

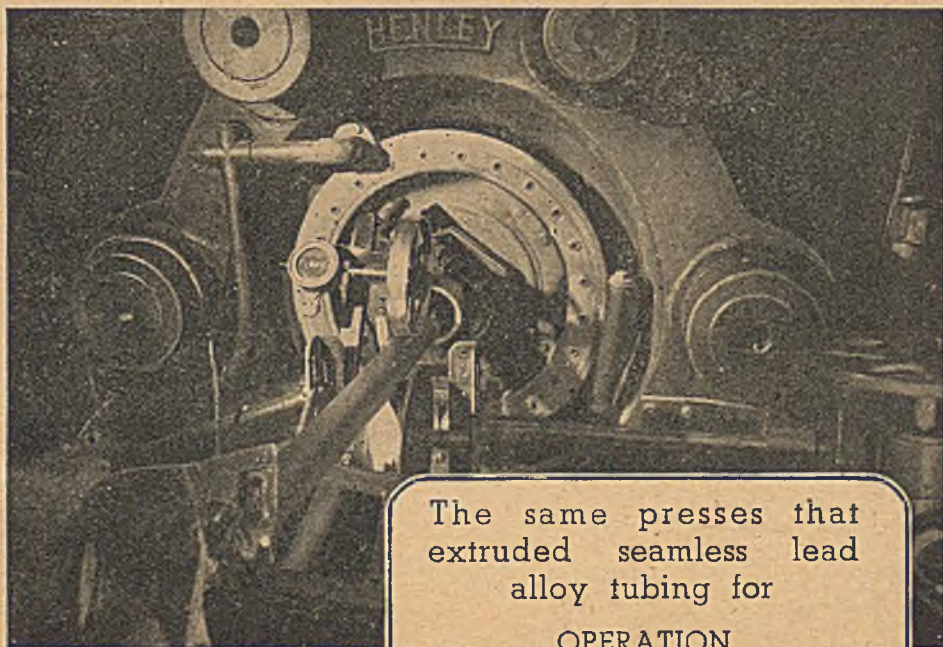
THE ELECTRICIAN

Vol. GXXXV. No. 3508

Friday, August 24, 1945.

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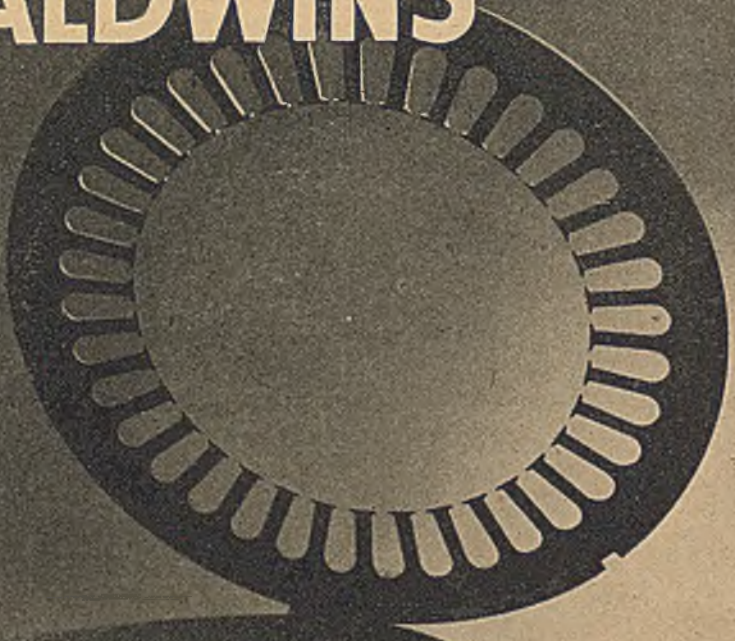
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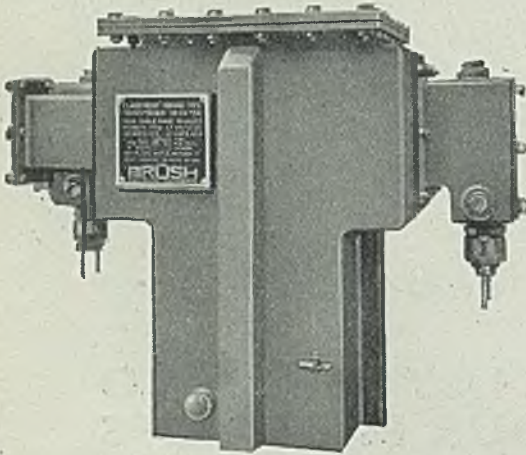
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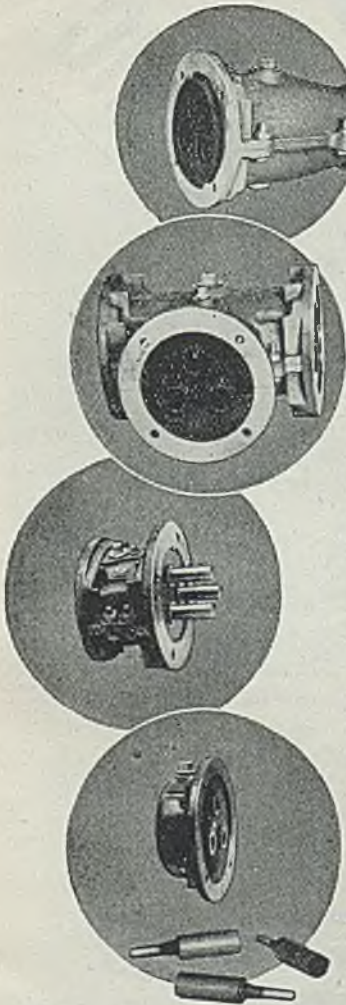
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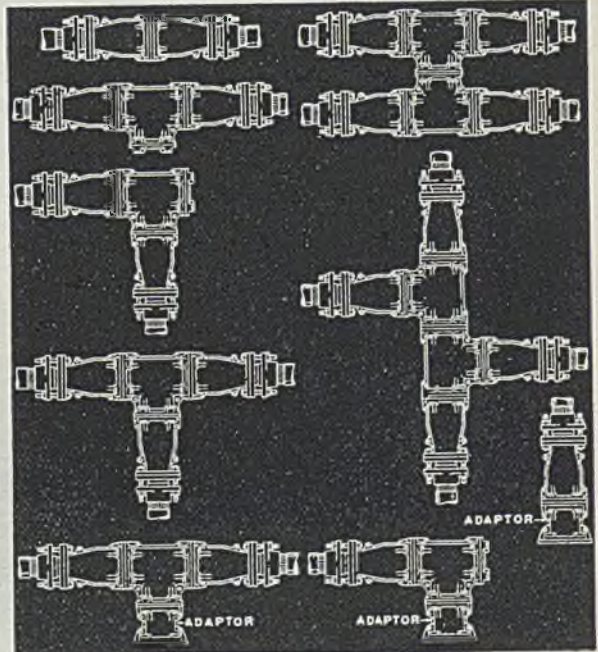
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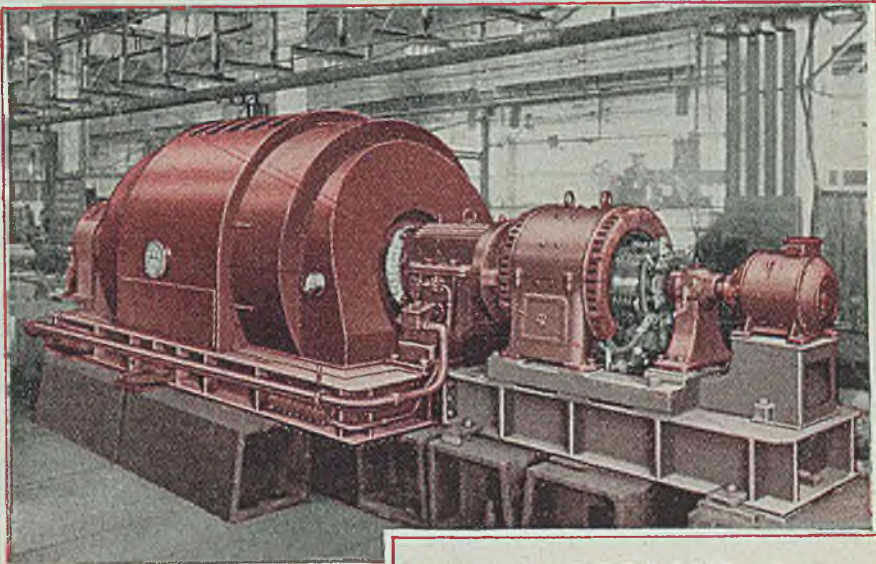
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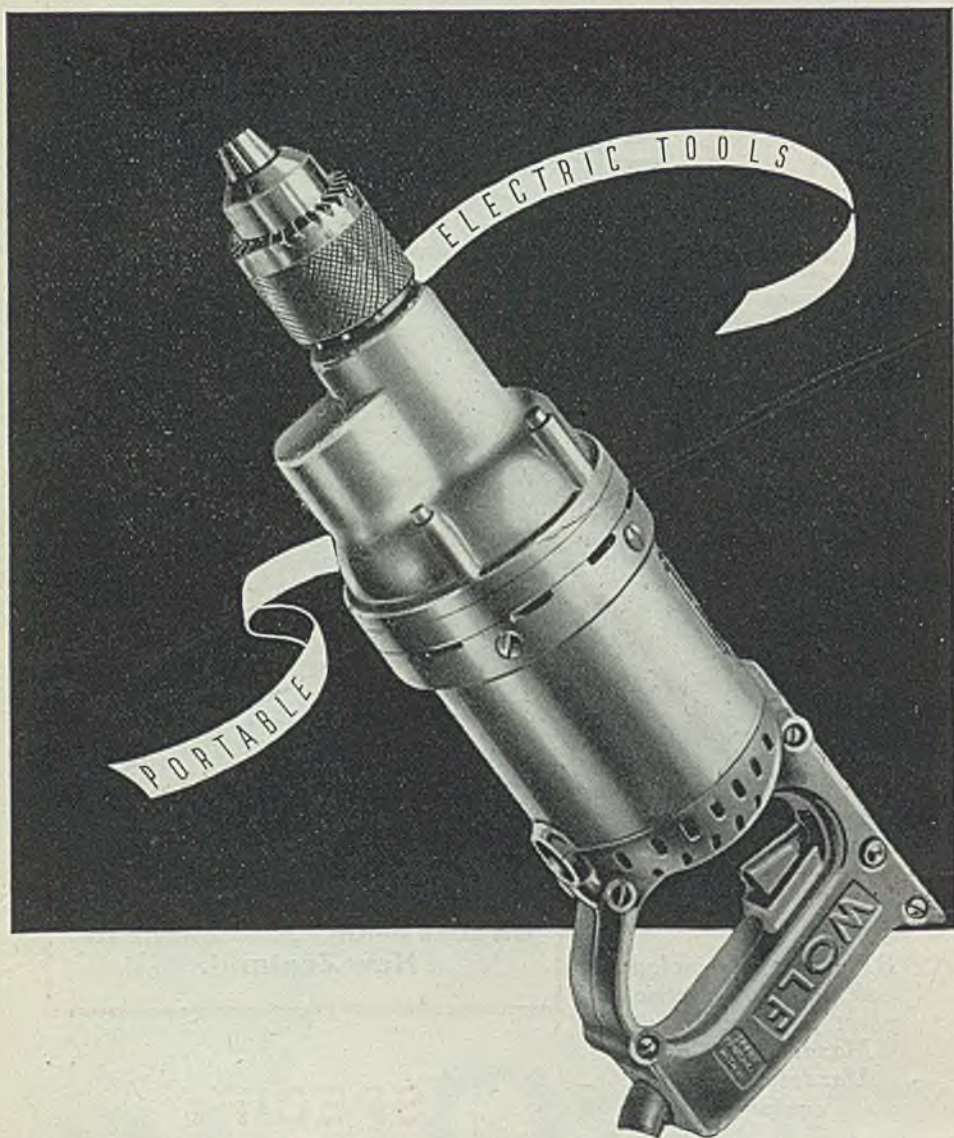
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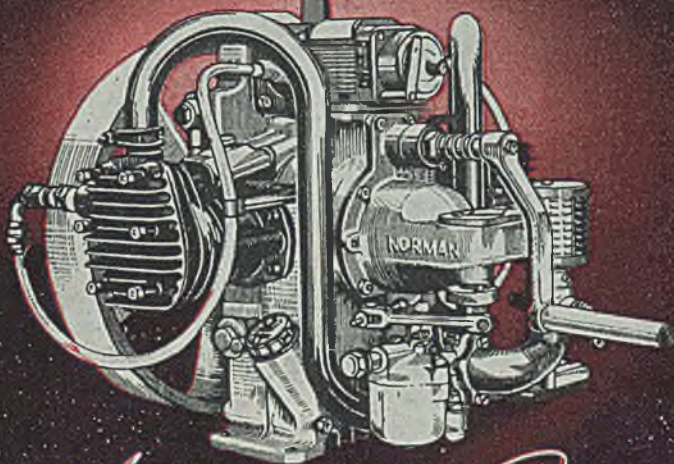


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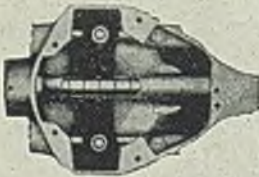
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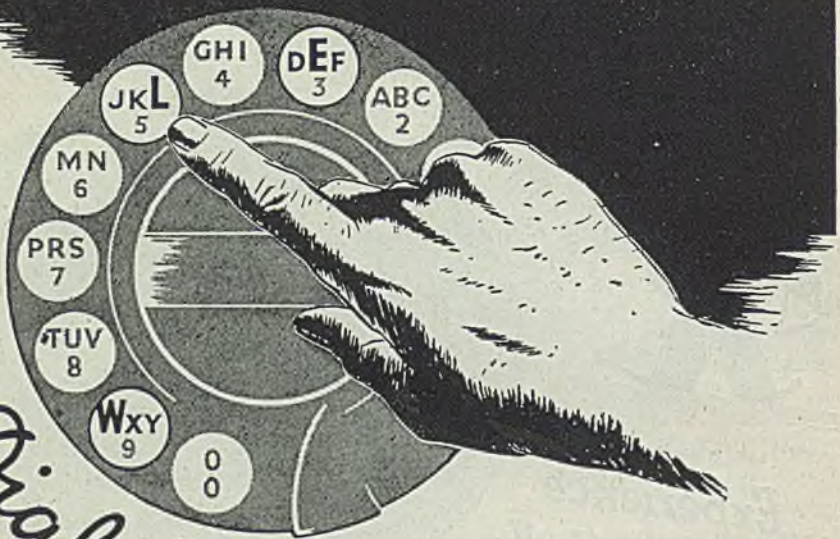
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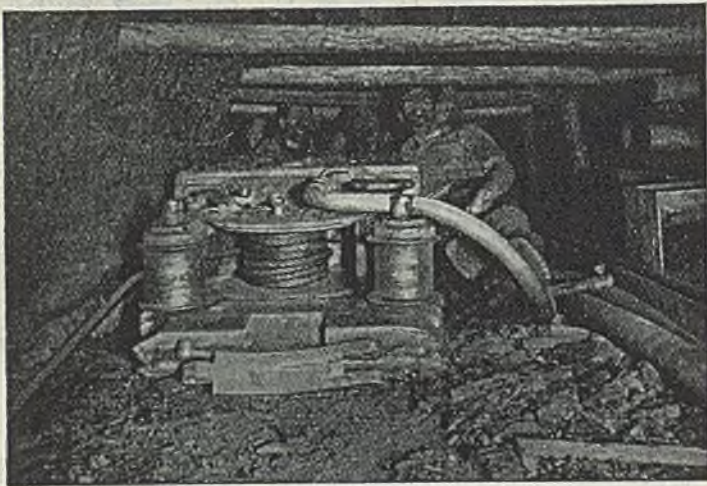
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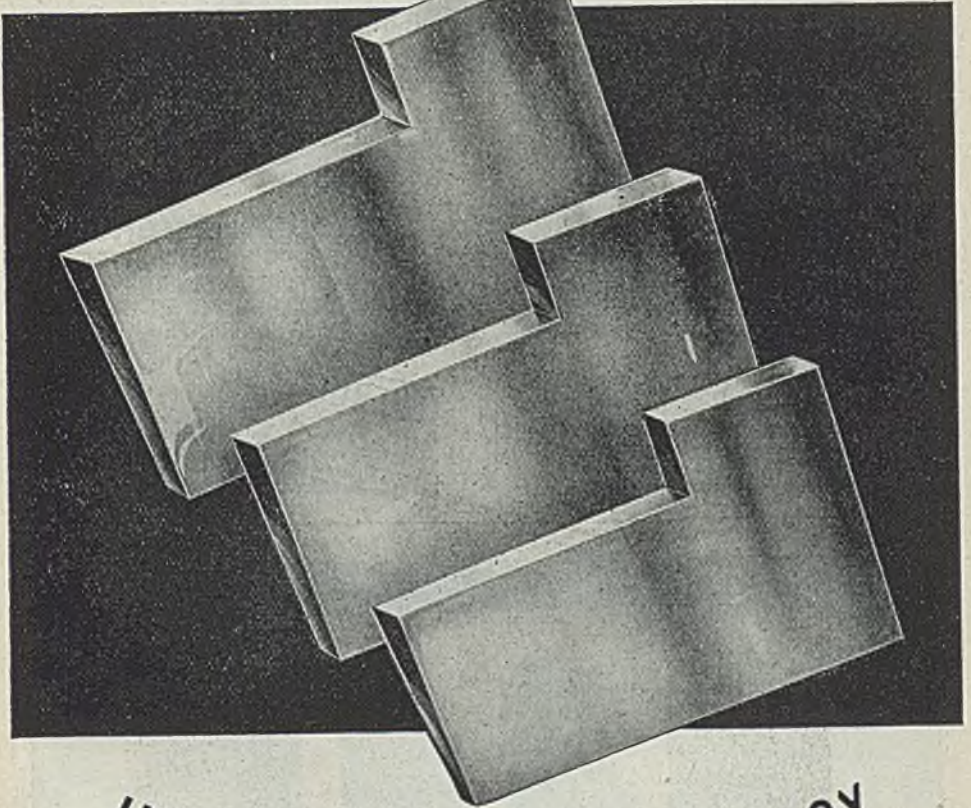
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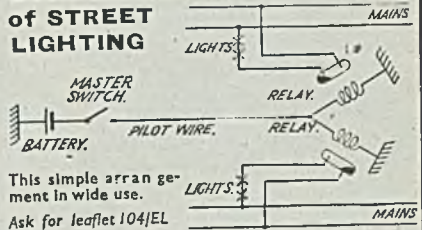
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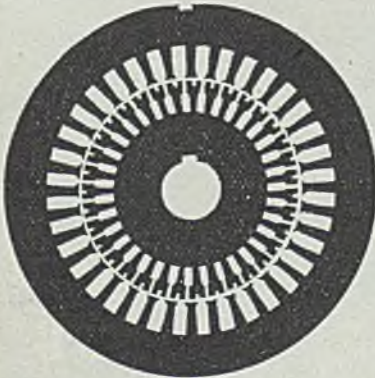
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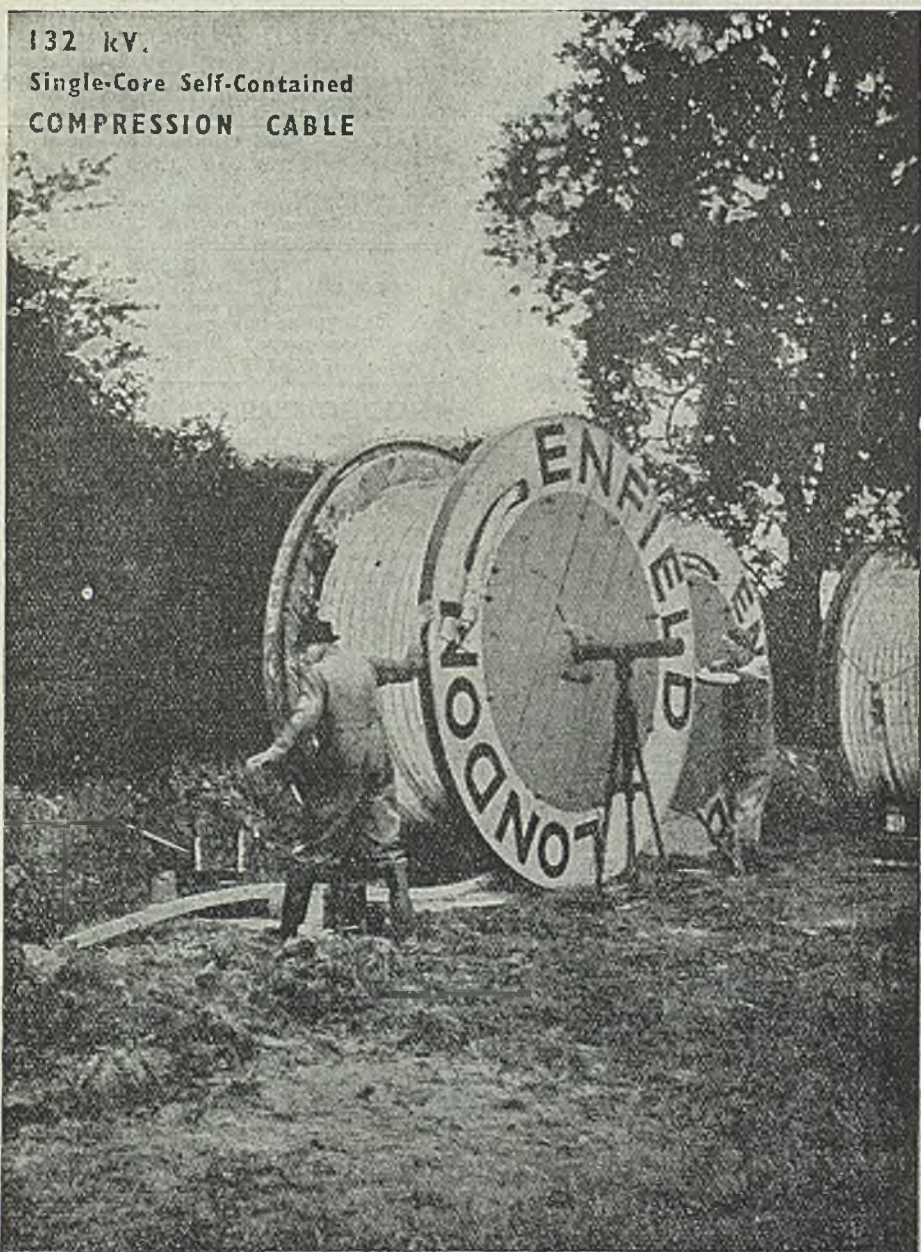
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The Offices of THE ELECTRICIAN are closed on Saturdays in accordance with the "Five-day Week" plan adopted by Benn Brothers, Ltd., and its associated publishing organisations. Until further notice the offices will be open between the hours of 9 a.m.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

No. 3508. [No.8
Vol. CXXXV]

August 24, 1945

Annual Subscription 25s.
Overseas 30s.

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embarrassing in its interest at the time—in that it taxed the accommodation of the I.E.E. building to the utmost and had to be delivered on a second occasion—has, as a result of the unnecessarily heavy hand of officialdom now lost much of the attention it deserves, in that with the permission to publish has been released volumes of information regarding applications of radiolocation, the training of personnel, and so on, thereby deflecting public interest from the more important principles upon which the whole arrangement works, to the more spectacular aspects of operation.

Radiolocation

A CONSIDERABLE amount of information is released from censorship this week with respect to the part which the electrical industry played in the development and production of the equipment which gave practical application to the war-time results of research carried out on radiolocation, and in this issue will be found details of some of the industry's achievements. Also included in this issue is an abstract of the lecture which Sir EDWARD APPLETON, F.R.S., delivered on the scientific principles of radiolocation, in the Lecture Theatre of the I.E.E. last April.

The success which attended the research carried out in the years immediately preceding the war will be realised from the contours of the sketch maps reproduced on page 185, showing the depth and height of cover with which the country was protected at the time of the Battle of Britain. These same maps bring home, too, appreciation of the enormous effort which the industry brought to bear in meeting the demand for equipment, for special valves, transmitters and receivers, while at the same time providing technical man-power to handle the equipment, train Service personnel, and maintain the chain stations in good repair.

It will be remembered that after hearing Sir EDWARD'S remarks, we mentioned that he said nothing which in our view could not then have been published, for the lecture did not reveal sufficient data to make it of material assistance to our enemies. These omissions were, no doubt, due to the deliberate intention of the lecturer, and from the abstract of the lecture given this week, it will, we feel, be appreciated that the censorship authorities have been unduly cautious, to say the least. The lecture, almost

These efforts have until this week been a closely guarded secret so far as publication is concerned, but in this issue tribute is paid to the work which was executed with such skill and enthusiasm, and but for which, the Battle of Britain might have ended differently. The names of the various manufacturers mentioned are for the most part well known, but there must be many firms whose manufacturing capacity, too small to warrant individual mention, when tied to the machinery of their bigger brothers made

an appreciable contribution to the defences of the country, and to whom credit is equally due.

An Old Fallacy Disproved

UNLIKE the application of atomic energy, the future of radiolocation is assured an immediate peace-time use in reducing the hazards of air and marine travel, in predicting the most suitable wavelengths for use in communicating over various distances at different times in all parts of the world, and in the furtherance of our knowledge of the electrical reflecting layers in the upper atmosphere. It has often been said that though we in this country may provide many fundamental researches, we are never able to apply the results; the history of radiolocation disproves such a statement.

Floodlighting of Big Ben

IN a letter to the London "Evening News," a correspondent has made the suggestion that the floodlighting of Big Ben should be made permanent, as a reminder to all who pass of the dangers to which the country has been subjected in the last six years, and to serve as a war memorial to all those who have suffered. The idea will, no doubt, commend itself to the electrical industry, but we would like to see, in addition, the permanent floodlighting of all those other features of London, which at the time of the Faraday Centenary celebrations assumed a nocturnal interest never before enjoyed. The floodlighting permitted during the VJ celebrations were scanty in comparison and disappointingly short; in the circumstances the suggestion that Big Ben should be permanently floodlighted, is a good one, and, if acted upon, would do at least something to reveal the beauty which may be produced by painting with light. It might, of course, be argued by the Ministry of Fuel that such lighting would be against the public interest and an unnecessary consumption. To which we might reply—no more so than the many incandescent gas lamps which may be seen in the city of London burning in competition with daylight.

Turbo-Electric Tanker

AN indication of what we hope may be a future trend, is the placing of an order by the Anglo-Saxon Petroleum

Co., Ltd., for an oil tanker of 17 000 tons dead-weight to be driven by turbo-electric machinery. The new vessel will have a speed of 16 knots, and a shaft horse-power of as much as 13 000, and upon her performance may depend the building of many similar tankers. Since 1939, little or nothing has been heard of the progress of the turbo-electric ship, but that progress has been made cannot be in doubt. Before the war there was evidence in plenty that this form of propulsion was establishing itself in mercantile marine circles, though there still existed a core of resistance against its more general adoption. The wartime tanker experience of the Anglo-Saxon Petroleum Co., will no doubt have influenced the company in ordering a vessel of the turbo-electric type, as opposed to the more normal oil or coal drive, and it is anticipated that the experiences of other companies owning sea-going fleets will have been such as to encourage them also to turn to electricity.

Mr. J. S. Highfield

BY the death of Mr. J. S. HIGHFIELD, last week, the electrical industry has lost an engineer whose knowledge of electricity supply transmission and distribution was wider than is that of most of us, and his views on future policy will be sorely missed. Though Mr. HIGHFIELD had had a long experience as a power station engineer, he will be remembered by most readers as a partner in the firm of consulting engineers, Messrs. Highfield and Roger Smith, who acted as consultants for the Central England Scheme of the C.E.B. He was this year made an honorary member of the Institution of Electrical Engineers, of which body he was a past-president, and in awarding this honour at a meeting of the institution last April, Sir HARRY RAILING referred to Mr. HIGHFIELD as the originator of the metal-enclosed bus-bar system for switchgear, the discoverer of the reason and remedy for the failure of h.t. alternator windings, and the introducer to this country of the Thury system of l.t., d.c. constant current generation and distribution. He also carried out original experiments on air-insulated single core cables which were tested successfully at 60 kV. His inter-

ests were by no means confined to electrical affairs, however, for a keen yachtsman, he was vice-commodore of the Royal Thames Yacht Club, and during the 1914-18 war demonstrated at sea the use of shrouded hydrophones for detecting submarines. He took an active interest as vice-president in the affairs of the Royal Institution and of the Royal Society of Arts.

Durham Power Station Controversy

THE outcome of the opposition to the proposal of the North-Eastern Electric Supply Co., to build a power station at Kepier, is that the company in an endeavour to mitigate the effects of the delay which has taken place in the matter, "have taken steps to meet present demands for additional electric supply by the installation of plant elsewhere than at Kepier." This statement has behind it the authority of the Minister of Town and Country Planning, and is largely in accordance with the views expressed by the Minister at the time of the inquiry last December. It is obvious that the main concern of the opponents to the proposal to build the station, was not so much the welfare of the industrial north as the glory of Durham, and while this may be a commendable attitude to take up it would be wrong to assume that the North-Eastern E.S. Co. were unmindful of the beauty of the city or that it was their intention to in any way spoil it. However, whatever objection to the scheme there may have been is now, we hope, satisfied and there remains only to be learned where and when the new station is to be built.

British and American Co-operation

THE VJ-Day celebrations last week, understandably deprived the meeting of the International Chamber of Commerce of some of the attention it would have otherwise received, and at a luncheon of the American Chamber on Monday, Mr. WINTHROP W. ALDRICH, the president, took the opportunity or reporting upon the proceedings. The luncheon was, incidentally, attended by Mr. PHILIP D. REED, chairman of the G.E.C. of America. Mr. ALDRICH is a champion of private enterprise and is a believer that the economic welfare of this country is inseparably bound up with that of the

United States. His remarks, though not necessarily directed to the electrical industry, have a special interest for all who hope to engage in export trade, and for this reason, an abstract of his address is given on another page. The views expressed may possibly promote discussion, for there must be remembered that during the last week no fewer than 650 controls affecting American industry have been abandoned, and the American manufacturer may now enter trade fields where his British counterpart is not permitted to tread; these fields, according to report, include the manufacture of portable domestic appliances, refrigerators, radio sets, and cookers.

Electrical Appliances and Purchase Tax

THE industry will have read with special interest, the promise made by the Chancellor of the Exchequer, on Tuesday, that he is to consider the suggestions made by local authorities and other bodies, that domestic electrical appliances should be exempt from purchase tax. The demand for such equipment by the house building programmes alone, is extensive, in that every dwelling, temporary or permanent, must sooner or later be fitted with cooking appliances, and the like—not as luxury articles, but as necessary appointments of the dwellings as are wash basins, tables and chairs. The position at the moment makes the acquisition of such appliances unduly costly, for whereas hitherto supply authorities have been hiring their domestic equipment on favourable terms to the hirer, the application of purchase tax makes resumption of these hiring schemes extremely difficult. With the present scarcity of electrical appliances the tax cannot result in much revenue, but unless it is removed it is likely to react unfairly on those small income groups, who, in the absence of hire schemes, are required to purchase appliances outright. Electrical appliances, it will be admitted, are essential in every home and since the Government has promised early relief in the house shortage, both by requisition and building, it seems reasonable to assume that the appliances necessary to run those homes, should be freed from taxation so that their purchase may be within the scope of all pockets.

Blackburn Electrical Exhibition

Advanced Views on Housing—The North-West Kitchen

THE advent of the all-electric house which will reduce domestic drudgery to a minimum, and electrification of industry, were advocated at Blackburn by Coun. G. B. Eddie, chairman of the Housing Committee and a member of the National Hous-

When this was dealt with the development visualised by Coun. Eddie would be expedited.

Mr. C. D. Tate (managing director, Lancashire Electric Power Co.), who said he was a personal friend of Mr. Giles, Blackburn's first electrical engineer, said one reason why electricity was expensive was because of the small scale generation which had applied hitherto. With proper planning this drawback would be overcome.



Mrs. Moffat; Coun. G. B. Eddie, chairman, Housing Committee; Ald. C. A. Critchley, chairman, Electricity Committee; Mrs. Harral; and Mr. R. H. Harral, electrical engineer and manager, at the Blackburn Exhibition

ing Advisory Committee, when opening on August 14 the exhibition organised by the British Electrical Development Association under the name of "Electricity Looks Forward." The display was sponsored by Blackburn, Bacup, Accrington and Rawtenstall undertakings and the Lancashire Electric Power Co.

Coun. Eddie said the slogan in which he pinned his faith was: "Plan or perish"—plan with courage and wisdom. In such planning electricity must have an opportunity of proving its enormous benefit to the community. He wanted big developments in its application to housing because it would reduce domestic drudgery and help to provide cleanliness, comfort and convenience. But all the gadgets in the world would not provide a satisfactory home, badly planned to begin with. Housing should keep pace with the growth of education and culture and the use of electricity was one way to do it. He wanted an end of the pre-war policy of using electricity grudgingly, and installing the minimum number of appliances. Houses must have full and complete wiring installations. These things were not expensive luxuries, but ordinary necessities.

Sir Thos. Higham (Accrington), agreeing on the possibilities of electricity, said one of the greatest drawbacks was its cost.

In the assembly hall at the exhibition is almost every type of domestic and canteen equipment incorporating both utility and novelty. The N.W. built-in kitchen is particularly intriguing in that it is based on ideas submitted by housewives in the north-west, invited to submit their suggestions for the "ideal kitchen." There are larger domestic units of different patterns which include fluorescent illumination, dining room recess, and washing facilities. A pre-fabricated bathroom-kitchen on view, requiring only a few hours to instal, is also attractive. The heating service is so arranged between the ground floor bathroom and kitchen as to effect every economy in heating space. Another hall is devoted exclusively to all-electric industrial plant including a Northrop automatic loom, electrode boilers, humidifiers, infra-red drying plant, etc. The exhibition closes tomorrow, Saturday.

TESTING FINISHED MOULDINGS

The British Electrical and Allied Industries' Research Association has published Report Ref. B/T40, entitled "Methods of Testing Finished Mouldings," by B. Shearman, B. C. Fleming-Williams, Z. Rogowsky and D. J. Strong. The report describes a series of investigations to ascertain whether tests usually carried out on moulded materials with standard test-pieces could be made on miniature specimens cut from finished mouldings.

Methods of cutting the mouldings are discussed and specimen sizes are suggested. Tests which could be applied to specimens obtained from mouldings were evolved for impact strength, cross-breaking strength, crushing strength, electric strength, surface resistivity, plastic yield with temperature, resistance to heat (glowbar), specific gravity and water absorption, and are described. The results obtained by these tests are compared with those of standard tests to see how far correlation is obtained, and tentative conclusions are drawn.

Copies of the report may be obtained from the Association, price 3s. 10d., post free.

Radar in Production

Electrical Manufacturers' Achievements Since 1939

IN THE ELECTRICIAN last week were given some details of the application of radiolocation, and below will be found particulars of how the electrical and radio industries managed to cope with development and the ever-growing demand. At the peak of the European war a quarter of a million people were engaged in various phases of manufacture, and last year 38 million valves were produced for the Services, compared with a quarter of a million in peace-time. An additional production of 360 000 cathode-ray tubes each year was necessitated by the needs of radar alone.

Some appreciation of the equipment involved will be gathered from the fact that a battleship carries about 50 transmitting sets of various kinds, and many more receiving sets, while a Lancaster bomber fully equipped with radio and radar devices may account for over 400 valves, used in as many as 16 different systems.

Changes in Valve Design

With the advance of war methods came revolutionary changes in valve design, ranging from acorn valves to large tubes for coastal radiolocation stations, and from the simplest diode to the magnetron and other valves with their own self-contained, ancillary circuits. There were, in fact, some 600 different types of valves being turned out. The main brunt of the nation's valve production was undertaken by Philips organisation, Marconi-Osram, Cosmos Manufacturing Co., Ltd., A. C. Cossor, Ltd., and Standard Telephones and Cables, Ltd.

The numbers of components needed was astronomical—on an average 20 to every valve in every kind of apparatus. Of condensers alone there were 13 000 different types, and the number of resistors produced last year was of the order of 89 millions.

One of the first demands made by radiolocation was the production of the chain stations before the war, as explained last week. The transmitters were at that time made the responsibility of the Metropolitan-Vickers Electrical Co., Ltd., and the receivers were made by A. C. Cossor, Ltd. Those two firms thereby became fore-runners of the many large and small organisations which went into this special manufacture, and it is a matter of interest that they, together with Pye, Ltd., met the heaviest proportion of war-time demands for R.A.F. ground radar stations of all kinds.

The airborne radar sets may be said generally to have owed their existence and production in the main to the General Electric Co., Ltd. (who also worked on the valves for the early radiolocation ground chain), the Gramophone Co., Ltd., E. K. Cole, Ltd., Bush Radio, Ltd., Pye, Ltd., and A. C. Cossor, Ltd.

The Navy in the early days made an equally strenuous demand on the output of Allen West and Co., Ltd., of Brighton, the British Thomson-Houston Co., Ltd., Standard Telephones and Cables, Ltd., the General Electric Co., Ltd., Pye, Ltd., the Marconi's Wireless Telegraph Co., Ltd., A. C. Cossor, Ltd., Aeronautical and General Instruments, Ltd., and the Plessey Co., Ltd.

A. C. Cossor, Ltd., and the Gramophone Co. largely served the Army's needs for G.L. (gun-laying) equipment for anti-aircraft batteries.

The remarkable way in which ordinary Service radio communications were kept supplied in spite of radar demands is another example of the industry's enterprise, and the contributions of the Marconi Co., Standard Telephones and Cables, Ltd., the G.E.C., the Philips organisation (Mitcham Works), Pye, Ltd., the Telephone Manufacturing Co., Ltd., and Siemens Brothers and Co., Ltd., were among the heaviest. Such firms as the Telegraph Condenser Co., Ltd, Dubilier Condenser Co. (1925), Ltd., the Morgan Crucible Co., Ltd., and the Eiric Resistor Co., Ltd., also bore a great load in the production of components.

Special Cables Developed

The development of the special cables, utilising the new material polythene introduced by Imperial Chemical Industries, was effected by the Telegraph Construction and Maintenance Co., Ltd., who disclosed their technique to other cable manufacturers; these cables helped greatly to open the way to the new very short wavelength techniques so essential to radar.

Mention must also be made of the smaller firms, which not only met the sudden demands placed on them, but rose to eminence in doing so; for instance, in a private house, Dynatron Radio, Ltd., undertook the production of airborne radar and other sets for the R.A.F.

At first, when the radiolocation chain was of immediate importance, the two contracting firms had to provide separate buildings for assembly and testing in complete secrecy, and the two men informed

of the plan were Dr. J. M. Dodds, of the Metropolitan-Vickers Electrical Co., Ltd., and Mr. L. H. Bedford, of A. C. Cossor, Ltd.; their colleagues were told only about the transmitter or the receiver—never both.

Early in 1937 when Sir Robert Watson-Watt presented certain ideas to Sir Arthur P. M. Fleming, director of research at the Metropolitan-Vickers Electrical Co., Ltd., in connection with radio direction finding, Sir Arthur arranged that some of the best men among his research workers should devote their time exclusively to the technical problems to be solved and the investigator, who, with the assistance of a remarkably small team of researchers, found the answer required was Dr. J. M. Dodds; in recognition of his work he was awarded the O.B.E. in 1944. All the high power transmitters were designed around the company's continuously-evacuated demountable valves, developed several years before as the result of original research carried out in the company's research laboratories by Dr. C. R. Burch, F.R.S., and his brother, the late Mr. Francis Burch, who in 1930/33 demonstrated the considerable powers which could be transmitted on short waves.

Shop Built in Seven Weeks

The constructional facilities of the Metropolitan-Vickers research department were inadequate to complete these large transmitters at the rate required, and the second main problem had to be faced, i.e., the design and building of a new shop complete with testing equipment and, concurrently, the planning and tooling for production of many other equipments which in themselves presented new technical and manufacturing problems. It was due to the appreciation of the urgency of this work shown by the works director, Sir George E. Bailey (now managing director of the Associated Electrical Industries, Ltd., which include the Metropolitan-Vickers Electrical Co., Ltd.) and to his drive and energy, that a new assembly shop building of 25 000 sq. ft. area was erected, and assembly work started in seven weeks' time. The tooling and manufacture were carried out under the supervision of Mr. W. Symes, now works manager.

The Metropolitan-Vickers Co. were also engaged on a number of projects emanating from Government research bodies, and were responsible for a number of technical contributions, including which were a range of mobile high power radio transmitters; increased power for the main chain stations; many contributions to the technique of pulse modulation; the practical design of what is believed to be the first electrically-driven scanner; and important advances in ultra-short wave technique.

Provision for additions to the radiolocation chain system and of the coastal defence radar for detecting enemy aircraft towing magnetic mines were early problems of the war. A Cambridge professor undertook a hurricane programme for the introduction along the coast of equipment which existed only in a single laboratory model, and he took his ideas to the development section of Pye, Ltd., for materialisation.

Following these developments was that known as the V.H.F. (very high frequency) system of fighter control, using a radio telephone circuit whose suitability for a European war, with the increasing speeds of aircraft then envisaged, had been agreed during 1938. Three hundred of these equipments were hand-made by the G.E.C. at Coventry during 1938, while the production problems entailed were being solved.

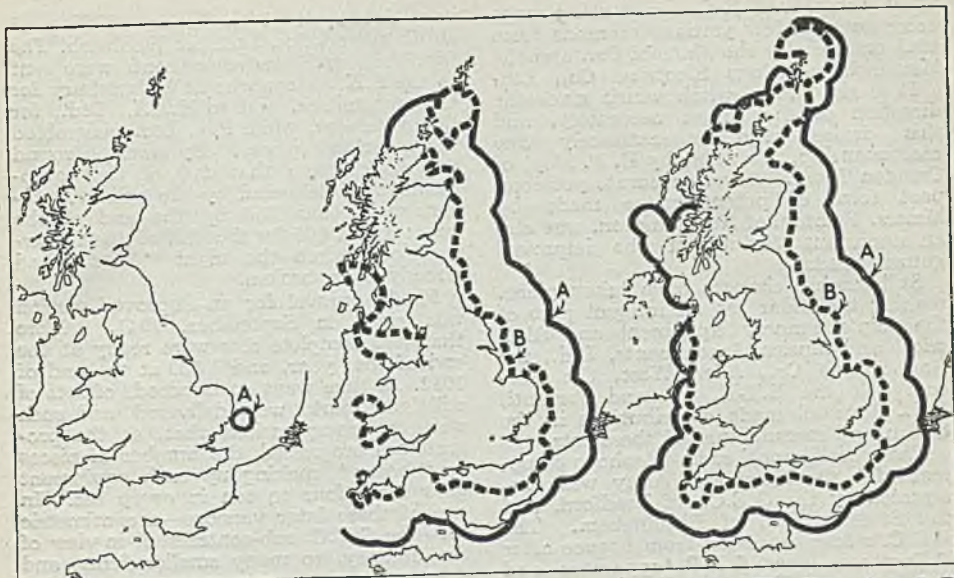
From Test Bench to Fighter

The Battle of Britain began as soon as real production was arranged, and the race was so furious that the sets were collected by Air Force tenders as they came off the test bench, to be installed immediately in the fighters which were giving battle. Under the guidance of the Royal Aircraft Establishment, the ground equipment was designed and built by E. K. Cole, Ltd., at Aylesbury, and the G.E.C. at Coventry. One of the great production feats of the war was achieved when the Coventry G.E.C. benches and all the tools, representing about 80 000 man-hours, were almost destroyed by the enemy overnight. Plant was immediately set up at Bradford, and so speedily organised that only half a month's output was lost.

Outstanding among the firms which successfully accepted burdens thrust upon them throughout the war by the Admiralty is Allen West and Co., Ltd. Two of the firm's most remarkable achievements can be mentioned; one, the manufacture without working drawings of 250 early models of a radar set for detecting surfaced submarines from destroyers or corvettes, and the immediate response to an Admiralty request to manufacture a radar set for giving early warning of low-flying enemy aircraft. The firm were themselves responsible for the installation of the set in trailers which were sited on the coast.

A similar type of set was made for fitting in ships with an aerial which produced a narrow beam. To cope with the rolling of the ship this aerial had to be "stabilised." This was successfully put into production by Ferranti, Ltd., the Metropolitan-Vickers Electrical Co., Ltd., and W. A. Bentley of Leicester. Most naval radar gear required gyro control in one form or another, for which the Sperry Gyroscope Co., Ltd., was largely responsible.

Anticipating the Battle of the Atlantic,



Growth of radiolocation cover (left), 1935; centre, 1940; right, 1941. The lines A and B represent cover up to heights of 15 000 ft. and 500 feet respectively.

the Navy set up a network of radio direction-finding stations, the equipment for which was for the main part based on receivers and other devices developed and produced by the Marconi Company, at Chelmsford, and the Plessey Co., Ltd. The latter company also devised and manufactured, under naval guidance, an instrument which enabled a signal of very short duration to be instantly "D/I'd," an important contribution to the defeat of the U-boat.

The first production of radar sets for the Navy in 1938-1939 was undertaken by Aeronautical and General Instruments, Ltd., of Croydon, who made the transmitters and aerial equipment, and Pye, Ltd., who made the receiver and display panels. A new type of treated, laminated wood made by the New Insulation Co., Ltd., of Gloucester, was found to be invaluable in lessening the weight of ships' radar aerials.

Demands for an improved type of air warning radar set made it necessary to spread production over a larger number of firms. Aeronautical and General Instruments, Ltd., Marconi Co., Pye, Ltd., and Allen West, assisted in producing what was at the time the most powerful radar set in existence. At the same time a radar set suitable for small ships was urgently wanted. As a stop-gap, an Air Ministry A.S.V. set was adapted. This was succeeded in 1941 by a more powerful naval set, the transmitter of which was made by the Marconi Co. and Aeronautical

and General Instruments, Ltd., the receiver by Murphy Radio, Ltd., and the Marconi Co.; a cathode-ray indicator by E. K. Cole and Co., and the aerial by Hutchinson and Hollinsworth.

The application of a cathode-ray tube to portray in plan the positions of all surface ships relative to each other and to the observer, as if on a geographical map of known scale was adapted for naval use by the Gramophone Co., and produced by them, Metropolitan-Vickers, and Allen West. Large quantities of motor-generators and control gear for radar equipment on ships were supplied principally by Whipp and Bourne, of Rochdale, the B.T.H., Co., Newton Brothers of Derby, and E. N. Bray of Walthamstow.

To-day the range of the naval guns' target is almost invariably measured by radar, and it has been found possible, too, to fire the guns at an unseen target by radar information alone. The first set equipment of the series, from the radio point of view a revolutionary design, was made (with the exception of the aerials) by a number of firms experienced in radio—transmitters by the G.E.C., Coventry, and the B.T.H. (both at Rugby and Willesden); receivers by the G.E.C. and Pye, Ltd., at Cambridge; the cathode ray indicator by Cossors, Parmeko and Ferranti. The aerials, which had to be of a novel type suitable for fitting to gun directors, were manufactured by Aluminium Plant and Vessels, Ltd., of Wands- worth, Pirelli General and Ferranti.

Greatly improved devices measuring range accurate to a few yards were made from 1941 onwards by the Marconi Co., and the Metropolitan-Vickers Electrical Co., Ltd.

It is the beam switch which gives the direction of the target accurately, and this device requiring extremely fine craftsmanship, was made by E. F. Moy, of Camden Town. A very accurate yet compact form of potentiometer made by Messrs. Painton, of Northampton, was also an important feature of the improved gunnery radar.

Still further changes have taken place, making the radar set an integral part of the ship's gunnery equipment and Electrical and Musical Instruments, Ltd., the Gramophone Co., Allen West, the Marconi Co., the B.T.H. Co. and Ferranti, Ltd., have all made contributions in the design and manufacture of these sets.

The cross-Channel radio-telephone equipment for the Navy and Army was constructed by the G.E.C., of Bradford, and the Stratton Co., of Birmingham. The B.B.C.'s first broadcast from France after D-Day was over G.E.C. apparatus and the first cross-Channel radio conversation on D-Day was over Stratton equipment.

In the preparations for the Normandy landings, certain radio equipment was most urgently required for bombing operations, and similar naval demands apparently could not possibly be met in time. The Marconi W/T Co. agreed to undertake the task. They were introduced to Leslie McMichael, Ltd., who were making the gear for the R.A.F. and, starting from scratch, produced the necessary 150 sets in seven weeks, instead of a normal "war urgency" figure of at least seven months.

Prefabricated Offices

A contribution of an unusual kind to the war against the U-boat was made by W. H. Smith and Co. (Electrical Engineers), Ltd., of Trafford Park, Manchester, in the prefabrication of radar offices, which entailed building the complete office on shore and installing all the equipment and wiring before it was taken to the ship.

On land the night "blitzes" had also been mastered by radar; the problem for the R.A.F., was the ground control in the dark by G.C.I. (Ground Controlled Interception) radar stations of fighters which themselves would carry A.I. (Air Interception) radar to finish the chase, and for the Army the accurate sighting of guns and searchlights by G.L. and S.L.C. Six hundred installations were ordered. In September, 1940, when production was about to commence, in one of the raids all the components and most of the piece parts for the transmitter and modulator

were destroyed at the works of Siemens Brothers and Co., Ltd., at Woolwich. The jigs, tools and new components were sent to the E.K. Cole works at Malmesbury for the transmitter, and to E.M.I., Ltd., for the modulator, while Pye, Ltd., assembled the other two pieces. By working round the clock, more than 200 of the equipments were delivered by the end of October, more than 350 by the end of the year; and 1 000 by the end of the following July, when the night "blitz" had already been broken.

Final approval for an improved version was given in September, 1941. More than 100 complete sets were ready at the end of that year, and 1 000 at the end of 1942. As time went on hundreds of sets of still later marks were delivered, and such were the complications that, as the programmes progressed, the number of pieces or "boxes" making up each equipment grew from four to ten in every set. In one of these later versions—a centimetric set—the G.E.C. sub-contracted, in view of the urgency, to many smaller firms, and even garages.

Bombed on Christmas Eve

The ground radar which directed the Army's defence over our coasts and cities was developed from the earliest days by A. C. Cossor and other big firms. The Metropolitan-Vickers Electrical Co. received a development and construction contract for the first gun-laying equipment at the beginning of February, 1939, and the first prototype was produced in August, still before the war, with more than 400 completed by November. On the next mark, both the Metropolitan-Vickers Electrical Co.—who were bombed on Christmas Eve but immediately continued in a dispersal factory—and the Gramophone Co. were engaged.

Yet another more advanced mark was designed by the B.T.H. Co. and came off the line in February, 1943. Early models of a radar system for directing searchlights on to enemy aircraft were made by Murphy Radio Ltd. in the winter of 1940-41, and produced in large quantities in 1941 and 1942.

Parallel with all the defence developments was the first of the airborne radar sets for the offensive, the A.S.V. (Air To Surface Vessel) equipment carried by Coastal Command to search for shipping. Early models were produced by E. K. Cole, Ltd., and Pye, Ltd.

Soon afterwards there followed a series of navigation and bombing aids which made possible the shattering of Germany's industry more certain. M.A.P.'s Telecommunications Research Establishment guided the development of "Gee," a radio-

navigation instrument, at Cossor's shadow factory at Chadderton, Oldham, in the autumn of 1941, the firm submitting a prototype for approval in exactly six weeks. They and Dynatron shared production of the first order for 500. By the end of 1942 Cossor's first bulk order for 2 850 sets, had been delivered. All crystals used in the circuit were supplied during this high-pressure production by the Post Office Research Establishment in North London. This equipment, like other types of apparatus, was further developed, and by the end of 1943 no fewer than 11 000 airborne sets of an improved type had been delivered by three big firms which were now working on it in the United Kingdom. The final achievement was a rate of production which enabled Britain to give 2 000 sets a month to her United States Allies. During 1943 the first mark of "Gee-H," a blind-bombing aid akin to "Gee," was developed and 200 sets delivered in three summer months.

A Triumph of Design

When the battle of the Ruhr started in full blast in 1943 the "Oboe" ground-guided bombing system was introduced.

The ground station was a major triumph of design and development, and its hundreds of valves and circuits achieved results which seemed almost unbelievable in their accuracy. It was produced by the Metropolitan-Vickers Electrical Co., Pye, Ltd., and Standard Telephone and Cables, Ltd., and developed as a mobile unit in 1944. From the Cossor-Dynatron combination 100 airborne sets of an early mark were provided by August, 1943, and the G.E.C., at Wembley and Coventry, fulfilled an order for 36 of a following type by the end of November.

When Standard Telephones and Cables, Ltd., undertook contracts for the ground end they finished their development work in nine months; the stations were built by Pye, Ltd., and Standard Telephones and Cables along the south and east coasts of England. Finally, the bomber was freed from any dependence on ground radar stations by the development of "H2S," with which the first direct picture of the unseen earth's surface at night or in cloud was provided. Industry helped pay the price for this development, for in an air accident which killed five of the small team working on it in 1942 the Gramophone Co. lost two of its research team. "H2S" went on, however, and within a year these sets were being turned out; the technique of scanners, the revolving dish-like aerials which serve "H2S" (and also A.I.) was considerably developed at the same time, the major work going to Nash and Thompson, Ltd. The eight "boxes" which made

up the original installation were developed and mass produced by the Gramophone Co.

"Rebecca," an airborne set which could send out coded signals to suitable ground or seaborne radar beacons to determine their position from the automatic answer received, was used with a beacon ("Eureka") taken into action by the first parachutists dropped to land glider and parachute troops and supplies. Work started on "Rebecca" in September, 1942, a prototype was submitted in the following March, and by May, 1943, more than 70 sets had been delivered by Dynatron; and a further number poured out steadily. The entire airborne force was equipped with "Rebecca" at the time of the invasion. I.F.F. equipment (Identification of Friend or Foe) automatically gave immediate identification of approaching aircraft to radar with a swiftness that made aircraft speed an insignificant factor and enabled our air defences to be instantly mobilised to meet the danger. This wholly British radar achievement was entrusted principally to Ferranti, Ltd., to develop and mass produce.

A Marconi Feat

Responsibility for handling the heavy communications traffic for the Prime Minister and his party at the Yalta Conference was assigned to the Senior Service. The problem amounted to providing aboard ship a first-class large wireless station such as is ordinarily only possible ashore, in Allied territory, at next to no notice. Two large shore type Marconi transmitters arrived at a fitting-out port overnight, and 24 hours later the company's engineers were working on the considerable modifications necessary.

On the arrival of the ship there was inevitable delay while bulkheads were removed and spaces prepared to receive sets, but in spite of this (and much credit must be given to the Marconi Co., their engineers, and their equipment), the ship sailed on her secret mission undelayed, all equipment tested and ready to operate.

Admission of non-Members to Meetings of the Institution.—In September, 1943, the Council instituted a scheme for making the technical meetings of the Institution of Electrical Engineers accessible to those who may be interested in the proceedings, but who may consider that their technical experience and educational attainments do not suffice to admit them to any form of membership. The Council have recently reviewed the working of the scheme during the past two sessions and have decided that it should be continued for the coming session.

Electricity in South Africa

Demand for Communication Equipment—Electrical Tobacco Curing

THE South African Minister of Posts and Telegraphs during a visit to this country shortly, is expected to meet manufacturers of telephone and telegraph equipment with the object of speeding up delivery of such devices urgently needed in South Africa. There are more than 25 000 applicants waiting for telephones and the demand is increasing steadily. It is reported that orders worth more than £1 000 000 have already been placed and are awaiting execution.

*Registered Wiremen

In a report on the Electrical Wiremen's Registration Board it is revealed that during the past year, 3 654 applications were dealt with, an increase of 314 on the previous year. Two written examinations were held, attended by 269 candidates. Approximately 30 per cent. passed both sections and 20 per cent. failed, the remainder passing one section only. At the five practical examinations held, 210 candidates presented themselves and only 15 failed. Regarding the registration of electrical contractors under the Act, the limited staff at the disposal of the board has somewhat delayed progress towards the co-ordination of the various views expressed on the subject, but it is hoped that concrete proposals for a suitable amendment of the Act will be framed at an early date.

A newly formed body, the Electrical Conductors' Advisory Committee is to make allocations on a priority basis of conductors which cannot be manufactured in South Africa, and which consequently must be obtained from Britain or America. The quota taken up by the Union each six months is now based on tons of copper content in cables and wires, and not on sterling value, as previously. All applications for conductors whose essentiality is approved are co-ordinated by the committee with (a) the capacity to manufacture the items locally and (b) the import quota to be taken up for the six months in question. Where demands exceed this available supply it becomes necessary to postpone the consideration of the less essential items to a later date. The latest information received from British manufacturers indicates a tendency for considerable easing of the position in securing the necessary licences for essential items. The position in South Africa to-day is serious, due to exhaustion of stocks of electrical conductors and very heavy calls on local manufacturing resources.

The General Manager of the Johannesburg electricity department has just issued

his report for the year ended June 30, 1944. Mr. J. C. Fraser has now succeeded Mr. A. Rodwell in this position. The Orlando and city power stations, operating in parallel throughout the year, sent out 429 655 956 units, 37 504 835, or 9.56 per cent., more units than in the previous year, which in its turn recorded 2.15 per cent. less than in 1941-42. The new rise in output is due mainly to a large increase (10.4 per cent.) in units taken by private and municipal consumers, probably as a result of extended building activities; and, secondly, to a marked increase in the number of units exported to the Victoria Falls and Transvaal Power Co.; 36 836 017 (8.6 per cent.), of the units sent out were converted to d.c., 28 770 253 (6.7 per cent.) being used for traction. The maximum demand on the system reached a record of 136 600 kW at 11.30 a.m. on June 14, 1944, this being 20 600 kW higher than the peak of the year 1942-43, and 15 600 kW more than the previous record demand on June 27, 1941. This peak load, falling as it did at approximately midday, was partially due to the V.F.P. Co.'s demand, and was shared in the proportion of 79 600 kW by the City and 57 000 kW by Orlando. The second generating set (No. 1 set) at Orlando was commissioned in October, 1943.

Overhaul Difficulties

Shortly afterwards, No. 2 set was taken off for general overhaul and was recommissioned in March, 1944. During this period the city generating station had to provide sufficient stand-by capacity to meet the possibility of Orlando tripping out while supplying the V.F.P. Co. In pursuance of the policy of maintaining the load on the Orlando station at a high level, 36.4 per cent. of the units sent out were from this station and 63.6 per cent. from the city generating station. During the year, no supply was taken from the V.F.P. Co., but 18 058 678 units were exported to the company as against 2 895 894 units in 1942-43, an increase of 602 per cent. The overall running cost per unit sent out by the City and Orlando stations combined, has dropped to 0.1646d., showing a decrease of 10.5 per cent. on the figure for the previous year. This is the lowest cost in the history of the department, and is due to the cumulative effects of the greater share taken by the Orlando power station in the total output; the fact that, owing to having two generating sets in commission at this station, the city generating station has had

to provide less stand-by capacity; the increase in the number of units sent out; and a considerable reduction in coal costs as a result of a drop in railrage rates since June 23, 1943.

Mr. J. S. Clinton, recently city electrical engineer, Salisbury, Southern Rhodesia, and now a consulting engineer in Johannesburg, lately investigated the practicability of curing certain tobaccos by electricity, and he recommended that the Salisbury City Council continue to experiment with the use of electrically-operated and controlled tobacco barns. He found that the average cost of curing tobacco was 1.045d. per lb. for wood fuel, 1.515d. for electricity and 1.44d. for coal. Although electricity was slightly more expensive than other methods, it offered a much bigger saving in labour costs. It was esti-

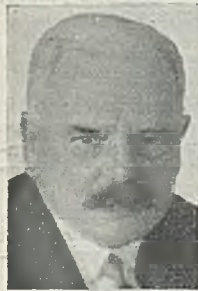
mated that if electrical curing of tobacco was taken up on the scale that was considered possible, as much as 12 million units might be sold annually by Salisbury for this purpose, and as this would happen before the winter peak demand, it would offer an excellent opportunity to balance the load effectively.

During the past year the Safety Precautions Committee of the Association of Municipal Electricity Undertakings has met twice and drafted regulations for the requirements of medical and industrial X-ray and electro-medical apparatus. A copy of these draft regulations has been forwarded to the Director of the National Physical Laboratory, Teddington, Middlesex, with the request that the British X-Ray and Radium Protection Committee favour the South African Committee with its comments.

Mr. J. S. Highfield

MR. JOHN SOMERVILLE HIGHFIELD, senior partner of Messrs. Highfield and Roger Smith, consulting engineers, died on August 15 in his 74th year. Born at Lisgard, Cheshire, he was educated at Rydal School and King's College, London, under Dr. John Hopkinson and Prof. Ernest Wilson. He took up

work with the Chloride Electrical Storage Co. Ltd., and became an assistant in Manchester electricity department when Hopkinson was introducing the five-wire d.c. distribution system. He became chief engineer to the Stafford electricity undertaking, where he devised the automatic reversible booster for controlling the input and output of storage batteries, and later, chief



Mr. J. S. Highfield

engineer to the St. Helens (Lancs) undertaking. He was subsequently appointed chief engineer and manager to the Metropolitan Electric Supply Co. Ltd., and introduced the Thury system of high voltage d.c. distribution over a large area of West London.

In 1917 Mr. Highfield started as consulting engineer at Victoria Street, being joined in 1921 by his brother, the late Mr. W. E. Highfield, and in 1924 by the late Mr. Roger T. Smith, and subsequently by the present partners, Mr. E. Ambrose and Mr. A. L. Coward. He acted as consulting engineer to many important electricity and

other undertakings in this country and abroad, and the firm has acted as consulting engineers to the Central Board for many years. He also did much work as an expert witness in actions and arbitrations at law. He perfected and patented many inventions both in the spheres of engineering and yachting, and was an authority on electricity trading.

Mr. Highfield was at the time of his death a director of the London Power Co. Ltd., London Associated Electricity Undertakings Ltd., and Central London Electricity Ltd.

He served on the Council of the Incorporated Association of Electric Power Companies, and represented the association on the Federation of British Industries for many years. He was a Fellow of King's College, London, past-president and honorary member of the I.E.E., past-president of the Junior Institution of Engineers, and of the A.S.E.E., member of the Institution of Civil Engineers and of the Societe des Ingenieurs Civil de France, fellow of the American Institution of Electrical Engineers, past vice-president and past-manager of the Royal Institution of Great Britain, vice-president of the Royal Society of Arts, and vice-commodore of the Royal Thames Yacht Club and the Brixham Yacht Club, honorary member of the New York Yacht Club, and member of several others. He was also a member of Council of the Yacht Racing Association, an honorary member of the Dynamicables and one of the Knights of the Round Table. He was a past-president of the Battiswallahs' Society.

A memorial service will be held at St. Mary Abbot's, Kensington, to-day (August 24) at 2.30 p.m.

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. D. Watkins has been appointed joint managing director of the British Vacuum Cleaner and Engineering Co., Ltd., as from Oct. 1.

Sir Leonard Browett has been appointed director of the National Union of Manufacturers in succession to **Sir Charles Hipwood**, who has retired in consequence of indifferent health.

Mr. J. E. C. Bailey, chairman and managing director of Baird and Tatlock (London), Ltd., has been elected President of the Scientific Instrument Manufacturers' Association of Great Britain.

Miss Caroline Haslett, director of the Electrical Association for Women, has been elected a vice-president of the Royal Society of Arts. She is the first woman to hold that office.

Commander Philip Baker, R.N. (ret.) has been appointed public relations officer to the British Export Trade Research Organisation. Before the war he acted in a similar capacity to North Eastern Trading Estates, Ltd.

Among the members of a committee to advise the Government on the development of atomic power will be **Sir Edward Appleton**, Secretary to the Department of Industrial Research, **Sir Henry Dale**, Presi-

dent of the Royal Society; **Prof. P. M. S. Blackett**, **Sir James Chadwick** and **Sir George Thomson**. **Sir John Anderson**, Chancellor of the Exchequer in the late Government, is to be chairman of the committee.

Mr. Joseph White has been appointed managing director of Brush (S.A.) (Pty.) Ltd. He was at one time manager of Rand Carbide, Ltd., and later manager of S.A. Pulp and Paper Industries, Ltd. Brush (S.A.) was formed in November, 1943, as a pilot venture for the local manufacture in South Africa of the products of the parent company, the Brush Electrical Engineering Co., Ltd.

Obituary

Mr. Leslie Burgin, on August 15, aged 58 years. From 1937 to 1940 he was Minister of Transport.

Mr. Ernest Matthew Lacey, a member of the Institution of Electrical Engineers, on August 16, aged 79 years.

Major James K. Tullis, aged 63, former chairman of John Tullis and Son.

Ald. Harry George Williams, Mayor of Gloucester, since November, 1943, and partner in the firm of Williams and James, on August 21, aged 69 years.

Anglo-American Trade

Mr. Winthrop W. Aldrich, president of the International Chamber of Commerce and chairman of the Chase Bank, New York, who was the principal guest of the American Chamber of Commerce in London at luncheon on Monday, said that reports from Washington that lend-lease was about to be terminated made it imperative that the United States should stand ready to grant England the immediate financial assistance she required to effect the transition from a war to a peace economy.

Mr. Aldrich suggested that a world trade conference should be called as soon as possible to speed restoration of multilateral trade.

Only if trade were free could reasonably full employment be attained without artificialities such as continued Government deficit financing which led ultimately to the socialisation of economy.

Removal of trade barriers was a prerequisite of the removal of exchange controls and the stabilisation of exchange rates.

Only if trade barriers were removed, **Mr. Aldrich** continued, would nations be assured that debts incurred for stabilisation could be repaid in goods and so lose the fear that certain currencies might be-

come scarce. Only if domestic economic controls were removed would competitive forces be given full play and national income rise high enough to support a large volume of foreign trade.

Mr. Aldrich condemned restrictions, monopolies and cartels, which interfered with the free functioning of the price system. He added:—

“Nations can all too easily drift into totalitarianism by permitting or promoting those practices which in themselves seem innocuous and perhaps even beneficial, but which in cumulative effect destroy the private enterprise system.

“Direct control by Governmental authorities over the types of loans to be made by commercial banks and over the use of savings funds inevitably lead to a form of State capitalism in which the State decides by means of its control over short and long term credits the types of industries to be favoured and of goods to be produced.

“If we are to remove war-time controls and let the competitive and dynamic forces of the economy have full scope we must, as once phase of this problem, decontrol the rate of interest.”

Domestic Electric Water Heating—II

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

THE 1½-5 gallon sink-type water heater is normally used for heating small quantities of water, but where it is required for use with a dual water heating solid fuel/electric system, two immersion heaters are installed in the tank. One, the main heater, at the base to heat the full capacity of water, and an auxiliary near the top, the exact position of which is decided by the capacity of the tank and the quantity of water required. Manufacturers of self-contained water heaters have appreciated the advantage of this arrangement with the result that appliances of the type have been designed.

U.D.B. Heaters

One manufacturer has designed a heater of this type for fixing under the kitchen draining board and this offers the advantage of a good water heating practice in that standing losses are kept down to a minimum, piping to the sink draw-off position being short. The full contents of the tank (15 or 20 gallons) are, too, available at the sink for abnormal requirements. The bath draw-off position may be supplied from the one heater, and since this hot water is required only occasionally, the heat losses from the pipe run are of small consequence, provided, of course, the run is not excessive.

As mentioned last week, this is preferable to the alternative and more common arrangement where the kitchen draw-off point is fed from the heater in the bathroom.

The vertically fitted immersion heater, or circulator, is designed to enable users to draw off small quantities of hot water, a few minutes after switching on. The circulator is, however, fitted chiefly in the cylinder type of storage tank in soft water districts. Circulators are not recommended in hard water districts, even where they may be easily fitted to the galvanised rectangular tank, because the top outlets of the circulating tubes may soon become fouled by hard scale. Since the top of the circulator is the hottest part, scale forms more readily at that point and so contributes to overheating. This disadvantage of overheating at the top of the circulator (apart from the formation of scale) has, however, been overcome in more recent designs. In these, the loading is high at the bottom and tapers off towards the top, or the neck, of the heater. As a result, the

heat distribution is fairly even throughout, so increasing the life of the element and reducing the tendency of scale formation at the small outlet vents.

Thermostatic control is always preferable to hand control, where water heating is concerned and is always incorporated in the self-contained heater, as opposed to converted installations.

Where a user does not desire to maintain a comparatively large quantity of hot water throughout the 24 hours, a dual system of hand, thermostatic control offers a solution. The heater may be switched on for a bath in time to heat the water content and when this has reached the pre-determined temperature, the thermostat cuts-out. This arrangement is particularly suitable for conversion jobs where the thermal insulation is not up to standard and standing losses are of a high order. In some cases during the conversion of solid fuel installations to electric, thermostats have not been fitted because the user has been under the impression that the heater should operate continuously, whereas dual control would have met the case. It is, however, invariably false economy to install an immersion heater without a thermostat since the additional initial cost is comparatively low.

Position of Thermostat

There are no hard and fast rules known to the writer regarding the positioning of a thermostat, though in the self-contained water heater the unit is normally fitted to the heater plate. The correct position in a conversion installation depends on the type of installation, type of tank, and the user's requirements. If fitted at the base, the thermostat will rarely operate except when no water is drawn off for a long period. If too near the top, the user loses effective storage capacity. Experience has proved that the half-way position offers certain advantages, as the thermostat will operate when the mean temperature of the water reaches a predetermined figure. On the other hand, it is often more practicable from the installation point of view to fit the thermostat on the heater plate.

Variable control is also possible by utilising more than one thermostat; instead of fitting two immersion heaters, when the aim is to provide a small proportion of the full contents, two thermostats may be used instead. One is fitted on the heater plate at the base of the tank to control the total storage capacity, and a second is fitted

near the top of the tank. By simple switching, either thermostat can be brought into operation as required. For instance, when, say, a quarter of the storage capacity is required, the top thermostat will operate once the water at this level has reached the temperature at which the thermostat is set. This system is cheap to instal and control, though there is a possibility that "mixing" of the cold incoming water with the circulating hot water may arise. This should not occur, however, if correct baffling is carried out, or where specially designed immersion heaters, on the circulator principle, are used.

Plumbing and Wiring

As the larger part of the work connected with installing a water heating system lies in the plumbing and the fixing of the heater or heaters, the importance of wiring must not be overlooked. Where possible, and it usually is possible, in domestic premises, water heating should be fed from separate circuits independent of the other services. While there may be some temptation to loop a small water heating circuit off the nearest heating point, this practice is not to be recommended. Special low rates of charge for electricity consumption are offered for thermostatically-controlled water heating, and the user should be given the opportunity of enjoying these. Where an all-in rate is in force, the consumer will enjoy the low running charge for all services, but the time may come when the user desires to revert to flat rates.

Electricity supply authorities usually provide free wiring within reasonable limits in respect of water heating. As the length of servicing allowed will usually cover most installations right back to the meter position, there is a further reason why the water heating circuit should be run independently in the first instance.

Pilot-lamp Indication

Whether the installation is thermostatically controlled or not, a control unit incorporating a pilot lamp should be fitted so that the user is aware immediately the current is interrupted, in time to make other arrangements for obtaining hot water.

The type of wiring system employed calls for little comment since so far as possible it should conform to the system employed for the other services in the house. Just prior to the war, however, increased use was made of the "Pyrotenax" type of heat resisting cable for the tails from the central unit to the heater. The writer also saw a number of installations where this form of cable was used throughout. As the wiring was a surface job there can be no question of its possible neatness.

Earthing is often a vexed point and it appears that too much reliance is placed

on the plumbing to provide the earthing. Although this is natural, a good test should be made and all joints and stop-cocks bridged in accordance with good practice; that is, where local regulations permit of earthing to the water system.

With respect to the cost of installation there are four factors to consider: (1) Capital costs of water heaters; (2) Cost of plumbing and piping the water heaters; (3) Wiring costs; and (4) Running costs. The capital cost of one large water heater is lower than that of a number of small ones. Wiring costs are also lower where one circuit only is required. Against these, the plumbing costs must be considered since these may be appreciably higher where one central heater is installed to supply a number of draw off positions. On the other hand, most supply authorities hire water heaters up to 100 gal. capacity, and fix them free, which includes small-scale plumbing. Limited wiring used also to be provided free, but was often confined to one water heater. As regards running costs, the heat losses of a large water heater are lower than in the case of a number of small water heaters having the same aggregate capacity. On the other hand, additional piping heat losses may outweigh the advantage in favour of local water heaters.

Running Costs

Accurate estimates of running costs of any particular installation can only be determined where all relevant data are available, viz., length of pipe runs, frequency of draw-offs, setting of thermostats, efficiency of lagging, and so forth. Excessively high running costs may usually be attributed to the careless usage of hot water, that is, hot water taps are often left running unnecessarily, while there is always a tendency for persons to wash their hands from the running tap. Such waste can be reduced by installing spring press taps. The slight inconvenience caused acts as a deterrent to the excessive use of hot water and thus lowers the overall cost of water heating. These and other facts should always be carefully examined.

Electric Lamp Manufacture.—Although the Board of Trade in 1942 made the Order restricting the manufacture of certain electric incandescent lamps with coiled coil filaments, the Ministry of Aircraft Production has for some time been responsible for administering the control. As the materials required for making these lamps are no longer in short supply, the Board of Trade has revoked the Order as from August 1. Any inquiries about the manufacture of these lamps or the effects of de-control should be addressed to the Ministry of Aircraft Production (D.O.L.P.) at 1, Clarendon Place, London, W.2.

The Kelvin Lecture

The Scientific Principles of Radiolocation

IT will be remembered that when the Kelvin Lecture was delivered before the I.E.E. on April 26 last, by Sir Edward Appleton, F.R.S., he chose as his subject the scientific principles of radiolocation, but because of the censorship regulations then existing the meeting was not reported. Last week the security restrictions on publication of details concerning radar were withdrawn, and below is an abstract of Sir Edward's address.

Definition of Radiolocation

Radiolocation may be defined as the process of locating the position of an object in space by radio waves without any active co-operation on the part of that object. In other words, radiolocation enables us to find the position of a body, such as an aircraft, ship, iceberg, or ionised cloud without going up to that body to find out for ourselves. The only co-operation required on the part of the detected body is of a passive character in that it is required to reflect radio waves. Fortunately, all solid and liquid bodies, as has long been known, do this.

The fundamental technique of radiolocation is not difficult to grasp. To detect any reflecting object it is necessary first to flood that object with radio waves, in much the same manner as a motor-car headlamp floods a road-sign at night. An aircraft, for example, reflects radio waves when it traverses the radio beam end, if ground detectors are used to pick up the reflected beam from the aircraft, it is possible to determine the direction of arrival of the reflected waves, and thus the direction of the radiolocated object with respect to the ground station. The determination of the direction of a radio source is, of course, a very old technique, but, alone, it cannot give us the true position of that source. In radiolocation, however, there is added, most essentially, the determination of the actual distance away along that direction. Briefly, then, we can say that radiolocation enables us to specify the position of a radio-illuminated target because it tells us, first, in which direction the target lies, and, second, how far away along that direction it is situated.

The method of determining the distance of a radiolocated object is one of the most interesting features of radiolocation, for it is a product of pure science, and involves the use of a technique developed twenty years ago with no thought of its present widespread practical application. The basis of the method is that the distance

away of the located object is found by timing the journey of the radio waves to the reflecting object and back. Such waves travel to and from an object 100 miles away in about one-thousandth of a second, and it is the accurate and speedy measurement of time-intervals of this order which is the basic feature of radio measurement of distance.

The first experiments on the measurement of distance by radio reflections were carried out in 1924 by two Cambridge physicists, E. V. Appleton and M. A. F. Barnett, in their experimental proof of the existence of the Heaviside layer and the measurement of its distance above ground. In these experiments, which were carried out under the auspices of the Radio Research Board of the Department of Scientific and Industrial Research, the timing of the radio waves to the reflecting Heaviside layer and back was achieved by changing the frequency of the waves by a known amount. Nowadays we should call their method that of frequency-modulation. It is no exaggeration, therefore, to say that the first object to be radiolocated was the Heaviside layer. In these early experiments it is noteworthy that B.B.C. stations were used. Shortly after Appleton and Barnett had finished their work, two American scientists, G. Brett and M. A. Tuve, working in Washington, succeeded in measuring the height of the Heaviside layer, using amplitude modulation of the radio waves. For this purpose they devised a radio transmitter which sent out very short pulses, or jabs, of radio energy and recorded the time-interval between the omission of a pulse and the reception of its echo on a high-speed galvanometer. The pulse method, because of its simplicity, has been widely used later in the measurement of the distance of artificial targets such as aircraft and ships.

Early use of Cathode-Ray Tube

In the earlier scientific experiments rather elaborate photographic technique was used for the measurement of echo-delay times. What has later turned out to be a particularly useful simplification in the technique of the pulse method was introduced in 1931 by E. V. Appleton and G. Builder in the use of the cathode-ray oscillograph, with an associated uniform time-scale, by which the presence of a reflecting object and the indication of its distance away could be continuously portrayed to the eye without the need of developing photographs. By 1932, there-

fore, the technique of measuring the distance of atmospheric reflecting surfaces, such as ionised layers and ionised clouds, by means of radio pulses and cathode-ray oscillograph display was becoming standard research practice in this country.

But the application of these methods to the radio-detection of such relatively small objects as distant aircraft and ships by no means followed automatically. In 1932, however, the engineers of the British Post Office reported what is considered to be the first recorded instance of the detection of the presence of aircraft by reflected short radio waves. In the following year, engineers of the American Bell Telephone Laboratories published an account of experiments in which it was shown that aircraft reflected sufficiently appreciable quantities of radio energy to make it possible to detect their presence even when they were otherwise invisible. By 1933 we may therefore say that the principles of scientific radiolocation were well known as applied to the radiolocation of naturally occurring reflecting surfaces, and that it was also known that aircraft were capable of detection at short distances by the amount of radio energy reflected by them. It remained to develop the military application of the position-finding of artificial objects by fusing both branches of knowledge and, in particular, by using higher-powered transmitters to extend the range

of detection. This application of scientific principles to forge weapons of the highest operational utility was begun in 1935 by a small group of British scientists, Messrs. L. H. Bainbridge-Bell, E. G. Bowen and A. F. Wilkins, led by Sir Robert Watson Watt, at an Air Ministry station on the east coast of England. This effort, begun by this small nucleus, gradually expanded in volume and, as a result, this country was already provided with radiolocation sentinels for the detection of aircraft when war broke out in 1939.

The use of methods of radio distance finding by reflection have already provided us with a vast fund of knowledge concerning the electrical reflecting layers in the upper atmosphere from which it is now possible to predict the most suitable wavelengths for use in communicating over various distances at different times in different parts of the world. Further work is now in progress in England on the location of meteor trails by means of radio reflections. Another problem being considered is the possible radiolocation of the moon. Calculations show that with a very powerful sending station, and sharp focusing at the sending and receiving stations, it should be possible to get back detectable radio echoes after the radio waves have made their $2\frac{1}{2}$ sec. journey to the moon and back.

Electricity Supply

Stockton-on-Tees.—The T.C. is to place contracts shortly for the erection of three electricity sub-stations.

Blackpool.—The Electricity Committee has arranged terms for the provision of supply to North East Lancashire Laundries Ltd., Bispham.

Middlesbrough.—Application is being made to the Electricity Commissioners by the T.C. for sanction to borrow £6 331 for capital works.

Glasgow.—The Electricity Committee estimates a revenue of £2 168 150 and an expenditure of £2 140 784 for the year, leaving a surplus of £27 366. Capital expenditure is estimated at £304 000.

Bolton-by-Bowland.—The R.C. has been notified that approval has been given to an extension of Clitheroe electricity lines from Newton to Dunsop Bridge and White-well, and further developments in Gisburn districts.

Consett (Co. Durham).—Following a letter by several tenants, the U.C. has promised to consider installing electricity in council houses at Leadgate as soon as circumstances allow.

Glasgow.—The Strathelyde Electricity Supply Co., Ltd., is to lay mains for the supply to temporary houses at Knightswood. The Clyde Valley Electrical Power Co. is to erect a sub-station at Glarkston.

Horwich.—A loss of £5 000 on the local electricity undertaking is reported by the Electricity Committee during the last six years. The cause is stated to be a reduction in the scale of charges and increases in wages and the cost of fuel.

Bradford.—The City Council's plans for the development of the electricity undertaking are estimated to cost £2 350 000 by 1948. Another plan which, however, has not yet been taken into account is the building of a new power station to replace the Valley station.

Oban.—At a recent meeting of the Lighting Committee it was reported that the cost of the mains and services to the proposed 20 Swedish houses to be erected at Longsdale, would be £434, and the Engineer proposed to charge £2 per annum for close and back area lamps, including maintenance, and 30s. per telephone kiosk.

Glasgow.—At a meeting of the Electricity Committee, with reference to the first section of the Braehead power station extensions at a cost of £4 000 000, the Central Electricity Board envisaged the need for a further turbo-alternator unit and two additional boilers, and the Committee decided to arrange accordingly; and seek sanction to borrow £4 672 800 for the scheme.

Durham.—The Highways Committee of the C.C. has considered a letter from the Belmont P.C. with regard to the question of altering the height of the street lighting to accommodate double deck buses which the Sunderland District Omnibus Co. proposes to run between Sunderland and Durham. The Committee has decided to refer the whole matter to the County Councils' Association, as not only is the question of street lighting concerned but also that of low bridges and additional road works.

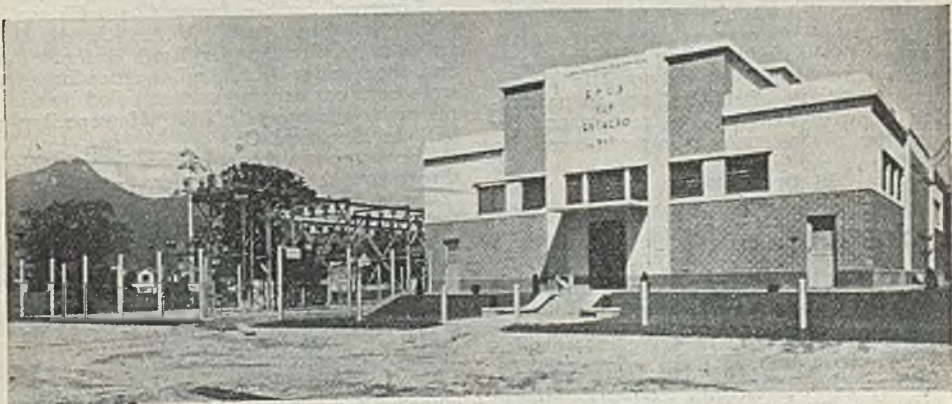
Stockton-on-Tees.—The annual report of the electricity undertaking showed a net profit of £572. The total income was £147 196 and working expenses £115 635 leaving a gross profit of £31 561. After meeting £5 995 for interest on loans, £13 786 for redemption of loans and £11 208 for income tax, the balance of £572 remains. The amount brought forward from last year was £33 130. The debt on the undertaking amounts to £115 837 compared with £130 738 a year ago.

Sunderland.—The report of the tramways undertaking for the year ended March 31 last, stated that the total revenue was £210 784 and working expenses £166 716. After meeting £1 263 for interest on capital there was a net balance of £42 805. This balance, including a balance of

£32 638 from the buses, was carried to the net revenue account and after meeting various charges including £30 549 for income tax there was £44 687 to be carried to the appropriation account for both undertakings. Of this £40 464 was carried to the renewals fund.

Reigate.—In the electricity undertaking's report for the year ended March 31, the statistics given show that the net profit was £8 360, after allowing for loan charges and income tax, and a 20 per cent. rebate to consumers in the March quarter. The balances on the appropriation and reserve fund accounts carried to next year amount to £22 707 for the appropriation account, and £17 707 for the reserve fund. No new loans were raised, but debt was repaid from revenue to an amount of £10 869. The number of units sold in the 1944/45 period was 13 139 013. Income from sales amounted to £104 605.

New Durham Power Station Site.—Following the strong opposition leading to a public inquiry last December, to the North-Eastern Electric Supply Company's plan to erect a £3 500 000 power station at Kepier, the Minister of Town and Country Planning has announced that the company has informed them that they have taken steps to meet the present demand for additional electric supply by the installation of plant elsewhere than at Kepier. Subsequently Col. S. E. Monkhouse, managing director of the North-Eastern Electric Supply Co., said recently that the company was erecting new plant at Dunston works, at a cost of nearly £2 000 000, but that the extension was not an alternative to the £3 500 000 Kepier (Durham) scheme. An alternative to the Kepier site would be considered by the directors.



One of two sub-stations of the Central Railway of Brazil supplied by the Metropolitan-Vickers Electrical Co. Ltd. The company has now received an order for two further sub-stations and three coach trains to supplement the 60 units already supplied

Atomic Energy

Further Details of Developments in British Laboratories

AMIDST all the interest, created by the development and use of atomic bombs, there is, as was pointed out in *THE ELECTRICIAN* of August 10, a fairly widespread knowledge of the fact that Manchester University, under the guidance of the late Lord Rutherford, was the cradle of some of the most important work which led directly, though at some distance, to the present understanding of the subject.

After leaving Manchester for the Cavendish Laboratory, Cambridge, Lord Rutherford pursued, with the same vigour and effort, his life's work on the problem of the constitution of the nuclear structure of the atom. He attracted round him as research students most of the world's best scientific brains in what, to him, was the younger generation, and it has been in the main, members of that team who have scientifically completed to the extent now known to the world, one phase of the work of which Rutherford laid the foundations.

Though the fundamental discovery that the whole mass of an atom was concentrated in a minute central nucleus was made by Rutherford at Manchester University in 1911, the whole of his work from then on until 1932 was based on the use of naturally occurring materials of the radio-active type. In 1932, Cockcroft and Walton at the Cavendish Laboratory, Cambridge, carried out an experiment in which the bombardment and disintegration of atomic nuclei was accomplished by projectiles consisting of hydrogen nuclei, to which a very high velocity had been given artificially by means of an applied electrical voltage. This one experiment opened up an entirely new field of investigation which at once attracted the attention of the world's leading physicists, and led to a rapid increase in knowledge of the inner structure of matter, and in particular, knowledge of the construction and behaviour of the nuclear structure of the atom.

Oil Condensation Pump

What is not generally realised is that this experiment was in itself dependent on a less spectacular, but nevertheless important development which had proceeded during the previous seven years in the research laboratories of the Metropolitan-Vickers Electrical Co. Ltd. In these laboratories Dr. C. R. Burch, F.R.S., assisted by a number of colleagues, had initiated and carried through a research programme on the development of a new technique which led to the development of what was then unique as a system of high vacuum engi-

neering. Dr. Burch developed what is known as the oil condensation pump which had been rendered possible by one of his previous developments of a new range of extremely low vapour pressure oils and greases suitable for use in high vacuum engineering.

Early Experiments

In the course of one of his many visits to the Trafford Park laboratories, Lord Rutherford saw the first large-scale vacuum condensation pump to be engineered in the laboratories and realising its possibilities, immediately adopted it for the use of himself and his team in the furtherance of their own projects. It was this pump which was used in the first successful experiments on the artificial disintegration of the atomic nucleus.

Since that time pumps of the type developed by Dr. Burch, and the basic principles of vacuum engineering developed and applied by the Metropolitan-Vickers Electrical Co., have been among the main features for the experimental apparatus used the world over in atomic research, and without them it is certain that the work would not have proceeded, if at all, at the speed which has been possible.

The development of high vacuum engineering has been continued by Metropolitan-Vickers who have maintained the lead they established by pioneering this branch of engineering.

One of the most important pieces of apparatus used in the later stages of the investigational work into the structure of the atom has been the cyclotron, and that used in Liverpool by Sir James Chadwick, together with that used in the Cavendish Laboratory, first, under Lord Rutherford and then under Prof. Sir Lawrence Bragg, were both constructed and installed by the research laboratory of the Metropolitan-Vickers Electrical Co.

The company has also made valuable direct contributions to the national effort towards the atomic explosive, and was selected to design and manufacture a special compressor, together with pump and control systems for use in the preparation of material of the kind used in the atomic bomb. In addition, for the same projects, many new types of instruments were developed and supplied.

Durham.—The County Works Committee and Parliamentary Committee are to meet to discuss the possibility of the Council taking control of the transport undertakings in the county.

News in Brief

Change of Name.—The name of Redifon Electronics, Ltd., has been changed to Redifon, Ltd.

Institute of Metals.—The annual autumn meeting of the Institute of Metals will be held at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on September 12. The sessions will commence at 10 a.m. and 2.15 p.m.

Social Item.—The staff and workpeople of Ferranti Ltd., recently held a victory sports gala at Oldham. The prizes won in the sports were distributed by Mr. and Mrs. Vincent de Ferranti.

"Bob in the £" Savings.—In the Slough Savings League calculated on a "bob in the £" of wages basis, Superflexit, Ltd., recorded 1s. 2½d. in the £, Sciaky Electric Co. 6½d., Ferguson Battery Co. 8d., Hanovia, Ltd. 2s. 10½d., and Lindley Thompson Transformer Co. 8½d.

I.E.E. N.E. Students.—A visit has been arranged to the shipbuilding yard of R. and W. Hawthorn Leslie and Co., Ltd. of Hebburn, on September 1, at 2.30 p.m. The party will meet at the entrance in Ellison Street, Hebburn.

Railway Companies' Charges.—Liverpool Electric Power and Lighting Committee has appointed a deputation to wait on the Liverpool M.P.s with a view to further representations being made to the Ministry of War Transport with regard to the charges made by the railway companies for the use of requisitioned hopper bottom coal wagons.

B.B.C. in British Guiana.—It is announced that a representative of the British Broadcasting Corporation is in British Guiana carrying out a technical survey for the B.B.C. and the Colonial Office. The B.B.C., he states, plans to establish a high-power broadcast station in British Guiana to cover the whole Caribbean area, also to serve an all-Empire relay station to facilitate the transmission of programmes throughout the Empire.

E.A.W. Examination Results.—The E.A.W. electrical housecraft certificate

examination for demonstrators was held at 11 centres this year. 72 candidates sat the examination—double last year's figures. 51 were successful, 5 gaining distinction. The E.A.W. electrical housecraft certificate examination for teachers was held at 9 centres. 130 candidates sat the examination—an increase on last year's figures. 104 were successful, 12 gaining distinction.

Institute of Fuel.—A meeting of members and guests will be held in the hall of the Royal Geographical Society on October 17, at 6 p.m. when the Melchett Lecture will be presented by Prof. C. H. Lander, the Melchett medallist for 1945. No tickets for admission are required.

Accrington Experimental Houses.—Two experimental concrete houses have been officially opened for public inspection at Accrington, by the Mayor (Coun. G. E. Slack). The houses were built for the Corporation and completed within a fortnight. One of the houses is fitted with electricity and gas, and the other is all-electric.

Abolition of Smoke Campaign.—The Stretford Public Health Committee have circulated firms pointing out their obligation to avoid the smoke nuisance and suggesting that, wherever possible, they should switch over to electrically-operated machinery.

Precision Measurement Exhibition.—An exhibition of apparatus for the measurement and testing of metallurgical equipment, was opened on Monday, at the Cutler's Hall, Sheffield. Forty British firms are represented, and among the exhibits are a Braille reading micrometer, a slip gauge interferometer for the calibration of reference gauges and absolute measurement to one-millionth of an inch in terms of wavelengths of light, precision measurement by compressed air jets and methods for the detection of flaws and cracks in steel by supersonic sound. Sir Charles Darwin, Director of the National Physical Laboratory, and two Russian representatives were among the scientists at the opening.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN of August 20, 1920: The electric accumulator comes into its own at the Irthlingborough iron ore mines of the Ebbw Vale Steel, Iron and Coal Co. These mines consist of a bed of iron ore 15 ft. thick, and estimated to contain some 45 000 000 tons. The mine is worked on the pillar and staff system, and an electric drilling machine supplied with current from accumulators carried on a special truck at the rear of the machine is used to drill the holes in the face of blasting. This is, we believe, the first time accumulators have been used for driving drills in this way, and we shall watch the results of the experiment with interest.

Now It Can Be Told—V

British Firm Develops Radio Identification Equipment

IN connection with the release of information on radiolocation, some particulars have become available of the work of individual firms in developing the equipment for operational purposes. The number of firms engaged in the work was of course legion, but the first personal details on the subject have been sent to us by Ferranti Ltd., and an abstract of their statement is reproduced below.

Pre-war Operations

As early as May, 1939, Ferranti Ltd., were approached by Dr. R. A. Watson-Watt (later Sir Robert Watson-Watt), then Director of Communications Development, with a view to ascertaining what assistance they could give. At Bowdsey in Suffolk, a representative of the company was shown a chain station of the first radiolocation apparatus. Radio equipment was necessary which would give immediate identification of approaching aircraft to the ground control stations in such a way as to make it possible to distinguish between hostile and friendly planes. I.F.F. (identification friend or foe) equipment, as it was called, was conceived by the Air Ministry research staff and entrusted to Ferranti Ltd. to develop and produce.

From a rough model which was shown to a representative of the company, great things developed. Security requirements made it essential that within the Ferranti organisation only research and development personnel could be informed of the exact nature of the equipment; but, despite all difficulties, by October, 1939, I.F.F. units, having passed life, altitude and tropical tests, were leaving the factory for immediate installation in aircraft.

An I.F.F. unit may be briefly described as being a transmitter-receiver device installed in friendly aircraft whose purpose is to reply to the interrogation of the friendly radiolocation station. This it does by automatically responding to small transmitted signals and returning a much stronger coded signal at the same frequency. This coding is readily changeable. It is possible therefore by prior arrangement to indicate that the aircraft is friendly, belongs to a certain operational command, or the type of aircraft. The frequency band covered by the I.F.F. is similar to that covered by the stations engaged in the interrogation. In addition, an aircraft fitted with I.F.F. equipment can act as a beacon control for other aircraft by replying to their interrogation. In an emergency, the I.F.F. can transmit

a coded signal indicating distress, and provision is made for rendering the purpose of the equipment unrecognisable and unusable in the event of it falling into enemy hands. This is by the incorporation of a detonator in the unit which can be fired by pressing buttons, or automatically in the event of a crash by an impact switch.

With the outbreak of war it became necessary to identify aircraft not only to radiolocation stations, but also to anti-aircraft defences on a different wave-length, so modified units were necessary. Special sets were also required for night fighters and Coastal Command.

As well as a succession of new versions of I.F.F. however, Ferranti Ltd., had to co-operate with the aerodrome maintenance staffs. For this purpose portable test equipment, the now famous signal generator and output tester, was designed and built. A cathode-ray tube device for testing I.F.F. beacons and radar generally was also designed and known as the Woodscope (so called after its designer).

I.F.F. equipment has always been in great demand. At the time of the big raids a squadron leader of an active night fighter station arrived at Ferranti's radio works in his own car and urgently demanded 12 sets of I.F.F. equipment as his pilots insisted on having them fitted to their aircraft because of the additional security they gave. The firm checked up on the squadron leader and found everything in order. He waited patiently until the sets could be completed and tested, packed them in his car and drove off.

Enemy Searchlight Confusion

I.F.F. has had an interesting operational career too. When our bombers first carried it over enemy defences it was the cause of great surprise and delight to our pilots and bewilderment and consternation to the enemy. The German searchlights were radar controlled, that is to say they transmitted a beam which, on striking an aircraft was reflected back to the control apparatus. This was by no means pleasant for our pilots until, when I.F.F. was fitted, it was found that the transmission from the I.F.F. units upset the enemy radar searchlight system to the extent of switching off the beams.

The Ferranti organisation also, of course, undertook production for all three Services, including optical and gyroscopic devices for gunnery and navigation, valves and cathode-ray tubes, G.L. equipments, the "Gen Box" and many component parts.

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.

Irvine B.C., August 24.—Electrical installations in 48 houses to be erected as an extension of Clark Drive housing scheme. Specification from the Town Clerk, Council Chambers, Irvine; deposit, £1 ls.

Newcastle-upon-Tyne, August 24.—Supply and delivery of two 300 kVA transformers. Specifications from Mr. H. C. Godsmark, Transport and Electricity Undertaking, Manors, Newcastle-upon-Tyne.

Sheffield Electricity Department, August 27.—Supply and delivery of three 1 000 kVA 11 200/3 300 V, three-phase, 50 cycle transformers. Specification from Mr. John R. Struthers, Commercial Street, Sheffield, 1; deposit, £2 2s.

West Hartlepool T.C., August 27.—Twelve months' supply and delivery of p.i. cables. Specification from Mr. S. Tillotson, Electric House, Church Street, West Hartlepool.

Birmingham Electric Supply Department, August 29.—Supply and delivery during the period ending August 31, 1946, of ten 750/410 V three-phase distribution transformers, and of various ratings from 50 kVA to 1 000 kVA. Particulars from Mr. F. W. Lawton, 14, Dale End, Birmingham, 4.

Bradford City Council, August 29.—Supply and delivery of three-phase static transformers (Contract "C. 31"). Particulars from Mr. T. H. Carr, Electricity Department, 27, Bolton Road, Bradford.

Brighouse T.C., August 31.—Supply and delivery of two 300 kVA transformers and two sets of e.h.t. switchgear. Specifications from the Electrical Engineer, Huddersfield Road, Brighouse.

Glasgow Lighting Department, August 31.—Supply of 500 lanterns for 300/1 500 W electric lamps. Specifications from the Lighting Department, 20, Trongate, C.I.

West Riding Standing Joint Committee, September 1.—Electrical work in connection with adaptations at the West Riding Constabulary Headquarters, Wakefield. Specifications from the West Riding Architect, County Hall, Wakefield.

West Riding C.C., September 5.—Installation of heating and domestic hot water services at new dental clinic, Bonegate House, Brighouse. Specifications from the

West Riding Architect, County Hall, Wakefield.

Lochgelly B.C., September 8.—Electric lighting installations in connection with 42 houses to complete the Lumphinnans Road housing scheme. Particulars from the Burgh Surveyor, Town House, Lochgelly; deposit, £2 2s.

Birmingham Electric Supply Department, September 12.—Supply and delivery during the period ending September 30, 1946, of electric kettles, saucepans, cookers, wash boilers, circulator water heaters, cooker control units and circulator control units. Specifications from Mr. F. W. Lawton, 14, Dale End, Birmingham 4.

Brierfield U.D.C., September 20.—Supply, delivery and placing into position, of two 250 kVA three-phase 6 600/400 V transformers. Specification from Mr. N. Ashton, "Electricity House," Colne Road, Brierfield; deposit, £1 ls.

Brierfield U.D.C., September 20.—Supply, delivery and erection of 6 600 V metal-clad switchgear. Specification from Mr. N. Ashton, "Electricity House," Colne Road, Brierfield; deposit, £1 ls.

North of Scotland Hydro-electric Board, October 15.—Supply, delivery and erection of 132 000 V transmission lines. Specification from Mr. T. Lawrie, 16., Rothsay Terrace, Edinburgh, 3; deposit, £5 5s.

Bridge of Allan T.C.—Electrical work in connection with the erection of 34 houses at Cawder Road and 16 houses at Cornton. Particulars from the Town Clerk, Burgh Chambers, Bridge of Allan.

CAPACITY CURRENT HEATING

The British Electrical and Allied Industries' Research Association has issued Report Ref. Y/T6, entitled "Capacity Current Heating," prepared by Messrs. T. H. Messenger, and D. V. Onslow, as a joint report of the R.A.B.R.M. and the E.R.A. The demand for high-speed production in the war industries and the rapid advance made in radio technique during the war have, it is pointed out, been responsible for an expanding interest in the capacity current heating ("dielectric heating") of wood, rubber, plastic and other non-metallic materials. This report summarises the position to date. It deals with the theory of the method of heating and; in some detail, with its applications. Equipment and costs are also considered. The report is supported by a Bibliography of 241 references; copies of it may be obtained from the association, price 9s. 3d., post free.

Industrial Information

Mazdalux Translucent Shade.—The British Thomson-Houston Co., Ltd., have published in leaflet L 714 a/M, details of their translucent shade, designed for all lighting purposes where low cost is a governing factor.

B.T.H. Activities.—The current issue of this publication of the British Thomson-Houston Co., Ltd., includes an article describing the electrification of Cosford water-works; another, on the lubrication of geared motor units, together with a number of items of personal interest.

B.E.A.M.A. Contract Price Adjustment Formula.—For the purposes of calculating variations in (a) rates of pay, the rate of pay for adult male labour at August 11 shall be deemed to be 95s.; (b) costs of materials, the index figure for intermediate products last published by the Board of Trade on August 11 is 182.5 and is the figure for the month of July, 1945.

Bristol Engineering Exhibition.—Sir Stafford Cripps, President of the Board of Trade, has been asked to open an exhibition, organised by the Bristol Engineering Manufacturers' Association, to be held at the Victoria Rooms, Bristol, from Friday, September 7, to Saturday, September 15. The exhibits will include the latest developments in lighting, in plastics and electric welding, new household appliances, kitchen units, and so on.

Industrial Law for Executives.—The Industrial Welfare Society's correspondence course in industrial law consists of six lectures each of which can be read in one to one and a half hours, and students are invited to submit any questions they wish on the lectures. Particulars can be obtained from the Secretary, Industrial Welfare Society, 14, Hobart Place, London, S.W.1.

Post-War Trade.—Manufacturers wishing to undertake preparatory work for post-war trade need not now make individual application to the Board of Trade before undertaking preparatory development work of this kind. It will still be necessary, however, for firms to obtain licences for raw materials which may be required for development work and for actual manufacture where this is subject to control.

Approval of Permitted Prices.—The Central Price Regulation Committee have approved the following prices for the electric boiling ring made by W. R. C. Ltd., Cobbold Estate, Willesden, N.W.10: manufacturer's selling price 17s. 6d.; wholesale selling price 21s. 10½d.; retail selling price 29s. 2d. Revised prices have also been

approved for the same company's electric irons, to take effect from July 1, as follows: manufacturer's selling price 13s. 6d.; wholesale selling price 17s.; retail selling price 22s. 8d. The prices are exclusive of purchase tax.

Eire Suspension of Import Duties.—The Government of Eire has made Orders continuing until October 31, 1945, the suspension of the Customs duties on the following articles:—Dry batteries and component parts; copper tubes and tubing, etc.; electric wire and cable; electric heating and cooking apparatus; sparking plugs and sparking plug parts. The duty on wireless telegraphy apparatus and certain component parts and accessories (Tariff Ref. No. 266/2) is not chargeable on dry batteries, or on component parts thereof, during the period of the continued suspension of the duty on these articles.

Radio Industry in War and Peace.—At the inaugural luncheon of the Radio Industry Council in January last, Mr. Duncan, chairman, described in his address some of the work of the industry during the war. Following that luncheon, it was decided to prepare in printed form a fuller version of the industry's war history and its plans for peace, so that there might be a better general appreciation both at home and abroad of the achievements of the industry and those engaged in it. A booklet—"The Radio Industry in War and Peace"—is the result. Copies have been posted to radio dealers throughout the country, but others may be obtained on application to the Council at 59, Russell Square, London, W.C.1.

Interrupted Apprenticeships.—A scheme has been prepared by the National Joint Industrial Council for the Electricity Supply Industry, acting in conjunction with the fourteen District Joint Industrial Councils for the Electricity Supply Industry, and approved by the Ministry of Labour and National Service, for the training of apprentices whose apprenticeships have been interrupted by war service. It relates only to the following skilled trades: armature winders, electricians, electrical fitters, fitters and turners (mechanical), meter repairers, and meter and instrument testers. Forms I.A.S./Scheme No. 11, embodying an agreement, can be obtained from the Ministry of Labour and National Service.

H.M.S. "Goodwill."—This title, though fictitious, is applicable to a naval establishment near Portsmouth where a garage has been converted into a clothing store for demobilised men, and where goodwill and

commonsense seem to permeate the atmosphere throughout the building. As will be



G.E.C. fluorescent lighting at a naval reclothing and demobilisation centre

appreciated from the illustration, fluorescent tubular lamps are used to make the selection of garments in their true colours easier.

Government Factories for Civilian Industry.—Twenty more Government factories have been allocated by the Board of Trade for future civilian production, though actual peace-time production will not begin in a number of instances until after the end of the Japanese war. Among the releases are a factory at Swinton, Mexborough, Yorks, of 556 000 sq. ft., to the General Electric Co. Ltd., for the manufacture of electric cookers and household appliances; one at Doncaster, of 109 485 sq. ft., to Crompton Parkinson and Co. Ltd., for the making of electrical equipment; and another at Newport, of 201 000 sq. ft., to the Standard Telephones and Cables Ltd., for the making of transmission equipment, rubber wire and plastic cables.

Export Credits Guarantees.—Under the provisions of the Export Guarantees Act, 1939, the Export Credits Guarantee Department is authorised to give guarantees to United Kingdom exporters for the purpose of encouraging export trade. War conditions have greatly increased the risks to which exporters are exposed in overseas trading, and the Department has put into operation special facilities giving them

protection against these risks on exceptionally favourable terms. The standard form of cover is the War Emergency policy which covers the exporter of consumable goods sold for cash, or on short credit, from the time he books an order until he receives the amount due to him in payment for the goods. The cover at present available is either 85 per cent. or 90 per cent., according to the particular risk. The Department also issues a policy which enables exporters to quote firm c.i.f. prices some months ahead of shipment. Under this guarantee exporters in respect of any c.i.f. transaction are covered against any rise in marine insurance, Government war risk insurance and freight rates occurring within an agreed period (normally six months). Further particulars can be obtained from the headquarters of the Export Credits Guarantee Department at 9, Clements Lane, Lombard Street, London, E.C.4, or from any of the branch offices.

Licensing Industrial Electrical Equipment.—Under the Control of Industrial Electrical Equipment (No. 4) (Revocation) Order, 1945, it is no longer necessary for an acquirer to obtain a licence before placing an order for any industrial electrical equipment. A system of selective control has been introduced to take care of Service and other essential requirements for certain items where the supply position does not permit a complete relaxation of licensing. These items appear on a nominated list and orders for them can only be accepted by suppliers under the authority of a supply licence issued by Machine Tool Control, except where the transaction is covered by one of the exemption clauses. The present nominated list comprises d.c. motors, d.c. and a.c. generators, static condensers designed for power factor correction and automatic voltage regulators.

"Conversazione" for Works Staffs.—The Witton development laboratory staff of the General Electric Co., Ltd., recently arranged a "Conversazione" to which 600 members of the administration and production staffs of G.E.C. works in the South Midlands area were invited by Dr. W. Wilson, chief of the laboratory. The object was to give the visitors an insight into the work of the laboratory and the wide variety of investigations being made there. The work in progress in the 32 sections of the seven main buildings of the laboratory was explained by the operating staff and demonstrations were given, notably in the increasing use of electronic apparatus; new techniques in connection with carbon and metal electrode welding, and, in the insulation section, a method of automatic high speed treatment of rotors by means of synthetic impregnants and infra-red heating. Scien-

tific cine films were shown in the conference room, and lectures were given in the library.

Northolt Demonstration Houses.—The Ministry of Works demonstration houses at Northolt are to be handed over to the Ealing Borough Council for letting in the normal way. These, and particularly the two all-electric houses, were briefly described in *THE ELECTRICIAN* on Sept. 29 last year. During the eleven months since the opening of the site for exhibition 35 000 visitors have inspected the houses. Representatives have come from the United States, reconstruction committees from Russia, France, Norway and Poland, professional visitors from Australia, New Zealand, Africa (South, East and West), Jamaica and the Argentine, delegations of Arabs and Jews from Palestine and representatives of the Allied Control Commission in Germany. At home, practically every local authority, from the smallest rural district council to the corporations of the great cities, has sent representatives. A considerable number of parties from the Services, both men and women, have also been conducted over the estate.

Trade Mark Radio Sets in Autumn.—A plan for the partial change-over of the radio industry production from war to peace equipment has now had Government approval and makers have new programmes in hand, announces an official of the Radio Industry Council. The first new sets are likely to be available in the autumn, although initially supplies will be very limited. Not until well into 1946 will there be a possibility of making any substantial inroad into the large public requirements for new radio receivers. The first post-war sets will be very similar to models in the immediate pre-war ranges; refinements of production introduced during war-time will add to reliability and general efficiency. The new models will be individual designs backed by the radio manufacturers' trade marks so well known before the war. Labour and material costs are likely to make the prices of the new sets considerably higher than the immediate pre-war models; and, like other household necessities, purchase tax has to be added. Arrangements with the Board of Trade will result, however, in a large percentage of the production being in sets at a price of £15 or under, exclusive of purchase tax.

Industrial Estate Proposed.—The Board of Trade, it is understood, are at present investigating the suitability of sites in the Lanarkshire area between Hamilton and Rutherglen for the erection of an industrial estate. This would be in addition to the 140 acres industrial estate to be erected at Newhouse. Lanarkshire, the

Board of Trade states, is now a priority area in Scotland for industrial development. Certain war-time factories there have either shut down or are about to be closed, but efforts are being made to induce firms occupying them to turn over the plant to peace-time production, instead of relying exclusively on their main works in other parts of the country. It is in this connection, reported that Philips Lamps, Ltd., are to open a Government-built factory in Hamilton, and E. K. Cole, Ltd., have already commenced production in a factory in Rutherglen. Hoover, Ltd., are moving their factory from Rutherglen to larger premises at Cambuslang, while Magnetic and Electrical Alloys, radio component manufacturers, at present occupy a Government-built factory at Burnbank. Other firms who have recently started production in Lanarkshire are Vactrics, Ltd., now making appliances at Chapelhall; and Smith's Electric Clocks, at Carfin.

Exports from Latin America.—Following up its survey of Britain's post-war export possibilities in the Latin American countries, the Bank of London and South America has now issued another brochure under the title of "Post-War Exports from Latin America," dealing with the scope for trade in the reverse direction. The bank emphasises, that once the large reserves of foreign currencies accumulated during the war have been used in covering the pent-up demand for imported goods in Latin America, the means to pay for continued imports will depend mainly on the extent to which Argentina, Brazil and the other South American countries are able to sell their products abroad. One war-time development which is brought well to the front in this review is the expansion of Latin American production far beyond the relatively few staple lines which constituted the major part of exports a few years ago. Although Latin America's economy is and will continue to be based primarily upon natural resources (farming, mining, forestry), there are many other less well-known products which might replace those unobtainable for some time to come from the Far East and other quarters. On the facts it is clear that there are vast untapped resources, the future development of which will continue to depend to a considerable extent on capital and technical assistance from abroad. Copies of the booklet may be obtained upon application to the head office of the Bank of London and South America Ltd., at 6, 7 and 8, Tokenhouse Yard, London, E.C.2, or at the agencies in Bradford (19, Sunbridge Road), and Manchester (36, Charlotte Street).

Company News

TILLING-STEVENS, LTD.—Fst. and fin. div. 5% (same).

NORTH-EASTERN ELECTRIC SUPPLY CO., LTD.—Intm. div. 2½% (same).

EAST AFRICAN POWER AND LIGHTING.—Fin. div. 4% (same) mkg. 7% (same).

W. H. DORMAN AND CO. LTD.—Fst. and fin. div. 16½% (same). Net pft. to Mar. 31, £82 723 (£123 637).

CIRCUIT ELECTRICAL CO., LTD.—Nom. cap. has bn. increased by addition of £1 000 beyond the reg. capital of £500.

TIDNOCK INDUSTRIES, LTD.—Nom. cap. has bn. increased by addition of £19 900 in £1 shs. beyond the reg. cap. of £100.

TELEPHONE RENTALS, LTD.—Fin. div. of 6% (same) for yr. ended May 31, 1945, payable Oct. 4, mkg. 10%, less tax, for yr. (same).

CRYSTALATE LTD.—At a recent meeting a resolutn. for the conversion of the co.'s issued shs. into stk. was carried unanimously.

MEXICAN LIGHT AND POWER.—Gross earnings for May, \$1 210 154 (increase \$180 184). Net earnings, \$238 826 (increase \$75 970).

SILENTBLOC LTD.—Intm. and fin. divs. mkg. 25% less tax, absorb £20 625 (£18 750). Blee. carried fwd. £13 487 (£13 465).

BOGNOR AND DISTRICT GAS AND ELECTRICITY LTD.—Intm. 3½% (same) on "A," 4½% (same) on "B," and 3½% (same) on new cons. stk.

ROTHERMEL CORPORATION, LTD.—Nominal cap. has bn. increased by the addition of £90 000 in 1 800 000 ord. shs. of 1s. each beyond the reg. cap. of £50 000.

BAYLISS JONES AND BAYLISS, LTD.—Nom. cap. has bn. increased by 50%. The authorised total has been raised from £400 000 to £600 000 by the creation of 200 000 £1 ord. shs.

TELEGRAPH CONSTRUCTION AND MAINTENANCE CO. LTD.—Shareholders have subscribed for 92% of issue of 227 212 £1 shs. offered at 50s. each in the proportion of one for every two held on July 31 last.

VACTRIC LTD.—Net pft. for yr. to Mar. 31 £37 774 (£43 325). Fin. div. 15% (same), mkg., with the 7½% intm., total of 22½%, less tax, on ord. Pft. of Vactric and subsids. for 1944-45 is £55 439 (£68 804).

F. J. W. LTD.—Private co. reg. Aug. 9. To carry on the business of dirs. in and mnfrs. of radio, television and elec. apparatus and materials, etc. Cap. £1 000 in £1 shs. Reg. office, 68, Watling Street, Radlett, Herts.

LARMUTH AND BULMER LTD.—Pft. to Mar. 31, £12 836 (£15 008). To dirs.' fees £800 (same), deprecn. £768 (£1 097), tax £6 399 (£7 753), lvg. net pft. £4 870 (£5 357); pref. div. £1 133 (same), ord. div. 10% (£3 000) (same), fwd., £6 099 (£5 363).

JAMES HOWDEN AND CO., LTD.—Net pft. to Apr. 30, 1945, £181 332 (£203 390); brot. in, £28 414 (£22 874); tax provision, £150 000 (£139 000); deferred repairs £2 000 (£31 000); to gen. res., £10 000 (same); ord. div. 15% (same); fwd., £29 896.

PARRY BROS. AND HALL, LTD.—Private co. reg. Aug. 9. Cap. £2 000 in 2 000 shs. of £1 each. To carry on the business of constructional, mechanical, marine, motor, electrical, aeronautical and general engineers, tool makers, etc. Reg. office, 60, Harford Street, Birmingham, 19.

MILLS AND YOUNG, LTD.—Private co. reg. Aug. 10. To carry on the business of consultants, electrical, heating and ventilating engineers and contractors. Cap. £5 000 in 5 000 shares of £1 each. Registered office, 145, Wardour Street, W.1.

METAL INDUSTRIES LTD.—Pft. for yr. to Mar. 31, £266 548, £9 042 increase, taxatn. £143 071, £5 303 increase, earnings on ord. £108 193, £3 224 increase. Div. on the 5% pref. absorbs £12 734 (£12 969), on ord. £97 959 (£93 659). Dirs.' fees are £2 550 (£1 800). Sum taken fwd., £10 234 more at £161 390.

Company Meetings

VICTORIA FALLS AND TRANSVAAL POWER CO.—The annual meeting was held in London on August 14. In the statement circulated with the report and accounts, Mr. Arthur E. Hadley, the chairman and managing director, said the volume of business had been well maintained during the year and the results, while of the same general order as last year's, showed improvement. The net profit of £575 921 compared with £555 579 for 1943. This had enabled a dividend of 15 per cent. to be paid on the ordinary stock and 10 per cent. on the preference stock, with an addition of £150 000 to the reserve, bringing that fund up to £1 600 000. The amount carried forward at £342 240 showed a small increase of about £15 000.

W. G. ALLEN AND SONS (TIPTON), LTD.—The annual meeting was held at Tipton on August 15. Mr. Arthur Colegate, the chairman, presided. In the course of his address the chairman said that in addition to other war-time activities the company has sent large quantities of accessories of all kinds to Russia, particularly in connection with the great power

stations which were being built there and also for the mobile power stations which had been of such advantage to the devastated regions of Soviet Russia. He was glad to be able to say that their order book was full for their normal products for home and export, which seemed to be required in ever increasing quantity, and as soon as they were permitted to do so, they would devote all their efforts to the

production of those commodities which were as urgently required for peace as their war products were for the prosecution of hostilities. Everyone must be careful to give the new Government a fair deal, but it was equally important that the Government itself must give a fair deal to those upon whom would rest the main burden of turning the energies of the nation once more into productive channels.

Commercial Information

Mortgages and Charges

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

DOWSING CO. (ELECTRICAL MANUFACTURERS) LTD., London, S.E.—July 28, assignment, to Barclays Bank Ltd, securing all moneys due or to become due to the Bank; charged on various contract moneys. *£500. June 20, 1944. *

ELECTRICAL AND GENERAL ACCESSORIES (LEICESTER) LTD., B'ham.—July 30, £8 000 deb. to Branch Nominees Ltd.; general charge. *Nil. Feb. 14, 1945.

R. J. KEMP AND CO., LTD., Coalville, elec. engrs.—July 25, assignment securing to Lloyds Bank Ltd. £1 000 (not ex.); charged on contract moneys. *—. Mar. 25, 1943.

Satisfactions

BUTLER'S RADIO LTD., London, E.—Sat'n. July 31, of deb. reg. Mar. 16, 1934, to the extent of £50.

JOHNSON AND PHILLIPS LTD., London, W.C.—Sat'n. July 31, £400 000 reg. Mar. 7, 1933.

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.

BIRCHALL, Thos., 13, Marston Road, Marston Moretaine. electrician. £13 18s. 9d. May 2.

HAYMAN, H., 26, Devonshire Street, W.1, (Tradg. as Hayman and Craig), radio engineer and dealer. £22 8s. 10d. June 27.

RADIO REPAIRS, 71, Melton Road, West Bridgford, radio dealers. £18 0s. 10d. June 19.

TOMBS, P. R. A., 13, Richmond Road, Oxford, electrical engineer. £14 11s. 1d. May 30.

Companies Winding Up

DOWNTON ELECTRIC LIGHT CO. LTD. (Members voluntary winding-up).—Creditors of the above named company are required on or before September 10, 1945, to send in their names and addresses with particulars of their debts or claims to Mr. Arthur M. Scott, of 24-30, Gillingham Street, London, S.W.1, Chartered Accountant, Liquidator.

AMESBURY ELECTRIC LIGHT AND GENERAL SUPPLY CO. LTD. (Members' voluntary winding-up).—The creditors of the above named company are required on or before September 10, 1945, to send in their names and addresses with particulars of their debts or claims to Mr. Arthur M. Scott, of 24-30, Gillingham Street, London, S.W.1, Chartered Accountant, Liquidator.

Metal Prices

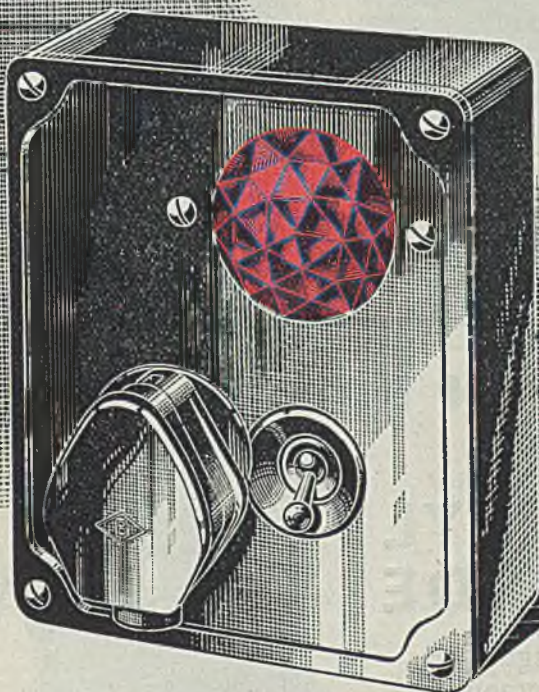
		Monday, August 20.	
		Price.	Inc. Dec.
Copper—			
Best Selected (nom.) per ton	£60 10 0	—	—
Electro Wirebars ... "	£62 0 0	—	—
H.C. Wires, basis ... per lb.	9 $\frac{7}{8}$ d.	—	—
Sheet ... "	11 $\frac{1}{2}$ d.	—	—
Phosphor Bronze—			
Wire(Telephone)basis "	1s. 0 $\frac{1}{2}$ d.	—	—
Brass (60/40)—			
Rod, basis ... "	—	—	—
Sheet " ... "	—	—	—
Wire " ... "	11 $\frac{1}{2}$ d.	—	—
Iron and Steel—			
Pig Iron (E. Coast Hematite No. 1)... per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ... "	£28 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ... "	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G. ... "	£26 0 0	—	—
Lead Pig—			
English ... "	£31 10 0	—	—
Foreign or Colonial ... "	£30 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity) ... "	£303 10 0	—	—
Wire, basis... per lb.	3s. 10d.	—	—
Aluminium Ingots ... per ton	£85 0 0	—	—
Spelter... .. "	£31 5 0	—	—
Mercury (spot) Ware—			
house per bott.	£69 15 0	—	—

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

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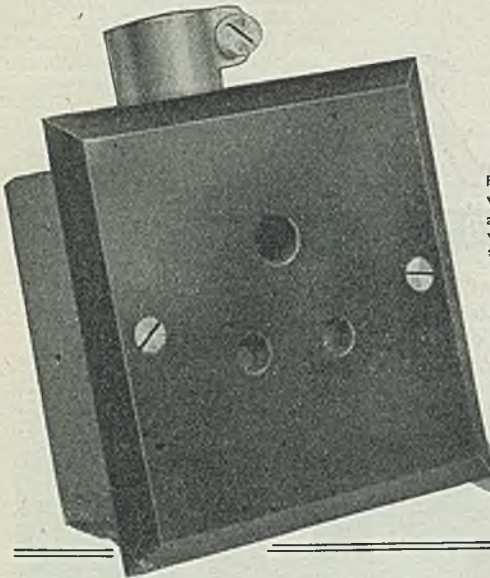
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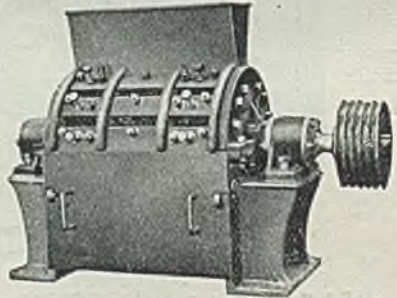
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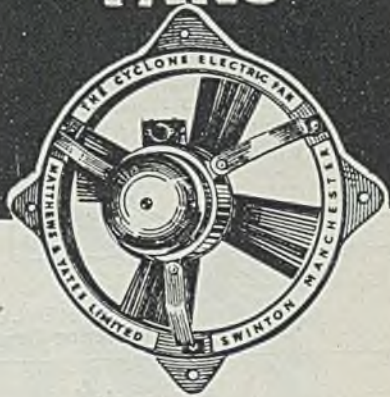
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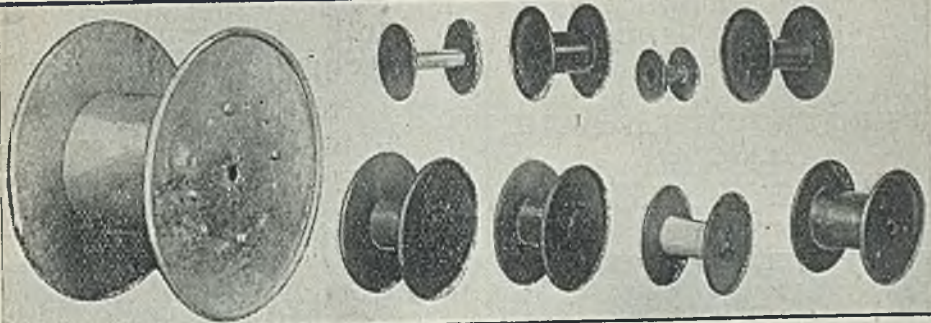
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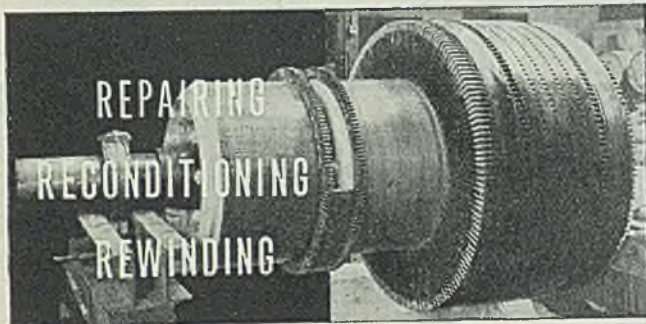
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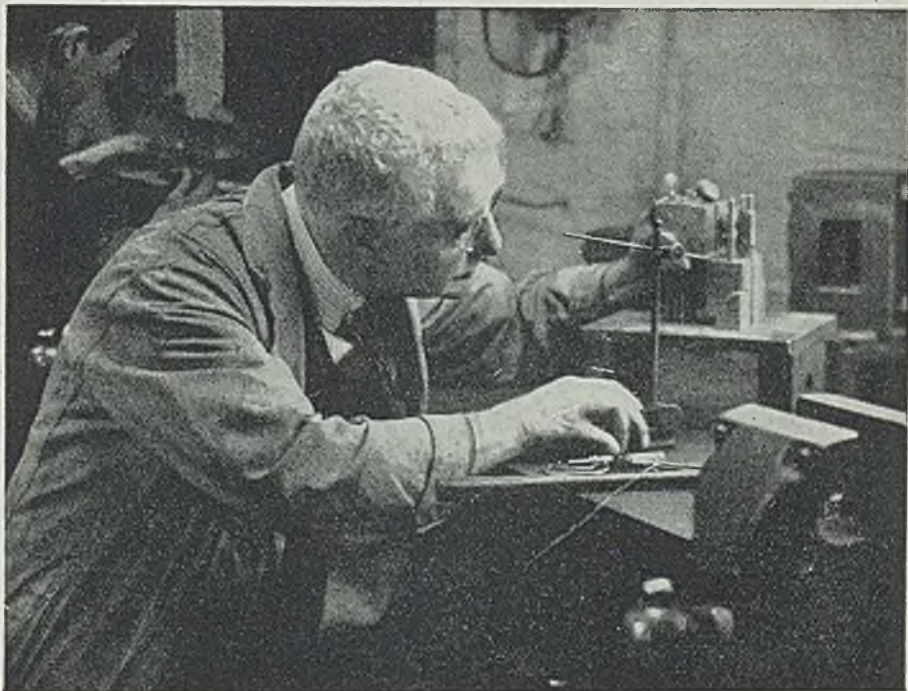
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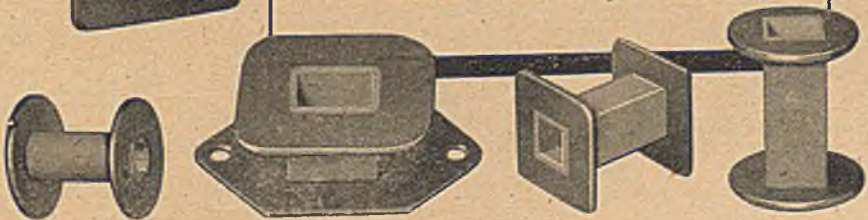
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