THE
ELECTRICIAN

Vol. CXXXV. No. 3507. Friday, August 17, 1945. Sixpence
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No. 3507. [Vol. CXXXV, No. 7] August 17, 1945 Annual Subscription 25s Overseas 30s.

CHIEF CONTENTS OF THIS ISSUE

VJ-Day and After

WITH the surrender of Japan, has come to an end a war which has lasted just short of six years' duration.

During that time the electrical industry has, as was referred to in connection with VE-Day, played a part unparalleled in importance, for without its efforts, its sacrifices and its inventions, no branch of the Armed Forces would have been able either to withstand the onslaught of the enemy, or to attack with such unquestionable success. Without in any way belittling the generalship, the courage, endurance and hardship which went to make our victories possible; without in the slightest degree denying the Armed Forces the credit which is their due, the electrical industry has achieved since 1939 feats, which if suggested as being possible before that year, would have been regarded as being beyond its ability.

Since commenting on the achievements of the industry up to the time of VE-Day, roughly three months ago, such electrical engineering accomplishments as Operation Pluto, the anti-magnetic mine cable, the atomic bomb, and others, have become known to the general public, and no doubt others will follow. Such achievements, altogether apart from their technical difficulties, have not by any means been easy, for, in addition to the hazards of aerial bombardment by piloted aircraft, V1 and V2 weapons, the industry has operated under the most appalling shortages of technical man-power and materials; with an ever-growing demand for power from generating stations which the Government would not permit the industry to extend; and for the operation of which the Ministry of Fuel supplied an inconceivably low-grade, or unsuitable coal.

In reviewing these difficulties, however, they cannot be regarded as something which may be forgotten, for some are still with us, and look like remaining for some time; added to which the continued shortage of technical man-power may quite conceivably jeopardise the power station extension programmes scheduled for completion in the next three years. This in turn is likely to bring about a delay in the reconversion to peace-time production of industry as a whole, for the power shortage resulting from the non-expansion policy set by the Government during 1940-41, and the possibility of load shedding next winter, may aggravate the necessary time-lag between the placing of machine tool orders and their completion.

The gravity of all the problems which face the industry must, therefore, temper the exuberance of any rejoicing, and should also ensure that political theories be subordinated to the background until such time as industry is able to recover from the shock of war.

Men now in the Forces will sooner or later find themselves in the civilian em-

ployment field, and if industry is to absorb their services at an adequate rate, there is much yet to be done. Machine tools which during the last six years have been working with little time for overhaul are in many cases now either worn out or obsolete, and until the man-power to make new machines is released in sufficient volume to meet the demand, industry in general cannot reasonably be expected to be able to make its switch-over to peace-time production with that speedy flexibility which is its hope.

The Heavy Hand of Controls

SO far as electrical industry is concerned, we have no fear of the future nor any doubt of the expansion which will be brought about, but in those beliefs is an appreciation of the fact that the years ahead will make up a period of hard work and sacrifice. Not only has the leeway lost in the war years to be made good, but its recovery will have to be made in the face of keen competition, set by many who before the war were our customers. The industry has during the last two years made large-scale plans for expansion, but not until the aftermath of war has passed over can those preparations be put into effect. In this respect we must look to those who carry the responsibility of exercising the various controls, to give serious consideration to all the problems which the continuance of the restrictions must bring about; for the present stranglehold on the electrical industry is likely to have repercussions upon every trade where motive power is used in the production of its output—from clothing to house-building.

Cooling Towers for Lincoln

LINCOLN'S cooling tower controversy, which has lasted for nine months, has ended with a decision of the City Council by 13 votes to 11 to reject the alternative scheme submitted by Mr. E. C. FARRAN, consulting engineer, of Doncaster, and accept the scheme which provides for four, and ultimately eight, cooling towers 90 ft. high at their new generating station. There was, it will be remembered, much opposition to the cooling towers scheme, which, it was claimed, would seriously interfere with the amenities of the city. After a public inquiry several conferences were held between representatives of the Council and the Central Board, and the latter, after persistent pressure, agreed to the alternative scheme which utilises river water for cooling. The City Council, meeting in committee, then adopted this scheme but, at a public meeting of the council last week, voting went solidly against the Farran scheme on the ground that it was a gamble to which the ratepayers should not be committed. So, after nine months' controversy, the original intention may now be carried out without, we hope, any further brake upon the development of the local undertaking.

Overseas Trade Problem

THE circumstances of war are no doubt responsible for the abnormality of the import figures published by the Board of Trade last week, and because of this it is difficult to assess their relation to future trade, except to emphasise the extent of the adverse trade balance and the necessity of its rectification now that so much of our overseas income is lost. The widening of the gap between imports and exports is not only a matter of volume, however, for prices play an important part, and the increase in these and importing costs may persist for some time. Relating exports to non-munition imports, there was last year an adverse balance of over £1 000 million, representing in cash a rise of some £400 million compared with 1938, but a reduction in volume of 21 per cent. With the end of the war, the character of our import trade will doubtless undergo some change, but since much of the raw materials of exporting industries has to be brought into the country, it is questionable whether there will be any substantial reduction in import values while present prices obtain.

Imports of Electrical Goods

TURNING to electrical goods, the value of the imports last year reached £23 666 100, compared with £8 182 811 in 1943 and £3 106 805 in 1938; the value of retained imports of these goods, at 1935 prices, was £9 629 000, and £2 834 000 in 1938. Of the £23 666 100, £20 586 581 represents the value of goods from the U.S.A., and £3 067 316 of goods from Canada. This rise was due to heavy imports of wireless apparatus for operational purposes, following upon the preparations for the

invasion of Europe, and the expanding needs of the Forces in the Far East. The necessity for such large imports of radio equipment from America, added to the ever-expanding manufacturing capacity of the British electrical and radio industries, indicates the important part which electrical communication plays in total war. Much of this equipment when incorporated into war machines such as tanks, aircraft, and so on, will have been shipped to Russia, China and elsewhere, without leaving any record in the export figures—making it therefore more difficult than ever to assess the true value of the import figures just published.

Notes on Plastics

IT will be remembered that before the war and during its early years, there used to be published in THE ELECTRICIAN information with respect to new and various plastic materials and their applications. As the war progressed, plastics were used as a substitute material for many purposes, including metals, and for reasons in connection with censorship the articles were discontinued. In view of the fact that plastics are expected to play an increasingly important part in post-war reconstruction of trade, however, it is considered to be in the interest of the electrical industry, that we should now devote some space to making known the developments and improvements which have come about in the plastics world during the last five years. To this end we have arranged with our pre-war correspondent on the subject to resume his reviews in this issue, and thus will the manufacturing industry be informed on a matter which will no doubt have a considerable influence on the design of future domestic appliances, instrument cases, and so on. There is, of course, a certain amount of restriction on publishable material, but so much can be said without offence to authority that the resumption of what was before the war considered by the industry to be a most valuable series of articles, is now due.

Plastics in the United States

IN view of the plastics position in this country it is interesting to note that in a recent speech before the New York Society of the Plastics Industry, Mr. PAUL MCNUTT, the chairman of the United States War Man-power Commission, pointed out that employment in the industry in the U.S.A. had risen from 18 000 workers in 1939 to 50 000, and for the time being was likely to remain more or less stable. Mr. MCNUTT suggested that the United States was now producing plastic materials at the rate of 200 000 short tons a year; in 1939, when the United States was believed to be responsible for about half of the world output, production was around 100 000 tons. During the war, plastics have, of course, been used for making a wider range of products than in peace-time, and this has entailed a more than proportionate increase in the amount of labour employed. Doubtless, too, much of the additional labour has been less skilled.

Fluorescent Lighting in Trains

ONE of the greatest boons to those engaged upon the production of munitions and other work of national importance during the war, has been the shadowless light of the fluorescent lamp. As soon as conditions permit and sufficient supplies become available, the use of this form of lighting will doubtless have a tremendous expansion, for already one transport authority, more wide-awake than the others, has indicated by announcement, that in the G.W.R. coaches now being built at Swindon, fluorescent tubes will take the place of the usual electric bulbs, and will thus give an even daylight effect over the whole of each compartment.

Optimum Wavelength Forecasting

THE data obtained at the time of the eclipse of the sun will be of material assistance in improving long-distance radio communications by advancing what is known as "optimum wavelength forecasting"—a new science developed during the war. It was mentioned last week by Sir EDWARD APPLETON that there is now in progress a world survey of the electrical strength of the Appleton and Heavyside layers, in which Great Britain, India, Canada, New Zealand and Australia, in particular, are all taking their share. "We now know," stated Sir EDWARD, "that the reflecting powers of these layers vary from day to day, from month to month and year to year. We can now predict the best wavelengths to use months in advance to get the best reflections."

Now It Can Be Told—IV

Achievements in Radiolocation—The Man-Power Problem

WITHOUT yet revealing the technical details of radiolocation beyond what is generally well known, some particulars of the development and application of this form of radio engineering were revealed to the public on Wednesday, and we hope in our next issue to be able to give some hitherto unpublished information on the technical aspect of the subject.

As was explained by Sir Edward Appleton in the Kelvin Lecture last April, a chain of radiolocation stations round our coastline was started before the war, and as the months progressed more and more were erected until at the time of the Battle of Britain in 1940, the system enabled operators on the ground to detect, identify and plot the course of enemy aircraft from many miles away. Because of this a precious handful of fighter aircraft and pilots were able to concentrate their attack where and when it was needed, and to drive from the skies the biggest air armada the world had then ever seen.

British Leadership

It is a matter of history that the Germans were at first surprised and ultimately dismayed by this clear demonstration of British scientific leadership, and they never caught up with that lead.

Work in real earnest was made to finish the radiolocation chain facing the Continent at the time of Munich, and the building of a continuous chain of stations from Scotland to the Isle of Wight by March, 1939, was accomplished. In order that the warnings of enemy air attack could be transmitted from the stations to the R.A.F. controllers, and so to the civil defence and the public, a new network of telephone lines had to be specially laid by the G.P.O.

Ever since that Easter before the war when Italy invaded Albania, a 24-hour watch has been kept on the North Sea approaches and the majority of the aircraft approaching our eastern shores tracked and plotted. Soon after war began, the rest of the coastline of the United Kingdom was covered, too, completing the last link in the defence chain.

During that first year of scattered raids the chain, reinforced by special stations designed by Army authorities to deal with low-flying aircraft, gave the first warning that sent the sirens wailing, but the great testing time of the chain's capacity and value was the Battle of Britain.

Each radiolocation station was a combined transmitter and receiver. Its powers were the measuring of distance, and height of aircraft within its very considerable range, besides differentiation between friend and foe. As soon as the principle had been clearly established that pulses of energy on about ten-metre wavelengths could be transmitted to "floodlight," as it were, a wide space, and that all aircraft in that space would give an indication of their presence and a precise measure of distance from the station, the determination of direction was accomplished by adapting existing wireless D/F (direction finding) technique.

That meant that the position of an aircraft could be fixed in two dimensions: with its range and bearing known, it could be located on a map to within a mile, or better, while it was still half-way across the North Sea. Nor was the system confined to an isolated aircraft, for it could be applied to each in turn in the "floodlit" zone.

However, for the manœuvring of fighters the enemy's height must also be known. In fact, height finding had been developed about the same time as the determination of bearing, in a manner reminiscent of the stereoscope. By comparing the strength of the received echo at two sets of aerials at hifferent heights above the ground, it became possible to determine the height of the aircraft to within about 500 ft. This, together with a technique of estimating the number of separate aircraft in a formation, completed all the essential information except whether the aircraft were hostile or not; this key problem of identification in the operational use of radiolocation was tackled by providing a device in friendly aircraft which gave an echo characteristic of the friend.

The Battle of Britain, however, was only the beginning, for an early development was to improve anti-aircraft defence by equipping guns and searchlights with special types of radiolocation apparatus which assisted sighting. This gear was developed and made in commercial laboratories and factories, and by 1941 practically all the A.A. defence in this country was radio-equipped.

An Echo of Matapan

British naval vessels were the first in which gun-laying by radio beam was used. In 1941 an Italian fleet off Matapan was attacked in pitch darkness by the guns of British cruisers and destroyers, and with no one on board so much as glimpsing the enemy vessels. Radiolocation provided the "finding and fixing" of the targets.

In 1943 the German battleship " Scharnhorst " was sunk at long range by battleship gun-fire, laid dead on the target by still more advanced radiolocation gear.

To the same quarter must go much of the credit for our ultimate triumph over the U-boat menace. No less an authority than Admiral Doenitz admitted this fact a year ago when addressing his flag-officers at Weimar. Even in peace-time, he said, they had feared the possibility of the submarine's essential feature of surprise being neutralised by radiolocation methods. Britain's superiority in scientific research, he said, had won her final success in the U-boat war.

By the third year of war, night fighters were equipped with secret apparatus giving the pilots a spot on a cathode-ray tube to follow, which led them dead on to enemy 'planes. The final defeat of the night bomber was largely due to this and to the accuracy of our radio-assisted searchlights, which in the later stages were used mainly to illuminate the bombers for our fighters to get at them.

Technical progress at this stage was so rapid that hardly was one new type of equipment put into service than still more developments made it obsolete.

Radiolocation also found its place outside the direct field of combat. As our air attack on Germany grew in intensity, our own bombers were brought safely home to their bases by radio beams. Still later the reverse applied. Bomber planes from home aerodromes were conned inexorably and unfalteringly to their targets by instruments and equipment developed by the radio industry.

Pin-Point Bombing

" D " Day saw the most pregnant development of all, when new and special types of radiolocation enabled air-borne and parachute forces to be accurately concentrated on minute landing areas in darkness. So vast were the forces involved that no other means could have prevented their widespread dispersal and possible destruction. To-day, pin-point aerial bombardment is assured by the recently-disclosed " black-box," which gives the bomber pilot an ever-changing picture of the earthly scene below him, so that neither darkness, nor cloud. nor fog obscures the target from him. " The little black box " was again the development of British Service and civilian scientists, of whom some gave their lives in the early pursuit of what they knew was ultimately to be a scientific certainty.

Design details of all British radio and radiolocation equipment have been given without stint or hesitation to our Allies. Forces of all the United Nations have been equipped with British-conceived and British-designed apparatus made in factories all over the world. Some of our Allies—notably the Americans—have since developed their own types; but they are the first to agree that the pioneer work of the British radio industry saved them both time and bitter experience.

Development of the Magnetron

One important contribution from British engineers derives from an old name and an old device—the Magnetron. Known before the war, it has now been developed and applied to some of the most critical problems in radiolocation. It is something very much more than a valve, and its use permits effective operation of advanced types of gear at very high frequencies, giving—among other advantages—both secrecy and freedom from enemy interference.

After the war the Magnetron—or more probably its successors—will be applied to anti-collision devices for use initially in ships, aeroplanes, and ultimately, perhaps, on railways as well. It will be possible for radiolocation to give instant warning of obstacles ahead and even to take over automatic control so that collisions can be avoided.

This week has also seen the publication, by the Radio Industry Council, of information on how the industry was able to meet the enormous demand for equipment and technical man-power which was made upon it.

Beside the romance of radiolocation the industry's work on ordinary communications equipment sounds prosaic, but in the four years between Dunkirk and " D " Day, hundreds of thousands of wireless transmitters and receivers for land, sea, and air use under every conceivable condition were produced. Communications radio equipment is used only for the purpose its name implies. From Army Group Commanders down to individual soldiers in the battle zone; from air headquarters to the most remote air-field in the world, and thence to every plane that flies from it; from Flagship to tank landing craft, and from Naval headquarters to bases which girdle the earth—every single unit of all the Fighting Services is linked with the others by a vast and complex network of radio equipment, developed in literally dozens of different forms and sizes to meet the exacting and infinitely varied conditions under which it has to operate.

One or two examples will suffice to show the magnitude and intricacy of the task which the industry was called upon to meet.

To the Navy, which first successfully applied radio direction-finding in the Battle of Jutland, falls the honour of carrying and using some of the most advanced and complex types of gear that radio engineers have devised. Radiolocation detects surface craft, submarines and aeroplanes; range-

finders and predictors assist gun-fire with the accuracy already demonstrated in the "Scharnhorst" and a hundred other actions. Before the ship's commander is a huge illuminated "table" on which the movement of friendly and enemy vessels is plotted by means of radiolocation gear, independent of darkness, fog, or distance.

Ship-to-ship and ship-to-shore communication by radio was one of its first applications to public service, even before the last war. To-day it is so automatic and reliable that it is taken for granted, and to it has been added new gear for keeping touch with Fleet Air Arm and R.A.F. planes in flight, with shore bases and even with the Army.

Every four-engined bomber in the R.A.F. carries more than a dozen pieces of complex and delicate radio gear.

Every tank in the British Army has an elaborate radio installation, and the requirement is that it must withstand the gruelling shock and vibration of a tank on the move, and the still fiercer impact of artillery bombardment and the fire of the tank's own heavy weapons.

Following Dunkirk

In the four years after Dunkirk, during the long period when even those who knew something of what was going on behind the scenes wondered how long it would be before we could strike back—the radio industry was pressing on with work which had to be completed before an effective attack on the enemy could be launched. It was for this reason that the manufacture of civilian wireless sets was summarily stopped early in 1941; and it is because the entire resources of the industry have since been concentrated on war's needs that civilian requirements have for so long had to take second place.

During one critical year, the radio industry had to move in two directions at once. It had to find trained personnel for the Navy, Army and Air Force to operate and maintain the Service gear, and to train yet more thousands to follow on. At the same time, as technical life-blood flowed out at one end, the industry had to take in novices and train them to fill the depleted ranks—not only man-for-man, but at a progressively faster rate until by 1942 it was two-and-a-half times its 1939 size.

Making men is always harder than making goods, and in radio the problem set by war needs was, perhaps bigger than in any other technical field.

Even in 1940, when only relatively small quantities of radio equipment were being manufactured and the shortage was still acute, some of it was going straight into store solely because there was not enough trained personnel to operate it. In the early "blitz" days, skilled people with enough knowledge to operate radiolocation gear were so few that laboratory engineers, working all-out on new developments in the daytime, were manning radiolocation sets on A.A. sites at night.

If the immediate job was difficult, it soon became plain that future demands would go far beyond anything the industry could possibly provide, even if every single available technician was withdrawn. The industry then set about finding out how many radio men had been called-up and drafted into other jobs in the Services. In a week 23 000 letters were sent out and from the replies a thousand suitable radio men were located in the Forces. The War Office and the Air Ministry recalled them so that their skill could be diverted into the channels where it was so desperately needed. Many of these formed the nucleus of the Air Ministry's and the Army's technical training schemes. They became instructors to train yet more instructors, who in turn produced radio operators and repairers by the thousand.

Towards the end of 1940, when the unofficial committee, set up by the industry, already had behind it a considerable record of valuable work, the Cabinet asked Lord Hankey to take over executive responsibility, and the original group was reconstituted as the Wireless Personnel Joint Sub-Committee (Radio Industry and Services), with representatives of all three fighting arms, the Ministry of Labour, Board of Education, the Universities and the Radio Manufacturers' Association.

Technical courses for higher grade personnel were started at 30 universities, and no fewer than 90 technical colleges were brought into the scheme.

Training of Personnel

The whole arrangements depended on the closest and most effective co-operation by radio manufacturers. In the first year of the war the industry had to provide 80 to 90 per cent. of the personnel required to handle radiolocation gear for the Forces. In the succeeding stages the industry was used as a training ground. While playing its full share in finding and training people, the industry also had to manufacture the considerable quantities of equipment needed by the universities and colleges for training purposes.

It is a well-earned compliment to radio that it was the industry in which this particular method of supplying and training technical people was pioneered. A fitting result will be that the industry will start up after the war with an army of first-class, trained people to meet the problems of peace.

Notes on Plastics

By JAMES TAYLOR, B.Sc., F.R.I.C.

PRIOR to the war, and during its early days, notes appeared regularly in THE ELECTRICIAN describing various plastic materials and some of their latest applications. With the advance of the war, practically all the output of all types of plastic materials were used for war purposes and, for security reasons, it became increasingly difficult to make public information about new materials and their uses, and consequently the publication of these articles had to cease. With the end of war in the world, the curtain has been raised on many of the developments made and it is now possible for some of the facts to be told. Within the last few months the control of many plastic materials has been relaxed or even lifted entirely. As a result firms are turning to post-war work and uses, and the question of secrecy on these applications does not usually arise.

It is proposed therefore to resume publication of these articles and, as a first step, the intention is to deal with each type or class of plastic material, making reference to its properties and applications and bring the information available more or less up to date. To make each article a complete picture it is proposed to include briefly the earlier history, not in too great detail, and in most cases to give special emphasis to materials and applications connected with the electrical industry.

Types of Plastics

Plastic materials can be divided into two main classes:—(a) Thermo setting materials. (b) Thermo plastic materials. Thermo setting materials, as their name implies, are those which, under the action of heat and sometimes pressure, become plastic and then set hard. The further application of heat does not soften them again. Thermo plastic materials, on the other hand, soften when heated and harden on cooling. Reheating will then soften them again, and normally the cycle could be continued more or less indefinitely.

Amongst the more common thermo setting materials are those based on:—(i) Phenol-formaldehyde, (ii) Urea-formaldehyde, (iii) Melamine-formaldehyde, (iv) Glycerol-phthalic anhydride, (v) Allyl resins, (vi) Aniline-formaldehyde.

The thermo plastic materials are much more numerous and include the following:—Cellulose nitrate derivatives (celluloid), (ii) Cellulose acetate, (iii) Cellulose aceto-butyrate, (iv) Polyvinyl chloride, (v) Polyvinyl acetate and co-polymers, (vi) Ethyl cellulose, methyl cellulose and benzyl cellulose, (vii) Meth acrylate derivatives, (viii) Polystyrene derivatives, (ix) Polyvinylidene chloride, (x) Polyvinyl formals and acetals, (xi) Nylon moulding materials, (xii) Vinyl carbazole resins, (xiii) Polythene, (xiv) Polyterpene hydrocarbon resins, (xv) Casein, (xvi) Polyvinyl alcohol. Comparison of these lists of types of plastic materials with the lists published in the late 1930's shows that many new materials have been devised or discovered.

No War-time Discoveries

Whilst the war has not actually produced any new discoveries of plastic materials, it can be said that the war has been the cause of many materials, which were only more or less laboratory curiosities, being developed to the commercial stage and being actually used for war purposes. Not all the above materials are manufactured in this country. Some of them are commercially available only from America, not because the British plastics technicians are behind those in America in skill or learning, but simply because America possesses certain raw materials in abundant quantities which are not available to us over here.

Comparisons of nations are always dangerous, but it should be pointed out, when comparing this country with America, that America is a land of large population with a large consumptive power. Consequently American industry, including the American plastics industry, has been developed to produce large quantities, sometimes by mass production methods. Until comparatively recently, the war had not caused serious shortages of raw materials in America, and it has generally been the claim of American industries that they could supply all needs of the war and at the same time keep civilian and export requirements filled. To a certain extent this applies to the American plastics industry, but, as the war demands have increased, there have been indications of a need to restrict civilian demands. Nevertheless, in the main, the American plastics industry has gone in for large outputs of many materials.

In this country the impact of the war on industry has been much more severe. Firstly, we were in the war at least two years before the Americans and in 1940 and 1941 we had large overseas sources of raw materials closed to us. The result was that our industry was devoted perforce almost entirely to war needs. Many metals were in short supply. Difficulties of shipping made all sorts of materials very scarce. In the main, plastics materials are made from home materials and in consequence

plastics were called upon to replace many other materials. The result is that our plastics industry has developed in new techniques, new applications, and so on, rather than new materials. Our total output has, of course, increased and at least one new plastic material was put on a commercial basis during the war, viz., polythene. It is not possible yet to tell the full story of what the British plastics industry has done towards winning the war but the veil has been lifted from many items and it is hoped to refer to some of these in detail later.

So much for generalities; it is now proposed to review the various types of plastic materials referred to above.

The development of phenol-formaldehyde materials goes back to the first decade of the present century when Leo Baekeland carried out his historic work on the reaction between phenol and formaldehyde. This work was reviewed recently by Mr. H. V. Potter, in the First Baekeland Memorial Lecture delivered before the Society of Chemical Industry on May 30, 1945. It will suffice for our part to say that these materials are dependent upon phenol (commonly known as carbolic acid) reacting with formaldehyde (commonly called formalin) to produce a brown resin-like material. Provided the reaction is properly controlled by the use of catalysts and by regulation of temperature, the product can be obtained in a number of different forms. For example, a resin may be obtained which is soluble in alcoholic and certain other solvents to produce varnishes with good electrical insulating properties. On the other hand, the resin may be of a type suitable for use as an adhesive or cement. In this case the material may be either heat hardening or acid hardening. Still another type of resin is the class suitable for use in making moulding materials, and lastly it is also possible to produce resins, almost colourless and transparent, which can be cast in moulds instead of being moulded.

Electrical Mouldings

A very large proportion of the phenolic resin used in the electrical industry is consumed in the form of moulding powder for the production of electrical and other mouldings. These moulding materials consist of about equal quantities of resin and a filler and the properties of the finished mouldings will vary according to the type of filler used. The mechanical property most affected by the type of filler used is the impact strength but electrical properties are affected also. An indication of the properties obtained by the use of various fillers is shown in the table opposite.

It will be noticed that while the impact strength is considerably affected by change of filler, the effect on the tensile strength is not very marked. The presence of cotton as the filler has the effect of lowering the electrical properties; wood flour comes next and the best are the materials with mineral fillers such as mica or asbestos. Bearing in mind that cotton will absorb moisture more readily than the other fillers, these results are what might be expected.

Also of considerable importance to the electrical industry are laminated materials produced from paper or fabric, impregnated with a solution of a phenolic resin, dried, built up to several thicknesses and then pressed. Sheets of various sizes are produced but the largest commonly made are about 8 ft. by 4 ft. The sheets can readily be sawn, turned, drilled and otherwise worked. Numerous grades are produced with various properties and by altering the quality of the paper or cloth used, as well as the resin, materials can be produced either with specially good electrical properties or with good mechanical properties. Similarly, phenolic resin varnishes have many applications in the electrical industry. The solvents used are generally alcoholic and are used for impregnating armatures, transformer windings, and similar purposes. By suitable adjustment of the conditions of manufacture of the resin, it is possible to produce resins which are viscous liquids of solids. This type of resin is used for cementing purposes and finds application in the electrical industry for fixing glass to brass or glass to synthetic resin moulding in the manufacture of electric light bulbs and radio valves.

Filler	Impact Strength (BSS 771)	Tensile Strength lb./sq. in.	Electric Strength at 20°C. volts/mil.	Volume Resistivity at 20°C. megohms per cc.
Wood flour	.15	5 500	150-250	10^5-10^6
Cotton linters	.30	5 000	120-250	10^5
Chopped fabric	.90	5 000	120-250	10^4-10^5
Full fabric	2.5	5 000	120-250	10^4-10^5
Mica	.15	4 500	200-500	10^7-10^8
Asbestos	.90	4 500	100-200	10^4-10^5

Westinghouse Publications.—We have received from the Westinghouse Brake and Signal Co., Ltd., a set of their current publications comprising booklets Nos. D.P. 11 (15th edition) "A.C. to D.C. by Metal Rectification"; 11 B (12th edition) "The Metal Rectifier for Electrical Measuring Instruments"; 11 L (second edition) "Constant Potential Rectification"; and 11 M (third edition) "Static Auto Phase Converter"; a leaflet "The 'Stabilistor'"; and data sheets Nos. 12 to 36.

New Zealand Post-War Needs

Marked Growth of Industrial Capacity

BEFORE the war the bulk of the electrical equipment required by New Zealand was imported from the United Kingdom, and, according to the official figures published by the Department of Overseas Trade in its Review of Commercial Conditions in New Zealand (Stationery Office, 1s. net), in the years 1935, 1938 and 1939, the values of electrical goods and apparatus exported to that Dominion from this country were £503 000, £1 150 000 and £840 000, respectively. New Zealand's official statistics for 1937 and 1938 show that in 1937 the total value of electrical equipment imported was £NZ 2 600 000, of which £1 864 000 came from the United Kingdom, £242 000 from the U.S.A., £159 000 from Canada, and £186 000 from Australia; in 1938 the figures were: Total, £NZ 2 806 000, from U.K. £1 943 000, U.S.A. £252 000, Canada £246 000, and Australia £160 000. In addition, wireless apparatus to the value of £NZ 607 000 was imported in 1937, while in 1938 the value of such imports was £NZ 430 000. Of these, in 1937, goods to the value of £143 000 came from the U.K., £125 000 from Australia, and £318 000 from the U.S.A.; while in 1938 the figures were: U.K. £212 000, Australia £58 000, and U.S.A. £148 000.

For some years past there has been a marked increase in the industrial capacity of New Zealand. In the case of a few industries Governmental control is exercised through the Industrial Efficiency Act of 1936, under which without permit none can engage in certain industries to which the Act has been applied. In the case of other industries, however, this control is equally effective since import licences are necessary before plant or material of any kind can be imported.

Industrial Research

The engineering industry has been considerably developed in many directions during the war and the Government has established a well-equipped Dominion physical laboratory to assist the industry.

In the electrical section of the industry the production of all kinds of electric domestic appliances has been prohibited since the middle of June, 1942, and it was only in 1944 that the control was relaxed to allow of the manufacture of limited numbers of electric cookers, kettles, jugs, flat-irons and percolators, as well as of a few refrigerators and washing machines. The manufacture of wireless sets, apart from those required for the Services, has been prohibited since the same date.

The following parts of receiving sets are made locally:—Transformers, chokes, radio frequency coils, radio frequency units, valve shields, coil cans, chassis, dial mechanisms, dial scales, complete dials and loud speakers. The following electrical fittings and accessories are also made:—Plug tops and bases, flush plates, cord connectors, tap-ons, porcelain fuses up to 15 A, air-break switches, insulators, ceiling roses and appliance plugs.

Manufacture of Appliances

New electrical engineering products are domestic electric refrigerators, electric washing machines, vacuum cleaners, electrodes, cranes and electric hoists, passenger lifts, lamp bulbs, storage batteries, battery containers, battery separators, carbon brushes. The manufacture of electric transformers up to 15 kVA was started by one firm in 1942. In 1944 another factory was established to undertake the production of transformers up to 100 kVA. In the case of cranes and electric hoists, as well as passenger lifts, some of the essential mechanical equipment still requires to be imported. A new project is the manufacture of transformers up to 600 kVA and electric motors up to 25 H.P.

One of a number of new enterprises is the manufacture of electric porcelain. The growth of the plastics industry has taken place almost entirely during the war years. The articles now produced include coatings for cables and wires; electrical fittings; lamp shades; parts for electric cookers; radio parts and torch cases.

Both the Prime Minister of New Zealand and the Minister of Finance have, in public statements, stressed the necessity for the maintenance of the system of import control. There will certainly be a keen post-war demand for goods of all kinds, both capital and consumer, there being a wide range of shortages just as there is in the United Kingdom. There has necessarily been a considerable expansion of credit during the war and larger banking deposits will no doubt encourage the owners of these deposits to place orders that would entail a large influx of imported goods: the aggregate demand for imports of all kinds is likely to out-run New Zealand's immediate capacity to pay. On the other hand, by the end of 1944 it was evident that the public was spending less and buying with more discrimination. The peak of overtime wages had been passed. Furthermore, the public was no

longer willing to accept war-time utility type substitutes, but was seeking to buy goods of pre-war standard. The extent to which it will be possible for the Government to allow the wide spread demand to be satisfied from overseas must depend upon the size of New Zealand's external reserves and upon the value of her post-war current exports.

Australian Competition

It has been suggested that Australia may be able to meet some of New Zealand's immediate post-war needs of industrial equipment by the export of surplus machinery. In addition, the Australians hope to find a market in New Zealand for certain manufactures developed recently in the Commonwealth. An article in the "Australian Manufacturer" of January 30, 1943, forecast that the earliest demands in New Zealand after the war would probably include electrical fittings and radio. The potential of production in Australia would be sufficient to provide a large export surplus.

Competition from the U.S.A., also, is likely to be in evidence over a wider field.

It may be assumed that the end of the war will find New Zealand holding only very slender stocks of practically all imported commodities. Stocks were below normal when the war broke out as import control had already by that time been in operation for eight months and, subsequently, war conditions operated to prevent their replenishment.

Industrial expansion is an important feature of the Government's programme to provide employment for demobilised Service men; a valuable opening should thereby be created.

Manufacturing interests in the United Kingdom are likely to participate after the war in the local manufacture of motors and transformers and the warp-loom knitting of artificial silk fabrics. Wide interest is being shown in various new products evolved as a result of the scientific developments promoted by the war: in particular the extended use of plastics has attracted attention.

Among the railway projects envisaged are the reconstruction of the line from Wellington through Hutt to Masterton, and its electrification; the extension to Levin or Otaki of the present electrified line between Wellington and Paekakariki; the electrification of the suburban circular line round Auckland; and the diversion and electrification of a short stretch of the railway near Dunedin.

In the case of the tramway organisations the body-work of tram cars is manufactured in the workshops of the municipal corporation concerned, the electrical equipment, wheels, axles, etc., being imported.

The introduction of trolley bus systems is under consideration in the cities of Wellington, Auckland, and Dunedin. The general practice will be to import the chassis and electrical equipment, the bodies being constructed locally.

High priority will be given to the development of sources of hydro-electric power. During the war, work upon the extension of existing stations has been continued, but there have been war-time difficulties in obtaining plant from overseas to keep pace with the rapidly increasing demand for current. It is expected that the present serious shortage will be relieved after a year or two when plant at present on order has been delivered and installed. Plans have been made for opening a new station at Maraetai on the Waikato River, contracts for which were awarded in March, 1945. Two additional stations are included in the ten years' programme necessary to increase capacity from the 400 000 kW represented by plant already installed in the North Island, or in the process of manufacture, to about 730 000 kW. Extensions on a smaller scale are required in the South Island.

Book Review

"Electrical Engineer" Reference Book.—Edited by E. Molloy (London: Newnes). Pp. xvi + 1569. Price 42s.

With the assistance of Mr. M. G. Say, consulting editor, Messrs. R. C. Walker and G. Windred, associate editors, and fifty specialist contributors, Mr. Molloy, editor of the "Electrical Engineer," has produced in a convenient size a much needed comprehensive work of reference containing the most recent information available on new developments in all branches of electrical engineering, other than radio and telecommunications, as well as a summary of modern standard practice.

The work is arranged in thirty-two main sections, each dealing with a specific subject, or group of subjects. Section 1, headed "Theory and Calculations," gives an outline of the basic electrophysical principles which find their application in the many branches of electrical engineering, and deals fully with the subject of methods of circuit calculation. Sections 2 to 28 contain expositions of the standard practice in the main sub-divisions of the art and science of applied electricity. Under the title "Progress," Section 29 is devoted to matters of novel development, research construction and design in all branches. Other sections are concerned with education, electricity rules and regulations, periodicals and bibliographical references.

War-Time Electrical Imports

Heavy Acceptances of Radio Equipment, Wires and Cables

FOR the first time, detailed figures relating to the quantities and values of the principal commodities imported into the United Kingdom in each of the war years have been published by the Board of Trade. These show that last year retained imports of electrical goods and apparatus rose to more than treble those in 1938 or 1943, as a result of heavy consignments of wireless apparatus for operational purposes. The figures for the last seven years are as follows: 1944, £9 629 000; 1943, £3 056 000; 1942, £1 177 000; 1941, £1 243 000; 1940, £3 106 000; 1939, £2 675 000; 1938, £2 834 000. The total value of electrical goods and apparatus imported in each of those years was 1944, £23 666 100; 1943, £8 182 811; 1942, £2 742 856; 1941, £2 680 680; 1940, £4 198 815; 1939, £2 808 315; 1938, £3 106 805. The value of exports of imported electrical goods and apparatus is given as follows: 1944, £10 561; 1943, £4 002; 1942, £11 820; 1941, £23 570; 1940, £49 284; 1939, £112 540; 1938, £136 357. These figures do not include electrical machinery, vacuum cleaners, etc.

The Board of Trade accounts relating to the export trade of the United Kingdom for 1944, published in THE ELECTRICIAN of February 23, show that exports under the heading "electrical goods and apparatus" were valued at £12 637 292 for 1944, compared with £11 091 370 in 1943, and £11 162 895 in 1942.

The classified figures of imports for the last seven years are given below.

	Year Ended December 31st, 1938.	1939.	1940.	1941.	1942.	1943.	1944.
	£	£	£	£	£	£	£
Electric wires and cables, insulated ...	374 948	216 307	1 083 456	230 162	258 857	1 793 477	3 513 636
Wireless apparatus—							
Receiving sets and receiver chassis, complete, other than radio-gramophones, excluding valves	121 771	197 026	263 066	28 446	57 669	503 703	1 407 291
Valves, complete	130 712	221 254	204 393	66 407	146 318	554 297	1 388 344
All other descriptions	649 423	584 603	424 669	319 205	432 333	2 263 763	13 426 095
Telegraph and telephone apparatus, other than wireless	110 919	121 402	37 068	26 503	193 891	647 349	685 336
Carbons, electric, complete—							
Furnace	48 649	61 518	225 041	451 767	508 502	735 608	380 583
Other	27 612	21 895	175 686	173 990	132 746	151 587	121 722
Electric lighting appliances, accessories and fittings, and parts thereof, not elsewhere specified—							
Bulbs, complete, ready for use ...	123 175	88 802	322 135	177 808	46 763	542 751	625 357
All other descriptions	463 971	293 031	321 427	650 788	569 782	24 382	148 567
Batteries, primary (complete, and parts other than carbons)	42 592	204 710	692 892	237 181	67 421	261 105	214 983
Electrical instruments (other than telegraphic and telephonic)	384 688	276 022	154 247	74 384	75 636	100 250	217 923
Total of all other articles	628 345	521 745	294 735	244 039	252 938	604 539	1 536 263
Total of group	3 106 805	2 808 315	4 198 815	2 680 680	2 742 856	8 182 811	23 666 100
Electrical machinery—							
Motors (other than railway and tramway)	309 193	255 763	101 182	19 662	12 952	9 231	129 715
All other sorts	176 666	154 554	265 307	170 182	323 779	1 185 361	4 368 801
Portable appliances, electrically operated—							
Vacuum cleaners	193 174	113 692	7 959	9 198	330	—	85
Copper wire in coils (including uninsulated electric wire)	61 529	44 425	44 526	1 618	4 279	953 457	51 529
Total	3 847 367	3 376 749	4 617 789	2 881 340	3 084 196	11 330 860	28 216 230

Oxford.—The report of the Electricity Committee shows that during the past five years three of the years produced profits and the other two losses. Generally the trading results were governed by the load factor of the supply and the costs of fuel. The load factor was on several occasions affected by severe cold in the winter, one half-hour of which was sufficient to determine the maximum demand, which might increase out of all proportion the price which must be paid to the Central Electricity Board for the twelve months. This happened in the cases under review. The cost of coal had increased from 21s. 7d. before the war to 44s. 9d. However, the electricity undertaking was in a healthy condition, and had a reserve fund in excess of £70 000. Throughout the war it had not increased its prices, notwithstanding the fact that they had been and still were among the lowest in the country. The Electricity Commissioners were prepared to consent to price increases where they were considered necessary, and the Committee was bearing this in mind.

H.F. Heating in Chemical Industry

By H. SEYMOUR

THE possibilities of high frequency heating as a tool for industrial processing, particularly in the chemical industries, and some account of existing applications were outlined in a discussion by John W. Robertson at a symposium on unit processes before the American Chemical Society.

The term "high frequency heating" may be pictured by some as induction heating, because this was the first industrial application of medium high frequencies to the heating problem, and by others perhaps as heating by infra-red radiation. These two methods of applying high-frequency electrical energy are today the most widely used means of employing radiant energy for heating, but they are not the main objective of the present article because induction heating is best applicable to good conductors, such as metals, and infra-red heating is best suited for quickly heating and drying thin films uniformly.

The latest concept of the use of high frequencies in chemical work, particularly the heating of materials not considered good conductors, is to place the work or load in the electrostatic field set up between condenser plates located in a suitable part of the circuit. This means that the full effect is subjected directly through the materials being processed, rather than being induced in it by a magnetic field or irradiated by reflected rays.

In discussing frequencies above 100 MC. where much work is being done in the field of communication, it must be appreciated that these frequencies approach the mechanical and physical limitations of vacuum tube generators, and very small amounts of energy can at best be handled in this range. The jump in wavelength from 1 to 0.0001 cm. does not appear great when compared with the whole spectrum, but it holds secrets which may be well worth solving. The problem is the method of generating and handling these radiations with sufficient power behind them to permit practical studies.

Opportunities for Chemical Engineers

The phenomena of induction heating have been of considerable value to electrical, radio, and metallurgical engineers, but they have so far been of little assistance to chemical engineers. There is, however, a method of using high-frequency radiation to produce heat in chemical materials, which are normally considered relatively poor conductors of heat and electricity, and even materials which are called insulators. This phase is in its infancy, and many applications may be sidetracked or regarded as failures in the next few years through lack of understanding in applying the method, as well as for economic reasons; but for the longer-term outlook there is a tremendous field of opportunity and there should be a rapidly changing picture of both technique and economics.

Early Experiments

The first potential use of high frequency current appeared when the Viennese doctor, Wagner Jauregg, proposed curing diseases by creating a fever in the patient. His approach was drastic, in that he gave the patient mild forms of typhoid and malarial fevers to build up a body temperature to combat the disease. Later work in utilisation of electric fields showed that Jauregg was right in many of his deductions, and it is unfortunate that he did not live to see his artificial fever created by electrical means.

Only during the past ten or twelve years have commercial applications of high-frequency currents been seriously considered, and many valuable applications have been developed only in the last six years. Apparently no uses in direct manufacture and processing of chemical materials have reached the stage of an issued patent or published data, although this would appear to be one of the greatest potential spheres of application.

One of the earliest patents, issued in 1933, concerns an apparatus for heating by means of an electro-static field. Another about the same time deals with the rendering of fats, but the frequencies mentioned are rather low. Others appeared in the next few years covering special apparatus for drying leather, tobacco in hogsheads, etc. The greatest industrial progress so far recorded seems to have been made in the glueing of wood to make plywood and other wood structures.

Some physicists state that molecules in the rapidly changing electrostatic field try to reorient themselves with each alternation of current, and their activity produces heat from molecular friction. Others contend that it is resistance phenomenon, and that heating is due solely to the resistance offered to the passage of current such as would happen in a d.c. circuit of a resistance wire. There is some evidence to support both theories, but more data should be gathered and carefully analysed before a theory is evolved. The

molecular structure of the material or combination of materials being heated, their dielectric constants, and the particular frequency and voltage density being applied may probably all have a bearing on the phenomena taking place.

The process has been used in the cooking of resins and other poor heat conductors, with an elimination of hot spots with consequent improvement in colour and uniformity of product. Some work has been done in the cooking of alkyd resins and in making ester gums and polymerising resin. Wood or coal may be destructively distilled by the process, and there are possibilities for developments in the industries using these materials. For instance, the products obtained by this type of heating are not necessarily the same as those resulting from local overheating.

Some of the advantages and disadvantages of high frequency heating as applied to industrial chemical processes include the fact that temperatures may be raised uniformly throughout mass, while the power input, or rate of heating can be varied at will without regard to platen temperatures, etc. The temperature of a reactive mixture can be more closely controlled and the redistribution of moisture and case-hardening in heating wood are lessened. Colour possibilities are better as a result of less local overheating, while reaction temperatures or "apparent" reaction temperatures may be lower. The heating-up-to-temperature cycle is of short duration, internal stresses in mouldings are fewer, and better designs of some types of equipment are possible.

It must, however, be appreciated at the same time that the present cost of equipment is high.

A general idea of the power costs needed for a particular application may be obtained by calculating the B.Th.U. per hour and then converting this into kW. The following simple equation can be useful on preliminary calculations:—

$$\text{kW needed} = \frac{\text{wt. (lb)} \times \text{sp. heat} \times \text{temp. rise (°F.)}}{3413 \times \text{time (hr.)}}$$

To calculate approximately the size of power line needed, it is necessary to double this figure. Over-all efficiencies in high frequency heating installations can, so far as the chemical industry is concerned, vary from 35 to 75 per cent., depending on the job and conditions surrounding it, but are usually calculated at about 50 per cent. until better data are available. Such calculations are based on raising an entire mass from starting temperature to what is considered necessary; the selective heating effect is ignored, as well as the possibility that the reaction may be completed at a lower "apparent" temperature than is considered feasible. Other factors are also ignored in these calculations because no data are available to calculate their effects. One is the dielectric constant of the material being treated. If it is such as to cause the h.f. current to be "absorbed" readily, it appears to heat more efficiently. Another factor is the frequency to be used.

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

Lt.-Col. Parr-Dudley has been appointed manager of the London office of the Brush Electrical Engineering Co., Ltd., and subsidiaries. He obtained his training at Faraday House and with Bruce Peebles and Co., Ltd., and was subsequently on the London office staff of Petters Ltd.

The Poplar Electricity Committee has appointed **Mr. F. M. Hammond,** of the Ayrshire Electricity Board, as constructional and development engineer.

Torquay Electricity Committee has appointed **Mr. L. H. Shelley,** of Walsall, as assistant distribution engineer.

Dr. H. J. Gough, F.R.S., has accepted an invitation to join Lever Brothers and Unilever, Ltd., as engineer-in-chief. He will shortly take up his duties at Unilever House.

Liverpool Electric Power and Lighting Committee has appointed **Mr. J. S. Jennings** turbine engineer, Clarence Dock power station to be assistant shift engineer. **Mr. W. P. L. Lloyd,** assistant turbine engineer, has been appointed temporarily as turbine engineer. **Mr. E. A. Marshall,** superintendent engineer, Mersey Tunnel, has been appointed workshop superintendent, in the Liverpool electricity supply department.

Mr. Harry Hunter has been appointed an additional director of Richardsons Westgarth and Co. Ltd.

Mr. W. H. Hand, of the Midland Electric Corporation has been appointed deputy chief officer to the National Electricity Employers' Organisation which deals with the business of the National Council and the National Joint Board. Mr. Hand has been employed by the Midland Electric Corporation since 1925, and since 1933 he has been associated with the work of the

District Council and District Board for the No. 5 (Birmingham) District. In April, 1942, he succeeded the late Mr. G. G. Heathcock as secretary to both the district organisations. He will take up his new duties in the near future.

The Telegraph Condenser Co. Ltd., announces that **Mr. W. F. Taylor** has joined the board of directors. Mr. Taylor has been with T.C.C. for twenty years and has occupied several positions in the organisation. It is as sales manager, however, he is best known to the radio and electrical trades; he will continue in that capacity, controlling the company's various sales divisions.

Mr. W. F. Taylor

Lt.-Col. Sir Cuthbert Morley Headlam, who was made a Privy Councillor in the Resignation List Honours, is a director of the Jerusalem Electric and Public Service Corporation, and of the North-Eastern E.S. Co. Ltd.

The marriage took place on August 9, at St. James's, Spanish Place, between Captain Guy Heaton Heywood, son of Mr. and Mrs. Noel Heywood, of Acresfield, Alderley Edge, and Yolanda, daughter of Mr. and Mrs. Vincent Ziani de Ferranti, of Rose Hill, Alderley Edge. Canon Flood officiated. The bride was given away by her father. The reception was held at Claridge's Hotel.

Major Egbert Cadbury has been appointed a director of the West Gloucestershire Power Co. Ltd.

Mr. D. B. Taylor, Swinton, has been appointed borough electrical engineer, at Bacup, at a salary of £600 per annum, rising by two annual increments of £25 to £650 per annum, plus cost of living bonus, and car allowance.

The hon. Secretary of the East of Scotland branch of the Institute of Welding is now **Mr. E. R. Roberts** of 24, Boswall Green, Edinburgh, 5. The branch is planning a Victory Social to be held in November, at which it is hoped to have the president of the Institute, Mr. W. W. Watt, as the principal guest.

Public Lighting

A conference to be held in Glasgow from September 11 to 13 will mark the occasion of the 21st anniversary of the formation of the Association of Public Lighting Engineers.

Chief among the subjects included in the programme will be an address by Dr. J. W. T. Walsh, who will outline the work of the drafting sub-committee responsible for preparing the B.S.I. Specification on Street Lighting to implement the M.O.T. Final Report of 1937. The document, which will be laid before the conference, goes a long way to securing more economical, and at the same time uniformity in street lighting.

Other speakers will include Mr. J. M. Ward, deputy lighting engineer of Glasgow, who will describe in detail "Glasgow's Street Lighting." Mr. J. S. Smyth will present a technical paper dealing with "Engineering Principles in Street Lantern Design," while a further subject will be Mr. Francis F. Middleton's paper dealing with "The Lighting of Bends, Junctions and Roundabouts."

The president, Mr. E. J. Stewart, will in his presidential address expound some fresh angle on street lighting.

In connection with the conference an exhibition will be staged at the Corporation Lighting Department, 20, Trongate.

As an immediate post-war conference, confronted as it is with so many difficulties, the Council of the association is to be congratulated in their enterprise, and from the indications already available the conference promises to be a success numerically, for already well over 400 principal local authorities have intimated that they will be sending delegates.

The firms exhibiting at the exhibition will include: Automatic Telephone and Electric Co. Ltd., British Foreign and Colonial Automatic Lighting Controlling Co. Ltd., Brighton Lighting and Electrical Co. Ltd., British Thomson-Houston Co. Ltd., Concrete Utilities Ltd., Electric Street Lighting Apparatus Co., Engineering and Lighting Equipment Co. Ltd., Edison Swan Electric Co., Wm. Edgar and Son Ltd., Falk, Stadelmann and Co. Ltd., Gowshall Ltd., General Electric Co. Ltd., Girlings Ferro-Concrete Co., Holophane Ltd., Horstmann Gear Co. Ltd., Keith Blackman Ltd., Lighting Trades Ltd., Metropolitan-Vickers Electrical Co. Ltd., Siemens Electric Lamps and Supplies Ltd., Sangamo-Weston Co. Ltd., Venner Time Switches Ltd., Philips Lamps Ltd., Record Electrical Co. Ltd., W. Parkinson and Co., Wm. Sugg and Co. Ltd., Revo Electric Co. Ltd., Poles Ltd., Willey and Co. Ltd., Sordoviso.

Domestic Electric Water Heating—I

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

CONSIDERABLE headway was made in the development of electric water heating during the years immediately preceding the outbreak of war, and it has been stated that well over half a million water heaters were connected to the electricity mains by September, 1939. It is anticipated that in the post-war years this figure will be rapidly improved upon as supplies of appliances become available.

A recent P.E.P. report submitted to the Board of Trade gave the figure of 12.1 millions as being the estimated number of water heaters which would be sold during the first ten years, although, of these P.E.P. consider that only 884 000 would be electric, as compared with 2 958 000 gas, and 8 278 000 solid fuel. In the writer's view, however, efficient methods of selling, combined with good servicing facilities and low rates of charge for energy consumed, should capture for the industry a larger proportion of the potential market.

Sufficient experience has now been obtained of this specialist selling to allow of a closer examination of the difficulties met with and of complaints made by consumers, and this should be of value in deciding the most favourable methods of approach and the type of installation most suitable for the job proposed.

Every user of an electric water heater desires and expects an adequate supply of hot water, and is one of the chief reasons why a consumer decides to adopt electricity. Unfortunately, however, some consumers have discovered that such service is not always readily at hand, and disappointment has resulted. The failure of a system to produce constant hot water is almost always due to bad estimating of a consumer's existing consumption and failure to make provision for its increased use once the electric system is installed.

Calculation of Requirements

To meet such probable increases it has been suggested that existing consumption should be calculated and a probable 50 per cent. increase allowed for. Such a rough estimate is, however, too general and unreliable. Each estimate must, on the other hand, be calculated independently from data obtained from an individual installation, since personal experience has shown that the hot water requirements of no two individual families are alike, although there may not be any apparent difference between their standards of living.

Before an estimate is prepared, information should always be obtained with respect to the approximate quantity of hot water used per week; the purpose for which the hot water is required and the approximate temperature; i.e., for the purpose of calculations, 105° F. may be taken as average for personal washing and bathing, and 120° F. for washing-up and sink usage. From these figures the net quantity of water at storage temperature, viz., 180° F., may be calculated.

Number of Baths as Factor

The number of persons in the household, and the number of baths taken consecutively by the household should be noted. It should be ascertained whether more baths would be taken were the hot water system more efficient and greater quantities of hot water more readily available, and acceptance of the users' figures should be governed by experience. Few users of hot water realise the volume that is used for domestic purposes, and this must be allowed for. Full particulars of the existing system, particularly any disadvantages and inadequacy, should be collected, and where a back of the fire boiler is in use it is important to ascertain the period during which such fire is lit, other than for obtaining hot water, viz., heating the room. It should also be ascertained whether the room in which the fire-boiler is installed is that most frequently used for living or reception purposes; this may, for obvious reasons, have a considerable bearing on the consumption of fuel related to water heating. A layout of the existing pipe work should be obtained and where possible a rough sketch should be made; particular attention being paid to any circulating system or isolated draw-off positions. The largest quantity of water likely to be used over a short period of time should also be ascertained, so that peak will govern the size and type of proposed installation. If, for example, 100 gal. of hot water are consumed over a period of three days instead of 24 hours, a smaller water heater would meet the requirements. Other points to consider are, types of hot water taps installed, viz., spring press taps; which pipes, if any, are lagged; whether any sections of the piping are unduly exposed to low temperatures; particulars of the electric wiring installation and whether it is adequate to meet the additional load.

Having estimated the amount of hot water which a consumer will use over a given period and the storage capacity necessary to meet peak water demands, it has to be decided whether a self-contained storage heater, or a conversion of the exist-

ing system, should be recommended. Where electricity is to be the sole means of providing hot water, the self-contained water heater is, without any doubt, the preferable. If, however, electricity is required for " backing up " and intermittent use, as during the summer months when solid fuel is not used, there is much in favour of conversion.

Alternative Arrangements

Where it is decided to employ self-contained heaters, either of two alternatives may be adopted, namely, one large central storage heater which would feed each hot water outlet in the house, or separate local water heaters fitted adjacent to the draw-off positions. The sizes of the individual heaters would be governed by the amount of water required at each draw-off position.

Where the house is small and the draw-off positions are comparatively close together, one central storage heater should meet the case; where, on the other hand, draw-off points are some distance apart, local heating has much in its favour.

Usually the most adequate system to instal is a large heater for all adjacent draw-off positions and local heaters at isolated positions. In the small modern house, experience has proved that the best system is to instal a large heater to feed the bathroom points, with an additional heater of 1½ to 5 gal. capacity at the kitchen sink. The aim is, of course, to avoid excessive pipe runs, which add considerably to the overall losses of the system.

Where a hot water pipe run exceeds 15 ft. a local heater is the more economic, since the probable losses from the pipe run may exceed the standing losses of the additional heater. Against this must be weighed the extra cost of the additional water heater. Where water heaters are obtained on hire from the local supply authority, there should be no hesitation in installing local heaters, but where the heaters are to be purchased, each cost must be considered. Taking the long view, however, the outlay of additional capital on a more efficient system is always preferable to meeting the permanent cost of undue losses.

Before recommending a conversion of an existing system by utilising the present hot water tank or cylinder, an exhaustive survey should be made of all pipe work and draw-off positions, as well as a close examination of the tank, both inside and out. The number of conversions that have been carried out and which are still providing an efficient service indicates that there is considerable scope for this form of development.

The tank should always receive early attention; first, as regards capacity. If this is sufficient to provide all future hot water requirements it must be tested.

Pipe runs are often difficult to trace, particularly in the older types of property. If there is any doubt as to the route of specific runs, the conversion should either be abandoned or the pipe runs cut out and new sections installed in their place. Where this is not practicable, small storage heaters should meet the case. A circulating system, heated towel rails, radiators and the like should not generally be left connected when converting to electricity. Should the consumer still require these services, alternative means of heating, e.g., electric towel rails and electric radiators should be provided. Circulating systems are normally easy to deal with, for the return pipe may usually be cut out. Where, however, draw-off points have been tapped off the pipe, further work is involved in transferring them to the flow pipe, which becomes an expansion pipe.

A common plumbing error found in the average small house is that the kitchen hot water draw-off point is fed from the flow pipe from the boiler. This has been done both for reasons of economy and to provide the user with hot water soon after lighting the boiler, and before the contents of the tank are heated.

Since the aim is to reduce losses to an absolute minimum, adequate lagging of not only the storage tank, but also some of the pipework is recommended. That portion of the pipe work which feeds draw-off positions constantly in use, viz., kitchen sink and wash basins, must be lagged if losses are to be kept within economic limits. On the other hand, the feed to the bathroom tap which may be used only perhaps once a day, does not require lagging. Since the water in this " dead " leg will cool anyway, lagging only reduces its rate of heat loss but does not produce any saving.

If the entire installation is new, or new runs are required, the pipes should preferably be of copper, for by the use of this metal the reduction in losses is threefold.

Position of Heater

It is common practice to instal a hot water tank or the self-contained storage heater in a position adjacent to the point where the greatest volume of water is drawn-off, viz., the bath. This is a fallacy, since the hope is to produce heat losses in pipe runs. Therefore, where practicable, the heater should be installed nearest the point from which the greatest number of draw-offs are taken over a short period of time. The overall reduction of losses by reducing pipe runs to points used two or three times a week are practically negligible, and are outweighed by almost constant losses at points most frequently used.

News in Brief

Electric Paint-spraying.—The Clitheroe Electricity Committee is to acquire electric paint-sprayers for the use of their own and other departments.

Public Lighting Engineers' Conference.—The annual conference of the Association of Public Lighting Engineers is to be held in Glasgow from September 11-13.

E.L.M.A. Lamp Prices.—At a Liverpool trade meeting a few days ago dissatisfaction was expressed with the manner in which lamps controlled by E.L.M.A. had been reduced in price. A resolution was adopted, viewing with great concern the policy of E.L.M.A. in reducing prices without consulting the interests concerned and without making suitable provision for rebates.

Trolley-bus Proposal.—The Northumberland C.C. is opposing a Bill promoted by Newcastle-on-Tyne City Council seeking powers to run trolley buses on additional routes. Discussions are to take place between the two authorities regarding the running of trolley buses over county roads.

Electrical Cookery Demonstrations.—The Southport Horticultural Committee has invited the Electrical Engineer to arrange cookery demonstrations at the forthcoming horticultural show.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of August 13, 1920: At the present time Germany is a no less important factor in the world's politics than she was in 1914. And though for some time yet her influence is likely to be rather more potential than kinetic, the probable effect of her re-entry into international trade and commerce, a re-entry which will certainly come to pass before long, is worthy of close consideration, particularly by electrical engineers.*

Telecommunications Conference.—It is announced that the Commonwealth Telecommunications Conference which opened in London on July 16, has concluded its deliberations. It was attended by representatives from the Governments of the United Kingdom, Canada, Australia, New Zealand, South Africa, India and Southern Rhodesia. The report of the conference is to be submitted to the various Governments.

Proposed New Research Station.—It is announced that proposals from the Ministry of Works for establishing a centralised research station for the Department of Scientific and Industrial Research on the remainder of the Munden estate have been considered by the Watford Council's Town Planning Committee. The Committee has approved the proposals subject to the deposit of satisfactory plans and to the condition that there are no obnoxious fumes or smoke nuisance.

Electricity in the Textile Industry.—Mr. J. Bleasdale, speaking at a meeting of the Northern Federation of Ratepayers' Associations, at Burnley, emphasised the importance of restoring the textile industry, and the adoption of electricity to replace steam power in the factories. It was important in the interest of public health.

Blackburn Exhibition.—Domestic appliances are well displayed, and horticulturalists and poultry-keepers are also having much to interest them in the electrical appliances shown at an exhibition in King George's Hall until August 25. The British Electrical Development Association, in co-operation with Blackburn, Accrington, Bacup and Rawtenstall Electricity Committees, are staging the event.

Cooker Purchase.—The Douglas (I.o.M.) Electricity Committee has authorised the Electrical Engineer to purchase 40 cookers at an estimated cost of £1 100.

New Lichfield Showroom.—The Electricity Committee is to select a site for the erection of a new showroom.

P.O. Cable Ship.—The cable ship "Monarch," built, engined and equipped for lifting and laying ocean cables, built by Swan, Hunter and Wigham Richardson Ltd., to the order of the Postmaster General, was launched on August 9.

Street Lighting.—Reading has reversed a decision of its Highways Committee not to resume street lighting until September 1, as an economy measure. As a result the street lighting was commenced immediately. Ayr has resumed normal lighting in its main streets, using 250 V mercury discharge lamps. Lighting in some of the side areas is still inadequate or limited owing to faulty cables, but these are being brought into line as quickly as possible.

Electrical Farming in Scotland.—Farmers in Central Scotland who have protested against the delay in installation of electric power were met at a Forfar N.F.U. meeting by representatives of the Grampian Electricity Supply Co., who described the main problems as the lack of labour and materials. Farmers were assured by the company that every effort would be made to supply power to farms whenever conditions permitted and where availability was within the practical limit of economics.

Production Control

The Necessity for Research

IN the course of a paper on " The Necessity for Research in Production Control," read at the inaugural meeting of the Production Control Research Group, at Kingsway Hall, London, recently, Mr. D. Tiranti mentioned the work done by the British Standards Institution, consisting of two or three booklets, one bearing the title " Principles of Production Control " B.S.1100 Part 1, and another the " Production Control in the Small Factory " B.S.1100, Part 2, and said the fact that the subject was emerging under a " standard " was an encouraging sign.

Example of Engineering Industry

For some reason, the engineering industry had developed production control technique more than any other industry, and the reason might well be due to the progressive spirit that permeated that industry. This development by the engineering industry brought up two aspects: first, as to the work done by engineering in this field, and, secondly, the impression that production control was exclusive to engineering.

As to the first, let credit be given where credit was due, and let full appreciation be given to the engineering industry for the work done so far.

Here they had a typical industry full of tradition. They had seen it infused with glowing pride as to its resourcefulness and inventiveness, and they had noted the zealousness with which it guarded its tradition as to the high quality of its products. Those products had been made with a continuous improvement as to their development and a consistent regard that the quality of these products should at no time be permitted to fall below a self-imposed high standard.

These two factors—development and quality—had dominated the engineering industry to a greater extent than any other, and it could be argued that no other factors in the past carried any weight. But to some of them, there was a belief that the present and the future would be dominated by other factors, which were thrusting themselves forward and making themselves felt, and one was that of economic production. This factor when placed in juxtaposition to the quality factor, threw up most intricate complications. So much so, that in certain places, a hostile atmosphere was created, for the issue became one of quality competing against economic production.

Whilst the factor of economic production may not in the slightest affect certain branches of industry, in others, it may bear a most powerful influence. In that section of industry where economic production became a dominant influence, there arose the difficult problem of " How can we achieve economic production?" That involved industrial management costing, time study, production methods, work simplification, production planning and so on; though it could well be that production control should be the major function to take care of this, then, if that were so, there was need for research to establish that point.

It had been emphasised that engineering in the past had been domineered by development and quality, but with the coming of the war, a third factor was imposed which was of equal importance. That was production. In the course of securing production, various details of industrial management came into prominence; for example, production planning and production control. It was found that if work was planned it was of great help, but more so, if work was controlled so that it followed through as planned.

The reason why certain industries were intensely interested in economic production, was because of competition, and particularly foreign competition: and we, because of our great industrial background, had great need for exports. It was when our products were lined up on a table, side by side with foreign competitors' in some export market, as for example, Australia or Argentina, that the success or non-success of our production methods became manifest.

Switchboard and Motor Control Equipment.—With a view to facilitating the supply of switchgear and motor control equipment to meet the requirements of the Services, a specification (B.S.1220) has been issued by the B.S.I. for low and medium-voltage d.c. single-phase or three-phase equipment with total load not exceeding 300 kW, kVA or H.P. per panel. The specification does not purport to apply to equipment for special purposes, nor to shipborne and airborne equipment. A special feature is a section dealing with tropic design and the treatment required to provide protection against damage due to corrosion, insects and mould growth in damp tropical climates. Copies of the above specification can be obtained from the Publications Department, British Standards Institution, 28, Victoria Street, London, S.W.1. Price 2s.

Electricity Supply

Lichfield.—Supply is to be afforded to the Shenstone Wood estate at a cost of £2 680.

Blackpool.—The Electricity Committee has authorised a supply of electricity for domestic purposes in Division Lane, Marton.

Barrow-in-Furness. — The Electricity Committee has obtained sanction to provide supply to Holker Farm in the Ulverston rural area.

Glasgow.—Internal wiring at premises at Robroyston and Auchinleck farms at a cost of £480 is to be undertaken by the electricity department.

Kingsclere and Whitechurch. — The R.D.C. is to approach the local electricity companies and the Basingstoke Corporation with a view to securing a reduction in their charges.

Blackpool.—The Corporation is applying to the Ministry of Health for consent to borrow £154 269 for the provision of two electricity transmission lines from Peel to the Bispham area.

West Hartlepool.—Subject to the consent of the Electricity Commissioners the T.C. intends spending over £26 000 on electrical developments. The work includes five new sub-stations.

Barrow-in-Furness. — The Electricity Committee is to provide supply to a farm at Haverthwaite at a cost of £350; to a blacksmith's shop at Coniston, £27; and to Goldmire Quarry, Dalton, £600.

Southport.—The Electricity Committee is to extend the feeder from Nelson Street sub-station to Lancaster Road sub-station, at a cost of £3 490 and provide supply to bungalows at Balmoral Drive at £2 105, and Pinfold at £2 006.

Brierfield.—The Electrical Engineer is making application to the Commissioners for sanction to borrow £5 000. the cost of erecting two sub-stations. The charge for electricity for street lighting has been fixed at 1¾d. per unit from October 1.

Southport.—The Electricity Committee has arranged terms for the provision of supply to the L.M.S. by the Liverpool Corporation, for use on the Liverpool-Southport section of the railway, such supply being restricted to railway purposes.

Worcestershire.—The County Agricultural Committee reports that the S.W. and S. Electric Power Co. is contemplating the extension of the overhead line at Dunhampton to Acton and has arranged for the company to provide supply to the Council's small holdings, comprising 14 houses.

Blackpool.—At a meeting of the Electricity Committee it was reported that the Lytham St. Annes Corporation was prepared to instal public street lighting in Division Lane if the Blackpool Corporation would bear half the capital cost and half the maintenance costs of the installation. The Committee agreed.

Clitheroe.—The Chairman of the Electricity Committee reports that the existing industrial tariff of .5d. per unit (plus zone charge) operates at a loss in view of the increased cost of coal. Application is to be made to the Commissioners for consent to increase this tariff to .65d. per unit (plus zone charge).

Workington.—The Corporation Electricity Committee is to provide supply for the West Cumberland Joint Hospital Board at Ellerbeck hospital, to Wether Riggs farm, when the cable is laid to the new housing site, and negotiate terms for supply to the West Cumberland Stadium Ltd. at Lonsdale Park.

Preston.—The T.C. has approved application for a loan of £171 000 on part of the extension to the Fylde coast transmission service. The simple hire scheme for domestic appliances is to be reintroduced and application made for a loan of £10 000 for this purpose.

Turkey.—It is reported that plans for post-war expansion of Turkey's electrical power system involve the addition of plants that will increase the total capacity by approximately 1 190 000 kW. Production by central electric power stations, in millions of kWh, has fluctuated from 353 313 in 1939 to 396 898 in 1940, 415 299 in 1941, and lowered to 408 254 in 1942.

Barrow-in-Furness.—At a meeting of the Electricity Committee the Electrical Engineer reported upon his proposal for an alternative two-part tariff for cinemas, shops and business premises and the Committee adopted the following scale for a trial period of 12 months: A fixed charge at the rate of £2 10s. per kW of maximum demand per quarter, plus ¼d. per unit in Barrow and ¾d. per unit outside the borough.

Lincoln Cooling Towers.—By a majority of two votes, the City Council has reversed a decision made in committee about a fortnight ago, to adopt a scheme prepared by their consultant engineer, Mr. C. E. Farran, for the use of water from the River Witham and the South Delph for cooling purposes. It has now been decided to have four cooling towers no higher than the 90 ft. of the power

station building instead of 230 ft. towers, as originally proposed.

Torquay.—At a meeting of the Electricity Committee it was reported that the question of public lighting in Newton Abbot had been discussed with the U.D.C. and that it had been arranged that endeavours would be made to carry on the supply of electricity and afford facilities for lighting and maintenance of certain specified lamps as in pre-war days until the U.D.C. was able to undertake the responsibility for the actual lighting and maintenance of the lamps, the corporation then continuing only to be responsible for affording the supply of electricity.

Poplar (London).—At a meeting of the Electricity Committee the Electrical Engineer outlined the method adopted in connection with the electrical installations in the emergency pre-fabricated houses provided by the Ministry of Works, and the Committee, whilst appreciating the existing difficulties in regard to supplies, considered that the arrangements generally for equipping the houses left much to be desired and should be clarified by the Ministry. Every effort has been made to provide a.c. services in the houses, but on some sites it has been necessary to instal d.c. and delays have occurred in receiving the special switches and thermostats required. This is a contingency outside the control of the Council and it would appear that the Ministry has been unable to expedite the delivery of d.c. apparatus.

Electricity in Eire.—The staff of the Electric Supply Board are assembling a second 15 000 kVA turbo-alternator at the Poulaphouca power station. It is expected to be in commission before the end of the year, and together with a twin turbine, now partially dismantled for routine inspection, the combined annual output of the station will be in the region of 30 000 000 to 39 000 000 units. During the war years, when steel was unobtainable, the Board had no other recourse but to fit wooden-steel sluice gates. These are now being replaced by steel, and with the main turbo-set, which has been operating since before last Christmas, frequently for as long as 16 hours a day, being overhauled, generating will probably be held up until early September. In the main control room are being installed push-buttons to operate, by compressed air, a battery of main 10 000 V switches.

Leicester.—In the statement of accounts issued by the electricity department for the year ended March 31, 1945, statistics show that the quantity of units generated for 1939, was 188 887 060, compared with 376 687 050 in 1945. The total quantity sold was 154 086 076 (216 064 433). Units exported to the Central Electricity Board numbered 24 356 660 (115 934 650), while units imported from the Board totalled 25 604 340 (4 901 550). The maximum demand on the generating station was 62 000 kW, compared with 79 960 kW in 1945, and the maximum demand of the undertaking was 61 220 kW (79 860 kW). The average receipts per unit sold, including hire of apparatus, etc., was 1.178d. in 1939 (1.089d. in 1945); average receipts per unit sold (current) 1.141d. (1.057d.). The total number of units sold was 154 086 076 (216 064 433). The financial statement shows that for 1939, the gross revenue amounted to £803 830 (£997 796); working expenses, £580 614 (£747 912); interest and debt repayment, £99 179 (£75 012); income-tax and special expenditure, £94 493 (£62 728), giving a surplus of £29 544 (£12 144).

West Midlands J.E.A. — The statement of accounts of the West Midlands Joint Electricity Authority for the year ended December, 1944, shows that the cost of bulk supplies per unit sold in 1934 was .410d. (275 518 391 units); by 1939 it was .349d. (636 606 883 units); in 1940 .369d. (810 768 632 units); and last year the figure was .512d. (978 689 307 units). In 1936 the total capacity of the plant installed at the end of the year was 199 900 kW; in 1939, 279 476 kW, and in 1944, 288 530 kW. The units generated rose from 416 978 200 in 1936 to 1 051 769 630 last year. The year in which the highest net export to the Central Electricity Board occurred was 1942, when 310 750 194 units were transferred, compared with 44 694 710 last year. Consumers in 1936 numbered 5 365. By 1939 they had risen to 18 624, and at the end of 1941 they numbered 20 659. By the end of last year they had reached a total of 22 460. Units supplied to the area rose from 11 096 121 in 1936 to 84 577 991 last year. 1943 was the peak year, with 86 538 918 units supplied. The units sold rose from 9 888 417 in 1936 to 80 871 400 in 1943, with a slight drop to 79 287 681 last year.

Interruption of Supply to the L.P.T.B. —At about 9.20 p.m., on August 11, a busbar fault developed on the 33 kV metal-clad switchgear at one of the Northmet Power Company's sub-stations from which supply to the London Passenger Transport Board emanates. The faulty equipment was disconnected from the system by the action of discriminating electrical protective gear. A fire resulted which was suppressed by the " Atlas Oilfyre " installation which was brought into action automatically. Before supply could be resumed, the sound busbar and the remainder of the equipment had to be freed of water, dried and pressure tested.

Industrial Information

A.S.E.E.-N.F.E.A. Agreement. — With reference to the paragraph on p. 146 of our last issue, we are asked to point out that the figures given are exclusive of cost of living allowances.

Exports to Belgium.—The Board of Trade list of goods which can only be exported to Belgium and Luxembourg through Government channels has now been modified to include various coal-mining equipment.

Change of Address.—On August 30, the Electrical Apparatus Co., Ltd., will be transferring their Yorkshire office from its present Sheffield address to 21, Park Street, Leeds, 1. Telephone number: Leeds 22438.

Modern Building Tools.—The Ministry of Works announce that demonstrations of power driven hand tools will be held at Paradise Street, Liverpool, from September 11 to 15, and at Victoria Buildings Site, Deansgate, St. Mary's Gate, Manchester, from September 25 to 29. The demonstration will visit Cardiff, from November 13 to 17, at a site which is not yet determined.

Electric Irons.—The Central Price Regulation Committee has approved the following prices, exclusive of purchase tax, for the electric irons manufactured by Craft Electrical Industries Ltd., Schofield Street, Queensway, Rochdale:—Dixy iron, manufacturer's selling price, 14s.; wholesale selling price, 17s. 6d.; retail selling price, 23s. 4d.; Laxy iron, 14s. 5d., 18s. and 24s. respectively.

Vocational Training.—A course in radio servicing is already available under the Government scheme for the provision of free vocational training, with maintenance allowances, to assist in the resettlement of men and women who have been in the Forces or on other work of national importance.

Antigua Customs Tariff Modification.—The Board of Trade have received a copy of a Resolution (S.R. & O. No. 7 of 1945) passed by the Legislative Council on June 7, which provides for modifications to the Antigua Customs Tariff to the effect that the full and preferential rates of duty on electrical lighting and power machinery for industrial purposes are ad val. 15 and 10 per cent. respectively.

New Cable Manufacturing Plant. — Enfield Cables Ltd., of Brimsdown, Middlesex, announce their intention to establish in the Nantyglo-Brynmawr area of South Wales a new manufacturing plant, to which they will transfer from Brimsdown a portion of their business. The factory will be designed to employ not less than 600 people in one of the most hard-hit areas of the South Wales coalfield, on the borders of Monmouthshire and Breconshire.

The Stoker's Manual.—The Fuel Efficiency Committee of the Ministry of Fuel and Power have prepared a manual especially written for the stoker, giving practical details of how his job can best be done and explaining why it should be done in a certain way. It contains 88 pages and 39 illustrations. The price is 6d., at H.M. Stationery office. Also published this month, Fuel Efficiency Bulletin, No. 41, "How to Look After a Boiler Plant," is a handy guide to efficient operation.

Motors and Generators.—A revision of B.S.1156, a.c. and d.c. motors and generators for Government department requirements, has recently been issued by the B.S.I. This applies to all motors and generators up to 660 V and up to 300 H.P., kW or kVA, but excludes fractional H.P. machines and shipborne or airborne machines.

Imports from Italy.—It was announced in Rome on August 2 that Allied control over Italian export trade has been withdrawn and that henceforth the Italian Government and Italian firms will be free to conduct direct transactions with foreign firms. British importers are reminded that trading with the enemy restrictions have not yet been lifted in respect of trade with Italy, so that it is not yet possible to conclude a contract with the Italian Government (or Italian private traders). Inquiries may, however, be made of Italian exporters as to availabilities, terms of sale and prices of goods. British importers are also reminded that when transactions are permitted, import licences will be required for all goods imported into the United Kingdom from Italy which do not come under an open general licence. Import licences will not, in general, be granted for goods not, for the time being, licensed from other countries. Import licences will not normally be considered for food, the import of which will continue to be conducted by the Ministry of Food.

Australian Tariff Decision.—The Australian Customs have announced the following duties under the British Preferential Tariff:—Alternating current, watt-hour, 3-rate (or triple tariff) meters, free; phanotron tubes and pliotron tubes, 4s. 3d. each; kenotron tubes, ignitron tubes and thyratron tubes, free; glow tubes, barretter tubes and pentode tubes, free; glow tubes fitted with pin-type bases, free; glow tubes fitted with bayonet and screw-in type bases, 5 per cent. ad val.; and for each £1 by which the equivalent

in Australian currency of £100 sterling is less than £125 at the date of exportation, an additional duty of 8 per cent. ad val.

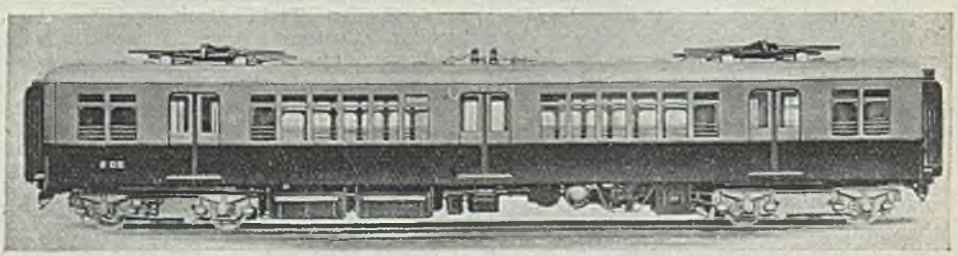
Central Railway of Brazil.—In 1935 the Central Railway of Brazil placed a contract with the Metropolitan-Vickers Electrical Co. Ltd. for the supply and installation of the first stage of the electrification of that system. This included the supply of 60 three-coach electric trains, two sub-stations, transmission and overhead line gear, supervisory control, electric signalling and track circuiting installation, and complete workshops, car sheds, etc. The whole of this work was completed before the war, but the continuation of the programme had to be postponed on the outbreak of hostilities. More normal conditions are now within sight, and this programme is being resumed. An extension to the first stage has now been placed with the Metropolitan-Vickers Co. for an additional 30 three-coach trains, extensions to two sub-stations, and considerable spares. The three-coach trains, as before, comprise a motor coach with a driving trailer-coach at each end. The motor coaches will be generally duplicates of that illustrated, equipped with four 175 H.P., 1 500/3 000 V motors. The coaches are of all-steel construction, and are of non-compartment type. The three coaches are connected together as a unit and can be operated in a train of two or more of these units.

The Severn Barrage.—The saving of 70 million tons of coal in the first century from the completion of the Severn Barrage is envisaged by Mr. C. G. Carrothers in an article, in the August publication of "Serial Maps," dealing with the 1945 Report on the subject, abstracts from which appeared in THE ELECTRICIAN of March 2.

The only tangible benefit given by the barrage, states Mr. Carrothers, would be the saving in coal consumption by steam power stations due to the reduction in load they would otherwise have to meet. After discussing methods of controlling intermittent tidal energy, including pumped storage and the operation of three basins, which, he says, do not offer any economic advantage in the special case of the Severn scheme, Mr. Carrothers refers to the problem of transmitting into the grid system the electrical energy generated. To utilise the barrage output of 800 000 kW, he states, it would be necessary to provide long-distance transmission lines to connect with sub-stations in the London area, in the Midlands, in South Wales and the west country. The intermittent output from the barrage would require the output of the thermal stations to be raised or lowered at times, varying daily in accordance with the progression of the tides; considerable thought would, therefore, have to be given to devise a scheme of combined operation to avoid excessive wear and tear upon thermal plant caused by frequent starting up and shutting down.

"The annual saving in coal," declares Mr. Carrothers," is the measure of the value of the barrage to the nation. The saving will become less as the years go by on account of the improved thermal efficiency of steam stations, but it is safe to say that in the first century after completion the barrage would save 70 million tons of coal."

Research on Atom Bomb.—The achievements of British scientists in solving problems of nuclear physics and applying the results towards the eventual production of atomic bombs were described in a long statement issued by the Department of Scientific and Industrial Research. At the beginning of 1940 Prof. Peierls, of Birmingham University, Dr. O. Frisch and Prof. Sir James Chadwick, both of Liverpool University, independently called attention to the possibility that a fast neutron fission chain reaction could be obtained if pure, or nearly pure, uranium 235, were available. A committee of scientists, with Prof. Sir George Thomson as chairman, was set up in April, 1940, originally under the Air Ministry, and later under the Ministry of Aircraft Production, to examine the whole problem. By the early summer of 1941 the committee decided that the feasibility of a military weapon based on atomic energy



Typical Metrovick electric motor coach supplied to the Central Railway of Brazil

was established, and that this weapon had unprecedented powers of destruction, that a method of producing the amounts of material required was in view, and that a fair estimate of the industrial effort needed to accomplish the project could be given. Work on finding conditions under which a mixture of uranium and some suitable " slowing-down " medium might give a neutron chain reaction in which the release of energy was obtained in a controlled way was carried out at Cambridge by Drs. Halban and Kowarski, two French physicists who had been sent by Prof. Joliot to this country at the time of the fall of France in June, 1940. They brought with them the 165 litres of heavy-water—practically the whole world stock—which the French Government had bought from the Norsk Hydro Electric Co. just before the invasion of Norway. Facilities were provided at the Cavendish Laboratory, Cambridge, and by December, 1940, they produced strong evidence that, in a system composed of uranium oxide (as actually used) or uranium metal, with heavy-water as the slowing-down medium, a divergent slow neutron fission chain reaction would be realised if the system were of sufficient size. The exchange of information with American scientists and further research and development in industrial establishments in England followed, and latest work was transferred to Canada and America.

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.

Chichester City Council, August 17.—Manufacture, supply and laying of approximately 20 miles of 11 kV and control cables and accessories. Specifications from Messrs. Mackness and Shipley, Parliament Mansions, Abbey Orchard Street, London, S.W.1; deposit, £2 2s.

Salford Public Health Department, August 20.—Supply and installation of one hydro extractor, 26 in. diameter, direct electric drive, at Laundry, Ladywell Hospital, Eccles New Road, Salford, 5. Specification from the Town Clerk, Town Hall, Salford, 3.

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.

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 1s.

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.1.

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.

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.

Overseas

City of East London (South Africa), August 20.—Supply and delivery of one electric-driven air compressor and one portable internal combustion-engine driven compressor. Specification from Davis and Soper, Ltd., 54, St. Mary Axe, London, E.C.3.

Company News

NORTHMET POWER CO.—Intm. div. on ord. 3% (same), payable Sept. 22.

UNITED RIVER PLATE TELEPHONE.—Fin. div. 2%, mkg. 7% (6%).

RUSHDEN AND DISTRICT ELECTRIC SUPPLY CO. LTD.—Intm. div. 4%.

NORTHAMPTON ELECTRIC LIGHT AND POWER CO. LTD.—Intm. div. 4% on ord. (same).

HERBERT TERRY AND SONS, LTD.—Intm. on ord. 6d. per sh. (same), payable Aug. 25.

CAWNPORE ELECTRIC SUPPLY CORPORATION.—Fin. div. 7% (same), mkg. 13%, less tax, for 1944.

RUTHS INTERNATIONAL ACCUMULATORS.—Net loss 1944 £459 (pft. £742), fwd., debit £70 506 (£70 047).

BRITISH VACUUM AND ENGINEERING CO. LTD.—Fin. div. on ord. 17½%, less tax (same), mkg. 30%, less tax, to Sept. 30. Net pft. is declared at £83 954 (£88 640).

WASTE HEAT AND GAS ELECTRICAL GENERATING STATIONS, LTD.—Intm. 2½% on ord. (same), payable Aug. 31 to holders reg. Aug. 18.

HEAD WRIGHTSON AND CO., LTD.—Fin. div. on ord. 3½% (same), payable Sept. 4, mkg. 6%, less tax (same) for yr. to Apr. 30. Net pft. is stated as £26 148 (£21 533).

ANGLO-PORTUGUESE TELEPHONE CO. LTD.—Fin. div. 5% (same) on ord., mkg. 8% (same), and 8% on "A" ord. (same). Net pft. 1944, after taxatn., £52 338 (£52 126).

CRYSTALATE, LTD.—Dirs. announce that cap. reduction plan has bn. confirmed by the Court and the cap. now is £375 000 in 150 000 10s. 8% pref. shs. and 6 000 000 1s. ord. All the pref. shs. and 2 925 000 ord. shs. are issued.

AYRSHIRE ELECTRICITY BOARD.—Arrangemts. with the Treasury to redeem the £721 320 Ayrshire (Local Authorities) Electricity 4½% redeem. on Nov. 11 next. in exercise of the option in the terms of the issue.

RHEOSTATIC CO. LTD.—Letters of right have been posted for the issue by the Rheostatic Co. of 70 000 4s. ord. shs. at 8s. each in the proportn. of one sh. for every £1 of ord. stk. held and 40 000 10s. 6% cum. pref. shs. at 11s. each at the rate of two shs. for every £2 10s. of pref. stk. held.

McMICHAEL RADIO LTD.—Tradg. pft. 1944 £61 077 (£49 482), interest and fees £1 073 (£1 111), mkg. £62 150 (£50 593). To dirs.' fees £950 (same), depreen. £4 526 (£4 513). defd. repairs £4 000 (nil). A.R.P. £2 465 (£2 162). war damage £112 (£270), lvg. pft. £50 097 (£42 698). Tax £21 279 (£9 800), prefd. ord. div. 2½ yrs. to Mar. 31, 1941, £28 758 (same), fwd. £1 255 (£1 195).

NEWTON BROTHERS (DERBY), LTD.—Tradg. pft. to Mar. 31 £100 367 (£174 048), other income £381 (£2 988), mkg. £100 749 (£177 036). To dirs.' fees £1 500 (same), depreen. £656 (£673), inc.-tax and E.P.T. £84 948 (£161 432), lvg. net pft. £13 645 (£13 431). To res. £5 000 (same), research and developmt. £1 378 (nil), div. 17½% £6 912 (same), fwd. £9 569 (£9 214).

A. C. COSSOR, LTD.—Accts. for yr. to Mar. 31 last show net tradg. pft., includg. interest and divs. receivable, and after providg. for taxatn., of £150 032, £33 461 increase. To dirs.' fees, staff pension and war damage contributns., together £15 602 (£13 965), net pft. is £134 430, a rise of £31 824. To this is added £45 000 (nil) net divs. from Sterling Cables, for the three yrs. to Mar. 31 last. Pref. div. again takes £15 000 net. £100 000 (£4 404) is written off goodwill. Carry-fwd. £111 325 (£109 395).

WEST MIDLANDS JOINT ELECTRICITY AUTHORITY.—Rev. acct. (bulk supplies) for 1944 shows production cost chargeable to Central Elec. Board £1 983,426, sundry income £3 538, sales of current £2 180 062. To generation exes. £1 572 903, transmisn. £10 116, rent, rates, etc., £31 611, mangmt. £29 482, other chges. £45 041, loan chges. £403 023, current reprchsd. from Central Elec. Board £2 060 000, lvg. surplus for yr. (partly estimated) £14 850, blce. £129 793. Distbn. acct. shows sale of current £377 974, meter rentals £2 198, less deficit from hire and sale apparatus £183. To cost current £206 611, salaries and wages £14 287, repairs, etc., £13 882, rent, rates, etc., £7 889. Managemt. £15 114, other chges. £8 854, estimated inc.-tax £20 500, loan chges. £77 211, lvg. surplus for yr. £15 641, blce. £21 122.

Company Meetings

BAKELITE LTD.—At the recent annual general meeting, with Sir James Swinburne, Bart., F.R.S. in the chair, Mr. H. V. Potter, managing director, said that in common with industry generally in this country, the company's activities had been gradually diverted from a peace to war footing late in 1938 and early 1939. The company manufactured raw materials and not finished products, and it had to face many problems in adapting the characteristics of these materials to meet the demands of the various Services. Radio and telephone communication equipment relies largely on Bakelite insulating materials, and in wartime, when the results of battles frequently

depend upon the speed and reliability of communications, improved Bakelite materials played a vital part. Production had been almost doubled, and the additional plant required to effect this increase was financed almost entirely from the company's own resources. The administration of the company had recently been reorganised and a number of units established, and it was the company's intention to enter new fields of plastics. For example, the manufacture of Vinyl plastics to replace rubber for electrical cable covering and tubing—a war-time activity—will be continued and expanded.

GREENWOOD AND BATLEY, LTD.—In the course of his speech at the annual meeting held in London, Col. H. A. Mecklen, the chairman, said that a short list of goods manufactured by the company up to the present during the war included—5 628 machine tools, 898 locomotives and electric trucks, 406 steam turbines, 156 cordite presses and rolling mills, and 3 542 high-frequency generator sets, 2 441 electric generators and motors. In developing a considerable number of different types of machines before the war, for and in conjunction with the Government, they were placed in the position of having designs, patterns, and experience immediately available when the rearmament drive started. For many years the company had made a practice of undertaking its own research and development work, and they encouraged their technical staff to achieve efficiency in the matter of engineering science, to apply the results of their training to the firm's manufactures, and to develop new designs. As a result of this policy, it was found possible before the war to capture a considerable share of markets abroad served previously almost exclusively by American and Continental concerns. It had always been a strong conviction of their management that there were as good brains in this country as there were abroad, but they must be given an opportunity to function.

COMPANY MEETING

Benn Brothers Limited

THE 49th annual general meeting of Benn Brothers Limited, proprietors of THE ELECTRICIAN, was held at Bouverie House, Fleet Street, London, on August 10. Sir Ernest J. P. Benn presided.

The directors' report showed net profit for the year of £99 705 11s. 10d., less income tax, E.P.T., and N.D.C. £55 325 8s. 2d., leaving £44 380 3s. 8d., to which was added the balance brought forward of £16 343 1s. 11d., making a total sum available of £60 723 5s. 7d. After allocating £4 000 to Jubilee Pension Fund and £1 500 to leasehold reserve, there was a net amount for appropriation of £55 223 5s. 7d. The directors recommended payment of dividends of 3 per cent. on preference shares, which, with the interim dividend of 3 per cent., made 6 per cent. for the year — 12½ per cent. on ordinary shares, which, with the interim, made 17½ per cent. for the year, and 3s. 6d. per share on the deferred shares. The report stated that on the occasion of the Victory celebrations a special staff bonus was announced at the rate of 10 per cent. on the year's salaries and wages.

Moving the adoption of the report and accounts and the dividend resolutions, Sir Ernest Benn referred to the great loss suffered during the year by the death of Mr. Gordon Robbins, the late chairman, and he spoke also of the grief felt at the death of Flight-Lieut. E. P. C. Kidd, who entered the company's service as a boy of 17 and rose to the position he was just beginning to fill in the Benn tradition as editor of a great paper.

Sir Ernest Benn said he was presiding that day in the enforced absence of the Chairman of the company, Major E. Glanvill Benn. He was still away on his military duties in Italy, but a month ago they had been able to welcome back Commander A. O. Gillett, R.N., and Major John Benn had also, on the previous day, got into "Civvy Street."

Alluding to the company's services, Sir Ernest said: This old ship has managed to weather two disastrous wars, and has come out not only unscathed but sound. The business had been founded on the right lines and the new directors will continue to be guided by high principles and experience.

He must express his feelings about the staff and the work of the last five years. This had been a total war, and even in the presence of one or two gallant men there who had faced the proper business of war he did not hesitate to say that the brunt had fallen on such people as those inside the building. Whoever a few years ago would have thought of a paper being put to bed with bombs falling on each side of the building; or of going on with the job when V-bombs were crashing a mile or two away; or of five people doing the work of seven and, later, of three people managing to do the work that the five had struggled to do? They had carried on in conditions as near to hell as he hoped to

experience. It was all very wonderful, and he was there to say " Thank you " and to express appreciation of that work.

The difficulties were, strangely enough, intensified today. There was a feeling that, following VE-Day, which was three months ago, there would be some little relief from the weariness and exhaustion of the past five or six years. However, it took time to get relaxation from the rush of those years.

Mr. Norman French (joint managing director) seconded the resolution, which was unanimously carried.

Captain K. E. Hughes and Mr. Basil H. Tripp were re-elected to the Board, and Cassleton Elliott and Co. were reappointed Auditors.

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.*

RADIO LABORATORIES (PENZANCE) LTD.—July 20, series of £1 000 (not ex.) debs., present issue £400; general charge. *Nil. June 12, 1945.

SAMUEL BROS (PLASTICS) LTD.—July 19, two charges, to Barclays Bank Ltd., each securing all moneys due or to become due to the bank; respectively charged on ppties. in Chester Rd., Owen St. and Bank St., Hulme, Manchester, and on ppty. in Chester Rd., Owen St., Bank St. and Arthur St., Hulme, Manchester. £480. Jan. 19, 1945.

Satisfaction

GENERAL WIRELESS RELAY CO. LTD., London, W.—Satisfaction July 27 of debs. reg. Nov. 29, 1935, to the extent of £5 300 and the premiums thereon.

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.*

DAVEY, Alfd. F., 9, Christchurch Rd., Reading, electrician. £11 11s. 10d.

HILLIER, Maurice (tradg. as Moreburns Radio), 486, Kingsland Rd., London, E.8, radio dealer. £13 14s. June 21.

WRIGHT, Leonard W., and Co., Burgess St., Sheffield, electrical suppliers. £20 3s. 7d. June 25.

Notice of Intended Dividend

DICK, Owen Robert Bruce, now serving in H.M. Royal Air Force, described in the Receiving Order as of, and residing at 32, Sheffield Terrace, London, W.8, radio dealer. Claims to be sent by Aug. 22, 1945, to the Trustee, Mr. Leslie Arthur West, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

Notice of Dividend

WEBB, Cecil Robert Golden (trading as Southern Electrical Mechanical Co.), 146A, Eastern Road, Brighton, and formerly carrying on business at 94, St. Georges Road, Brighton, as an electrical engineer. First and final dividend $9\frac{1}{16}$d. per £, payable August 17, at the Official Receiver's Office, 8, Old Steine, Brighton, 1.

Order on Application for Discharge

SYMONS, Julian James, carrying on business as The Zodiac Peerless Electric Lamp Co., 25, Denmark Street, Charing Cross Road, London. Date of order July 10, 1945. Discharged subject to consenting to judgment for £585 being entered against him by the Official Receiver, and for £1 10s. costs of judgment.

Metal Prices

		Monday, August 13. 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	„	$11\frac{1}{16}$d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. $0\frac{7}{16}$d.		—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
Wire „	„	$11\frac{1}{4}$d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£28 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ...	„	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G. ...	„	£26 0 0	—	—
Lead Pig—				
English	„	£31 10 0	—	—
Foreign or Colonial	„	£30 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	„	£303 10 0	—	—
Wire, basis... ...	per lb.	3s. 10d.	—	—
Aluminium Ingots ...	per ton	£85 0 0	—	—
Spelter...	„	£31 5 0	—	—
Mercury (spot) Warehouse	per bott.	£69 15 0	—	—

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

Printed in Great Britain by Straker Brothers Ltd., 194-200, Bishopsgate, E.C.2, and published by Benn Brothers, Ltd., at Bouverie House, 154, Fleet Street, London, E.C.4.—Friday, August 17, 1945