 000 (£23 500), tax £20 000 (£29 000), contings. £3 000 (£2 000). Pref. div. two yrs. to Sept. 30, 1944, £2 500 (same), fwd. £9 205 (£7 778).

FRANCIS MORTON AND CO. LTD.—Trdg. pft. to Mar. 31, £72 919 (£78 876), other income £1 196 (£930); to dirs.' fees £1 000 (£4 458), tax £49 212 (£51 212), leavg. net pft. £23 903 (£24 136). To 5% intm. (same) on pref. and ord. £4 250, fin. on pref. and ord. 7½% (5% on each) £6 375 (£4 250), bonus on pref. and ord. 5% (same) £4 250, mkg. 17½% (15%) on each class; fwd. £57 536 (£48 508).

COMPAGNIE FRANCAISE THOMSON-HOUSTON.—Earngs. for yr. to Dec. 31 were affected by interruption of activity and unremunerative prices. Profit of Frs. 16 038 000 (Frs. 32 813 000) is allocated to deprecn. and raw material reserves. Frs. 2 506 000 is carried fwd. Div. for 1943 was Frs. 16.25. An amount of Frs. 100 000 000 3¾% debs. was issued in Jan. to replenish workg. funds.

ISLE OF THANET ELECTRIC SUPPLY CO., LTD.—Rev. 1944 £77 804 (£60 821), less exes. £43 595 (£39 635), leavg. pft. £34 210 (£21 186), plus int. £786, employees' savings res. not required £1 555, mkg. £36 551. To cap. redmptn. skg. funds £11 679 (£11 681) deb. int. £8 283 (£8 475), skg. fund int. £2 782 (£2 361), leavg. credit blce. £13 806 (debit £1 331), reducing debit blce. to £22 066.

LLANDUDNO AND COLWYN BAY ELECTRIC RAILWAY.—Net rev. on operatn. 1944, after £6 800 (£6 700) dfd. repairs was £7 271 (£7 192) less deprecn. £5 202 (£5 113) and £1 369 (£1 379) int. on inc. deb., lvg. £700 (same), which is divisible in terms of scheme of arrangemt. as to 25% (£175) for deb. sinkg. fund and as to 75% (£525) for div. Div. on prefd. ord. 2% (same) absorbing blce. of net earngs.

WARD AND GOLDSTONE LTD.—Fin. div. on ord. 10% (same), and special bonus 5% (nil), mkg. 25%. for yr. to Mar. 31 (20%). Net pft. is stated as £38 939 (£28 330).

EASTERN EXTN. AUSTRALASIA AND CHINA TELEGRAPH. — Income 1944 £348 182

(£340 362). Exes. and deb. int. £37 867 (£39 013). Net pft. £310 315 (£301 349). Brot. in £2 797 (£1 447). Fin. div. 4¾% (same), mkg. 7½% (same), fwd. £13 112.

FRANCO SIGNS, LTD.—Combined trading pfts. to Sept. 30, 1944, of subsids., after all exes., tax and deprecn., £30 970 (£28 577), and a div. of £10 000 net (same) was paid to Franco Signs. Net premium of £20 955 received on Franco Signs sh. issue in March, 1945, transfd. to res., together with £3 958 from rev. acct., mkg. it £25 000. Div. 10% (same) on 400 000 old shs. for yr. to March 31, 1945, £10 000, fwd. £7 570 (£11 467).

LIGHTFOOT REFRIGERATION CO., LTD.—Gross pft. 1944 £102 984 (£98 882). To deprecn. £11 680 (£14 968), dirs.' fees £1 300 (same), deb. int. £3 813 (£6 868), tax £65 400 (£40,000), lvg. net pft. £21 068 (£37 745) plus pft. sale of Calcutta factories £31 316 and res. for subsids.' losses not required £8 940. To deb. redmptn. £1 140 (£210), off goodwill £1 800 (nil), 5% cap. pft. distribtn. £15 896, blce. cap. res. £12 563, fwd. credit £3 591 (debit £26 417).

MORGAN CRUCIBLE CO., LTD. — Yr.'s accts. to Mar. 31, show a tradg. pft. £305 828 lower at £488 391. Investmt. income rose £27 712 to £69 337, and specific reserves no longer required have bn. appropriated to the extent of £60 786 (£44 283), total £618 514 (£880 127). Fees, interest and taxatn. absorb £295 794 (£673 008), pref. £54 475 (same) and ord. divs. £121 387 (£107 900). Gen. res. nil (£44 283), off trade investmt. £147 000 (nil). Blce. fwd. £1 378 (£1 520).

WATFORD ELECTRIC AND MANUFACTURING CO., LTD.—Trdg. pft., after deprecn., 1944 £50 130, (£65 719), other inc. £194 (£331); to dirs.' fees £400 (same), lvg. £49 924 (£65 650). Brot. in £21 546 (£20 443), plus prov. for tax not now reqd. £3 393 (nil), mkg. avail. blce. £74 863 (£86 093). To tax £37 643 (£58 297), bldg. res. £1 000 (same), post-war changeover res. £5 000 (nil), pref. div. £1 500 (same), intm. ord. divs. totalling 15% (same) on larger cap. £4 250 (£3 750); fwd. £25 470.

THE GREAT NORTHERN TELEGRAPH COMPANY'S HOLDING CO., LTD. (OF DENMARK).—In view of the intention to hold an extraordinary general meeting of the Great Northern Telegraph Co., Ltd., later this year for submission of the accounts for 1944, the accounts of the holding company for the company's financial year 1944/45, which should normally be closed on June 30, 1945, will be held open until the question of the Great Northern Telegraph Company's dividend for 1944 has been decided at the above-mentioned meeting.

GARRARD ENGINEERING AND MANUFACTURING CO.—Net pft. to Jan. 31 (after deprecn., tax, etc.) £22 893 (£24 513), plus fees £40 (£36), mkg. £22 933 (24 549). To dirs.' fees £1 680 (same), prefd. div. 10% £37 500 (same), ord. div. 25% £8 126 (same) and bonus 5% (nil) £1 625.

CEARA TRAMWAYS AND POWER CO., LTD.—Net rev. to June 30, 1944, £12 894 (£28 918). To inc.-tax £3 167 (£8 605), depcn. res. £13 200 (same), prior lien int. and fst. deb. sinkg. fund £1 688 (same), lvg. deficit fwd. £7 675 (£774 deficit after deductg. res. for contins. £11 663).

CHLORIDE ELECTRICAL STORAGE CO., LTD.—Rept. for year to March 31 shows total assets risen £875 713 to £6 307 675. Pfts. after E.P.T., includg. those of subsidiaries to the extent of the gross divs. declred. and inc. from other investmts., were £526 033 (agst. £517 672). Prov. for inc. tax £220 000 (£245 000) and dirs.' fees £5 000 (same), leavg. net pft. £301 033 (£267 672). Allocatn. to res. for develpmt., research and reconstructn. £50 000 (same) and to employees' funds £57 000 (£37 000). After providg. £3 720 for the 6% pref. div., carry-forward is £203 913 (£176 905). Report states that in the accts. of the parent co. no depreciatn. has been charged on fixed assets for year, but cap. addns. amountg. to £13 370 have been written off. Depreciatn. amountg. to £102 539 has been charged in the accts. of the subsidiaries. Meeting, July 15.

RUSTON AND HORNSBY, LTD.—Tradg. pft. to March 31, after deprecn., managmt. exes. and E.P.T., £310 910 (£301 073), plus gross divs. fm. subsid. not wholly owned £22 500 (same), and gross div. fm. assoc. cos. and other invests. £39 150 (same), mkg. £372 560 (£362 723). To deb. int. £15 750 (same), deb. int. Davey Paxman £2 732 (£2 789), dirs.' fees £2 959 (£2 678), dirs.' fees Davey Paxman £1 000 (£922), leavg. combined net pft. of co. and wholly-owned subsids. £350 119 (£340 584). To tax on wholly-owned subsids. £30 755 (£28 313), retentions on sub. co.'s res. and pft. and loss accts. £16 460 (£19 786), leavg. parent co.'s net pft. £302 904 (£292 485). Brot. in £60 615 (£60 988). To tax £149 751 (£141 420), pensions £15 000 (same), post-war contng. res. £50 000 (£25 000), gen. res. nil (£22 813), pref. div. £11 750 (same), ord. div. 12½% (same) £76 875; fwd. £60 143.

ELECTRIC CONSTRUCTION CO., LTD.—Prelim. statement to March 31 shows net pft., after E.P.T., of £86 488 (£90 120). Brot. in £38 411 (£33 641), mkg. avail. blce. £124 889 (£123 761). To pref. div.

£3 500 (same), tax £42 500 (£41 000), defd. repairs nil (£4 600), gen. res. £20 000 (£15 000), superannuation nil (£2 500), ord. div. 12½% (same) £18 750, fwd. £40 149. Mtg., July 17.

Company Meeting

MEXICAN LIGHT AND POWER CO., LTD.—At the annual meeting held in Toronto on June 29, Mr. E. A. Graydon, who presided, said that an increase in rates had just been granted to become effective immediately. The increase would not redress the company's economic situation to the extent that it would earn a fair return on invested capital, but with increased sales made possible by new generating facilities, it would probably enable them in 1946 to bring the second mortgage sinking fund payments up to date, and resume income debenture interest. The company had agreed to undertake the installation of another 25 000 kW steam unit at Nonoalco, which would entail a considerable capital outlay.

Commercial Information

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.*

LYMBERG (male), 84, Forest Street, East Kirkby, radio dealers. £13 7s. 2d. May 25.

BARTON, T.W. (male), trading as B.E.-T.A. Services (Croydon), 221, Ross Road, S.E.25, electrician. £80 5s. 4d. April 18.

BRITISH AMERICAN RADIO SERVICE, 19, Stonecot Hill, Sutton, electricians. £50 9s. 4d. April 18.

Companies Winding-up

DOWNTON ELECTRIC LIGHT CO. LTD.—At a meeting of the company, held at 24-30, Gillingham Street, London, S.W.1, on June 26, 1945, a resolution was passed that the company be wound up voluntarily and that Mr. Arthur M. Scott, of 24-30, Gillingham Street, London, S.W.1, be appointed liquidator.

AMESBURY ELECTRIC LIGHT AND GENERAL SUPPLY CO. LTD.—At a meeting of the company, at 24-30, Gillingham Street, London, S.W.1, on June 26, 1945, a resolution was passed that the company be wound up voluntarily and that Mr. Arthur Mr. Scott, of 24-30, Gillingham Street, London, S.W.1, be appointed liquidator.

BRITISH INSULATED CABLES LTD.—At a meeting of the company, held on June 29, 1945, at Winchester House, Old Broad Street, E.C.2, a resolution, was proposed and passed that the businesses of this company and of Callender's Cable and Construction Co. Ltd., be amalgamated, that the company be wound up voluntarily and that Sir William McLintock, Bt., of Granite House, Cannon Street, London, E.C.4, be appointed liquidator.

Satisfaction

TURNER AND BOOTH LTD. (formerly TURNER AND BOOTH (SOUTHPORT) LTD., Southport, electrical engineers.—Satisfaction June 22, of deb. reg. Dec. 1, 1936.

Receiving Order

BOOT, Cyril Henry, 39, St. Cuthberts Street, Wells, Somerset, formerly residing and carrying on business at 29, Lyndon Road, Rubery, near Bromsgrove, Worcester. Radio and electrical engineer. Petition filed June 25. Receiving Order, dated June 25. Debtor's petition.

Metal Prices

		Monday, July 9. Price.	Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	9 7/16d.	—	—
Sheet	„	11 1/16d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. 0 7/16d.		—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
Wire „	„	11¼d.	—	—
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) Warehouse	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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