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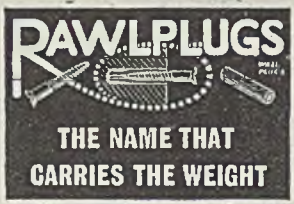

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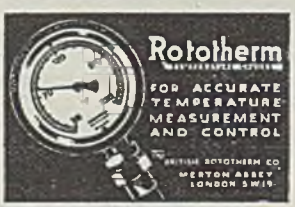

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CONTENTS

VE-Day

THE electrical industry will, no less than the rest of the country, feel heartfelt relief at the coming of VE-Day, and though for a short spell it may rest on its oars, it will, nevertheless, quickly return to its task in order to produce the goods and weapons needed to beat Japan. The defeat of Germany has removed a cloud which has overshadowed this country so long, that many operatives in the industry have no experience of working in conditions other than those imposed by the war, and now that the cloud is dispersed the industry is entitled to rejoice, entitled to look back upon what has been achieved so far, entitled to its quota of praise.

The years since 1939 have been hard, and though the experience of the 1914/18 war gave some appreciation of what might be expected, even that failed to indicate the difficulties which had to be overcome. Meeting the needs of a total war was expected to be exacting and the industry had already taken many precautions when the war-cloud burst, but experience of bombing, however, was at that time confined to second-hand information which reached us from Spain and Finland, and it speaks volumes for our powers of endurance, when it is realised that the industry's greatest effort and greatest output were reached when the bombing of this country was at its worst.

The industry will accept the spirit of VE-Day as something different from that which prevailed at the time of the 1918 armistice, for though all organised resistance of the German army has been overcome, there is still fighting to be done, still casualties to be suffered. Many in the industry still have their menfolk engaged in the Far Eastern battle and so the spirit of rejoicing must be tempered by the fact that though the fighting has not ceased, we are thankful that its volume and viciousness are at any rate reduced.

The industry and all engaged in it may well be proud of their contribution to VE-Day, and elsewhere will be found a brief review of what was endured and what was done to bring us where we are. It is a remarkable record, for in it is written something of the personal sacrifices which have been made, something of the tremendous effort which was made by all sections of the industry to meet the needs of war, without, in many cases, the normal materials with which to carry out the work.

As to the future, there remains an enemy in Japan no less powerful, no less ruthless than Germany, and so long as she is unvanquished there can be no relaxation of effort. For millions of British homes there can be no peace while there is fighting on the other side of the world, but with the Forces now released in Europe, there is reason to hope that peace in truth will be not long delayed. When

that time comes the electrical industry will once again be able to apply the whole of its efforts to the needs of Man instead of War, and though for a while the going will be hard, such is the unbounded energy of the industry that the future is not in doubt. Many new applications of electricity, many new processes and developments await exploitation and though the demands of the immediate future may try to press them into the background, the long hoped for withdrawal of controls and removal of bureaucratic restrictions will substantially assist in their being made available to the public as soon as it is within the industry's power to do so.

Taking Electricity Into the Highlands

THE North of Scotland Hydro-Electric Board are faced with the problem of covering with profits earned in other directions, the heavy annual losses that are anticipated on the distribution schemes to supply electricity to ordinary consumers in the sparsely populated district embracing the Highlands and islands of Scotland. As the Board are required by Statute to make such charges for electricity as, over a term of years, will provide the sums required for meeting all expenditure on the revenue account, what is lost on the swings must be made up on the roundabouts. In their first report the Board, in outlining their future policy, say efforts are being made to interest large power users in taking hydro-electric supplies, and projects of the same exporting type as the Loch Sloy scheme are being prepared, which will harness the undeveloped resources of the Highlands and help to pay for the many uneconomic distribution schemes there and to finance a grid in the North of Scotland district.

The I.E.E. Report

THE report which the Council of the I.E.E. presented at the annual meeting yesterday, Thursday, is of special interest in that it covers a period during which a considerable amount of special work has been, or is being, carried out in connection with post-war activities. First among these is perhaps the amendments to the bye-laws, for by their adoption, the full responsibility of election and transfer of members has, among things, been laid upon the shoulders of the Council, while corporate members throughout the country are afforded an opportunity of considering the Council's recommendations before the final decisions are made. In itself this may not appear of very great interest, but taken in conjunction with the fact that the membership of the institution is the largest of all the learned institutions in the world, the amendments are likely to have an appreciable influence upon a number of academic careers. The high esteem with which membership of the institution is valued by those who make up the industry is shown by the fact that of a total membership of all classes, of 26 665, no fewer than 12 573 are corporate members. In 1931, only fifteen years ago, the total membership was 14 670, of which 7 646 were corporate members, and though the growth of these figures in so short a time must be regarded as an indication of the importance with which membership of the institution is held, the volume of that importance is increased when it is appreciated that such growth has at all times been checked by the rigid standard of professional qualifications demanded by the institution.

Research Interests

ANOTHER item which engaged the attention of the Council has been the setting up of a permanent Research Committee with a view to strengthening the machinery for the consideration of matters bearing on research, particularly if the proposals of the institution's Post-War Planning Committee for the establishment of a British Electrical Research Board come into effect. The institution, conscious of the importance of research, has during the last few years made a more public display of its desire to see a wider recognition of the debt which industry owes to research, and anything which the Committee may be able to do in this respect will be doubly welcome. There has been much talk in Government circles on the subject, accompanied by promises of tax reliefs, but so far, the prospects of a more concentrated effort on research work has got little beyond the proposal stage. The work of the Council during the last year, as given in the report, has been both varied and exacting. From the short review given elsewhere in this issue, it will be appreciated that Council members have devoted a considerable amount of their time to institution matters, and while they are more than willing to do so, their sacrifice should not go unnoticed. The normal work of the insti-

tution is no small undertaking, but when is added to it all the extra business concerned with national service committees, advice to Government departments, and so on, those elected to serve on the Council must be possessed of a public spirit rich in self-sacrifice.

Measurements Section

THE remarks which terminated the luncheon of the I.E.E. Measurements Section last week, serve to remind us of the dependency upon instruments of most other branches of electrical engineering. The words spoken by Dr. W. G. RADLEY, chairman of the section, were particularly apt in this respect, besides reminding us that though the European war is at this stage a matter of celebration rather than concern, untiring and co-ordinated efforts are still called for. Such effort must henceforth be diverted towards liquidating the Japanese on the one hand, and restoring on the other, those amenities of civilised life which the public have learnt to associate with electricity. The growing importance of the Sections in the affairs of the institution were emphasised with conviction by the vice-president, Mr. T. G. N. HALDANE, whose suggestion that practically the whole membership of the institution should be registered with one or another of the specialised sections is worthy of serious consideration.

Increased Use of Milking Machines

ACCORDING to the agricultural correspondent of one of our national newspapers, there has during the last two years been a remarkable increase in the use of milking machines, in that the total for Britain is now 37 770, against 29 505 in 1942. This is attributed in some measure to the farmers' difficulties in keeping milkers, but its effect may well be to break down much of the resistance which was, before the war, offered to the substitution of hand milking. On the larger farm the installation of a machine saves some time in milking and on the admission of the farming fraternity itself, allows a reduced staff to manage at weekends. It has been claimed by some farmers that machine milking calls for a high degree of intelligence and scrupulous cleanliness if trouble is to be avoided, but the fact is, while the latter should be an accepted condition anyway, the need of the former is no more imperative than in the successful operation of any other machinery used on the farm. The reputation of milking machines, like that of any other, is dependent upon the human element, it is true, but since on many dairy farms they are already giving complete satisfaction, the frailty of the operative in this respect is in considerable doubt. In any case, according to the correspondent whose observations have prompted this note, the milkers like the machines, while the cows themselves do not suffer from Mastitis or other troubles. Electricity is clearly the ideal form of power for operating such machines, for apart from its obvious conveniences it permits that steady speed of operation which is essential if the best results are to be obtained. As to consumption, this varies between half and three quarters of a unit per cow per week; one farmer with a herd of 50 to 60 cows, in fact, claims that over a two-year period the current consumed varied from 18 to 26 units per week.

Growth of the B.E.T.R.O.

THE British Export Trade Research Organisation, the formation of which was commented upon in these columns a few weeks ago, has now acquired some seventy founder members, the size and prestige of whose manufacturing organisations will give the new body a wealth of experience. The electrical industry, which is already a major contributor to the success of our present export trade, is well represented and will no doubt, in the course of the next few weeks, make further claims to membership. It was said at the time of its formation that the organisation would need something like £50 000 per annum to be effective, and that the enrolment of one hundred founder members would be enough to give it a fair start. That being so, the latest figure of seventy founder members is promising of an early election of the council, whereupon the organisation will in a short while become operative. The growth of the body so far, is being watched by the basic industries of the country with considerable interest, for while most or all of them have their own facilities for investigating the export markets of the world, it is generally realised that the co-operative effort which the B.E.T.R.O. is designed to represent is likely to be more revealing than is economically possible where one industry is concerned.

The Industry's Aid to VE-Day

A Brief Review of Six Years' War Effort

THE ability with which the electrical industry was able to change in September, 1939, from peace-time pursuits to war-time manufacture demonstrated itself so well that not everybody has yet appreciated what tremendous contributions the industry has made towards winning the German war. For this reason, and within the limits which the Paper Control will allow, let us therefore review the happenings which have governed the industry during the last six years.

The number of new applications of electricity to equipment and services necessary for the prosecution of the war have often been subject to comment, but few realise how far-reaching and original many of these applications have been. Of plant, equipment and appliances manufactured for direct war purposes, reference may be made to anti-submarine devices, degaussing plant for ships to protect them against magnetic mines, land mine detectors, bomb disposal equipments, predictors, height computers, radio receivers and transmitters, generators for aircraft, cathode-ray tubes, new lamps for specific war purposes, and hosts of other equipment too numerous to catalogue.

In every branch of the industry the Government made incessant demands upon its resources, while many of the problems successfully solved involved the design and production of specialised equipment and apparatus of a type not associated with the industry in normal circumstances, as for instance the distant reading gyro-magnetic compass used for air navigation, and described in these pages in the March 2, 1945, issue.

Expansion of Factory Accommodation

The volume of war work for which contracts were placed with the industry necessitated increased production facilities. Many new factories were built during the war years, while many specialised works were entrusted to the industry for management on behalf of various Ministries. In the days before Lend-Lease the industry, too, made gigantic efforts to expand our export trade in those countries where currency was needed, and the electrical overseas trade figures which have been published in the last few months indicate the success which attended those efforts.

In the early days of the war, when the situation deteriorated to an extent that there was a likelihood of considerable damage to our power stations by enemy action, consideration was given to the design of temporary power plants of a transportable type for emergency operation of the more essential services, when and where required. Designs were prepared for units of this class by various manufacturers, some for mounting on barges, some for installation on road vehicles, and others on tracked wagons. Fortunately, the enemy efforts at destruction were sustained by the grid system, but the transportable power stations filled a gap which was not anticipated at the time of their design.

With the rapid invasion of Russia, the devastation as a result of the scorched-earth policy adopted by the U.S.S.R., and the natural ravages of war, power resources in the Soviet Union were largely destroyed. When the Russians by their offensives cleared these devastated areas of the enemy, restoration of power supplies became of primary importance in reconstruction, and to assist in this work the transportable stations developed by the electrical industry in this country were shipped in large numbers to the U.S.S.R.

Jet Propelled Aircraft

Considerable publicity has been given to jet propulsion during the last two years, both here and in the United States, and the development of the jet-propelled aircraft stands largely to the credit of the British electrical industry. When the United States entered the war a sample engine was shipped across the Atlantic for the inspection of American engineers, and whatever progress has been made in that country so far as jet propulsion is concerned owes its origin to British efforts.

Another British achievement which has been shared with American enterprise is the fluorescent lamp, though for reasons of all-out war production development in this country has not in the last six years been so pronounced as in the United States, where the war production tempo was slower.

During the war years, too, considerable headway was made with electric welding both in our shipyards and elsewhere, with the result that much time and man-power were saved without any appreciable loss in efficiency in some cases, and considerable advantages in others.

Many of our manufacturers, while continuing to produce essential electrical equipment, also undertook the making of munitions of war such as aircraft, tanks, guns, and so on. This is clearly indicated by the details given in our issue of

April 13, last, with respect to the making of bombers, while the series of articles which have been published regarding manufacturers' activities during the war years shows that this breakaway from the production of electrical equipment, as such, has had no appreciable effect upon the output of electrical machines. This is indicated, too, by the fact that the industry met the demands for plant for new power stations at Little Barford, Littlebrook, Earley, Gloucester and Ballylumford, to say nothing of many extensions to already existing stations. While meeting these demands the industry has, too, developed new designs in switchgear and improvements in other power station plant. In addition, exhibitions of all-electric kitchens and other equipment connected with housing show that the industry has, in spite of the war, not neglected the opportunities which presented themselves.

The shortage of materials, the need for economy in fuel and current consumption, the poor quality of coal supplies, scarcity of man-power, and the combing of the industry by the Services for technicians are just a few of the difficulties which have been overcome. To deal at full length with all that the industry has done in conditions of " black-out " factories, with a high percentage of operatives which is unskilled, would occupy space which in these days of Paper Control does not allow. In the information given above and in the following pages, however, will be found sufficient detail wherewith to paint an appropriate picture. It is a magnificent record, unsurpassed by the electrical industry of any other country.

How Munition Industry Was Served

The Grid in Battledress

THE story of how the expanded works and new factories engaged in the production of munitions of war during the last six years, were supplied with necessary current is one built-up on the experiences of the grid, and in the following paragraphs is given a brief outline of what was done.

From the beginning of the war up to the end of 1943 the grid system comprised 3 585 miles of 132 kV lines. 1 514 at 66 kV and lower voltages, and 344 sub-stations with an aggregate transforming capacity of 13 058 750 kVA. The number of selected stations was increased by five and the capacity of all such stations was raised by 2 326 656 kW, the number of stations at the end of 1943 being 142, with an aggregate installed capacity of 10 984 656 kW. The first section of the Little Barford station became operative in 1941, the station at Barrow-in-Furness was " selected " the following year and Littlebrook, Llynfi and Earley stations, two of which were constructed specially to meet war requirements, were commissioned in 1943.

Except during the fuel economy campaign in the winter of 1942-43, the aggregate output, which was a little over 26 400 000 000 kWh in 1939, rose to some 37 000 000 000 in 1943, and to 38 354 000 000 in 1944.

Difficulties were encountered in carrying out extension programmes, in respect of both grid lines and associated sub-stations, and of generating capacity in selected stations on account of the fact that the attitude of the Government's Production Executive was that priorities could not be granted for extensions which could only be justified by peace-time requirements. As early as 1941 it became apparent that there was a danger of a national shortage of plant and the Government was advised of the seriousness of the position which was likely to arise if, for reasons of war policy, the necessary priorities were not granted; the grid authorities were informed, however, that they would not be held responsible for any shortage.

Again, in 1942, a substantial programme of new plant for the autumn of 1945 was put forward but only about one-third of its extent was allowed.

During 1943, the greater part of a new programme of extensions was approved on the understanding that orders for the main items could be placed but that, pending the cessation of hostilities with Germany, no work of manufacture should be undertaken until further consent was given. In framing that programme its authors had in mind the replacement of some 2 000 000 kW of time-expired plant which would be over 20 years old by the winter of 1947 but decided that, in view of the interconnections provided by the grid, full replacement of that plant could be deferred until it was 25 years old.

From the outbreak of hostilities it became necessary to depart substantially from the peace-time policy of concentrating generation in the most economical stations and to keep a larger amount of generating plant than usual in constant readiness to secure, as far as possible, continuity of supply in emergency. Black-out restrictions and longer working hours resulted in the load factor, which was about 36 per cent. in 1938, rising to some 50 per cent. in 1942; in 1943, however, there was a decline to about 48 per cent. in that year. A further

effect of the war on grid operation was a transference of the peak demand, which in pre-war days was normally in the evening and limited to about one hour per day during the fortnight immediately preceding Christmas, to a period extending with little variation throughout the morning during three or four winter months.

The use for long hours of plant which would normally have been used only for short peak periods, the shortage of labour available for maintenance work, and the inferior and variable quality of coal had the combined effect of reducing the average thermal efficiency of stations during 1941 and 1942 by some 3 per cent. below that recorded in 1939, involving substantial annual increases in the quantities of coal consumed. During 1943, however, owing to improved war conditions and to new generating plant being brought into operation, a saving in coal consumption of over 400 000 tons was effected as compared with the quantity which would have been consumed on the 1942 level of thermal efficiency, though the efficiency figure attained was still 1 per cent. below that of 1939. Added to maintenance difficulties a progressive increase in breakdown brought about a serious reduction in the amount of plant available for service. During the winter of 1942/43 the aggregate amount of plant out of commission due to overhaul, breakdown and other causes averaged 1 250 000 kW, and in the winter of 1943/44 1 857 000 kW, being respectively 13 per cent. and 18.6 per cent. of the aggregate selected capacity of all stations as compared with a pre-war average percentage of about 6.

Up to 1943, extensions for which arrangements were projected amounted to 2 923 700 kW, while last year arrangements were made for extensions amounting to 3 000 000 kW, as outlined in our issue of November 24, 1944.

At the end of last year, out of programmes comprising some 3 394 000 kW of additional generating plant estimated to be required to meet anticipated demands for electricity up to 1948, 1 500 000 kW still awaited Government release for manufacture. There were 141 selected stations, with an aggregate installed capacity of 11 254 081 kW associated with the grid, while 48 others were operating for the Board under temporary arrangements. The grid itself comprised 5 142 miles of transmission lines, 3 614 operating at 132 000 V and 1 526 at 66 000 or lower voltages, and 348 switching and transforming stations with an aggregate transformer capacity of 13 422 750 kVA. The maximum simultaneous demand on the grid system was 8 351 000 kW, compared with a maximum demand of 7 867 000 kW in the previous year.

How Battle of Supply Was Won

Damage Caused by Enemy Action and the Results

WE have since the beginning of the year published a number of details respecting the air-raid experiences of several undertakings up and down the country, and now that the European war has reached its end, the full story of how the supply industry stood up to the Nazi bombing may be told, the data following having been taken from the files of the Electricity Commissioners.

September 3, 1939/August 31, 1940.—In this period no serious electrical incident was attributable to the war.

September, 1940.—In September the blitz on London, the provinces and airports commenced and on September 1, a bomb which fell in the yard of Gravesend power station caused some minor damage to buildings and interrupted supply on a 6.6 kV feeder for 9¼ hours.

During the month no generating station or grid sub-station was damaged outside Greater London, but within that area 15 stations and four grid sub-stations were hit or affected by near misses, some on more than one occasion accompanied by interruption of supply to consumers. Supply in these cases was restored, and in other cases was maintained, directly or indirectly, by the grid system.

During the year grid lines, and other transmission and distribution systems were affected on a number of occasions. Bombs and bomb splinters, cutting conductors caused 73 incidents; supplies were seriously interrupted on 18 occasions, there were 27 minor interruptions, and on 28 no loss of supply occurred. The aggregate time period of interruptions for the year from these incidents was 44½ hours.

Damage to grid lines by barrage balloon cables fouling them was a more serious matter, and accounted for nearly four-fifths of the total incidents in the year.

Damage to other lines and distribution systems was more frequent, but comparatively light. Out of 297 breakdowns there was no interruption of important supplies, minor interruptions numbered 280, and on 17 occasions no loss of supply occurred. The aggregate time period of breakdown was 2 241½ hours.

Damage due to barrage balloon cables was of minor importance on other lines and distribution systems, the number of incidents being 112 and the aggregate time period of interruptions 461½ hours.

During this period the A.R.P. protective measures taken by the supply industry

GENERATING PLANT IMMOBILISED DUE TO ENEMY ACTION. (kW)

Sept. 3, 1939 to Aug. 31, 1940...	Nil
September, 1940	200 000
October, 1940	266 000
November, 1940	176 000
December, 1940	81 000
January, 1941	135 150
February, 1941	135 150
March, 1941	147 650
April, 1941	154 500
May, 1941	190 000
June, 1941	185 000
July, 1941	182 000
December, 1941	73 000
March, 1942	25 700
June, 1942	11 000
September, 1942	45 000
December, 1942	38 000
September, 1943	15 000
September, 1944...	39 000
December, 1944...	3 000

and Central Board proved their worth in facilitating maintenance of supply and in limiting damage. For example, the continuous production at Battersea, in spite of repeated attacks, was largely due to the precautionary and protective measures taken by the London Power Company, including the provision of a duplicate control room. The National Pool of Emergency Plant was called on, once to replace a transformer and twice for switchgear.

The most serious incident of the month was at Fulham, where 190 000 kW of plant was put out of action. Littlebrook was attacked on two successive days, but without success.

During the month grid lines were damaged on 125 occasions, and other lines and distribution systems on 472. Outages due to barrage balloon cables were respectively 63 and 170.

At the end of the month 200 000 kW of plant was immobilised, 190 000 kW at Fulham and 10 000 kW at West Ham.

October, 1940.—In this month ten power stations in the London area were involved in incidents, together with Nechells, Birmingham, the first provincial centre. On only two occasions, however, were supplies to consumers interrupted. At the end of the month 266 000 kW of plant was out of action, the additions to the September total being Croydon, 25 000 kW, Deptford West, 20 000 kW, and Willesden, 21 000 kW. In addition Shoreditch, 24 500 kW, and Islington, 25 750 kW were temporarily shut down on October 16, the former for five days, owing to lack of water. At Deptford West, 16 men were killed and 14 injured when a bomb fell at the south end of the boiler house, demolishing the auxiliary switch house and damaging the boiler house and fitters' shop. Two grid sub-stations were damaged, one on two occasions.

Grid lines suffered less damage from enemy action in October than in September, but there was an increase in lines damaged and interrupted due to barrage balloons. There were 81 outages due to enemy action, but in very few cases was supply interrupted for more than an hour. Barrage balloons caused 82 outages.

Other lines and distribution systems had the highest monthly toll of breakdowns of the whole war, 601 interruptions, including damage to 48 sub-stations and switch stations. The latter figure compared with 52 in September. Aggregate time of outages was 5 004 hours. Balloon cables caused 63 interruptions, aggregating 374 hours.

November, 1940.—During this month damage to stations was small compared with September and October. There were no interruptions of supply from six damaged stations, five in the London area, and Hams Hall, Birmingham. A contributory cause was the extension of attacks to provincial centres, heavy raids being experienced at Coventry, Birmingham, Bristol and Southampton. No new generating sets were damaged, and with repaired plant at Fulham and Deptford West being recommissioned, the total capacity out of action at the end of the month was reduced to 176 000 kW. By the end of the month 75 per cent. of the total demand at Coventry had been recovered. Three grid sub-stations suffered damage.

Interruptions on grid and other lines was on a reduced scale compared with October, 61 and 205 respectively. Damage by barrage balloon cables again caused trouble.

December, 1940.—Damage to power stations and grid sub-stations was again small compared with September and October, while damage to transmission and distribution systems was similar to November.

Six power stations were affected, five in the provinces and one in London. At the end of the month 81 000 kW of plant remained out of commission, 60 000 kW at Fulham and 21 000 kW at Willesden. Two grid sub-stations were damaged, one slightly and the other extensively, involving interrupted supply to consumers.

A decrease in damage to grid lines due to enemy action occurred, the total number of incidents for the month being 7; of these 4 affected important supplies, while in the other cases there was no interruption. Damage to other transmission lines and distribution systems was on a scale comparable with November, and mainly centred in Birmingham, Sheffield, Stretford, Man-

chester and Liverpool, with relatively less trouble in London.

First Quarter, 1941.—January opened with a recrudescence of enemy activity and damage to power stations was more severe than in either November or December. Six stations were affected, including Portsmouth, Plymouth and Bristol, and at the end of the month immobilised plant aggregated 135 150 kW, the increase being due to Portsmouth, 40 000 kW, and Feeder Road, Bristol, 14 150 kW. February brought an easing of the strain, only one station, Gt. Yarmouth, sustaining slight damage. Plant out of action remained unchanged. In March there was damage to generating stations over a wide area, 14 being damaged in various parts of the country, but none of a serious character. Plant immobilised increased by 12 500 kW at Wallasey to 147 650 kW. During the three months six grid sub-stations were slightly damaged, one in January, two in February and three in March. Damage to grid lines, and other lines and distribution systems was on a reduced scale.

Second Quarter, 1941.—Ten generating stations and the Admiralty Dockyard station, Portsmouth, were damaged or affected in April. At six no interruption of supply occurred. Plant immobilised increased by 3 000 kW, Bristol, 18 000 kW, Grove Road, to 154 500 kW. In May major damage was done to several of eight generating stations, the principal areas affected being Merseyside and Clyde, London and Hull. Plant out of action increased to 190 000 kW, additions being West Ham, 35 000 kW; Greenock, 19 000 kW; and St. Martin's Lane, 2 500 kW. In June there was less damage than any month since September, 1940. Only one station was slightly damaged, and with one 5 000 kW set back in operation at West Ham the total of plant immobilised was reduced to 185 000 kW. During this period five grid sub-stations received damage, two in April, three in May, none in June. Interruptions on grid lines continued on a relatively low scale throughout the three months, other systems being rather more seriously involved than in the months immediately preceding. In May in particular there was much damage to sub-stations and distribution networks as the result of the heavy raid on London on May 10/11. The most serious was at Stepney, where a sub-station with 115 000 kW converting plant, h.t. and l.t. switchgear, auxiliary plant, etc., was burnt out. Liverpool, Greenock and other places also suffered considerable damage.

Third and Fourth Quarters, 1941.—By midsummer, 1941, though air-raids continued, the damage done was not as severe. Few power stations were damaged and there was progressive reduction of plant immobilised from 182 000 kW at the end of July to 73 000 kW at December 31, 1941. Stations that suffered during the period included Southampton, Hull and South Shields. A small number of grid sub-stations was involved, but none seriously.

DAMAGE TO GRID LINES DUE TO ENEMY ACTION.

	Sept., 1939 to 2 Sept., 1940	3-30 Sept., 1940	Oct., 1940	Nov., 1940	Dec., 1940	Jan., 1941	Feb., 1941	Mar., 1941	April, 1941	May, 1941	June, 1941	July, 1941	Aug., 1941	Sept., 1941	Oct., 1941	Nov., 1941	Dec., 1941	Jan./Dec., 1942	Jan./Dec., 1943	Jan./Dec., 1944
Major Interruptions	18	73	31	6	4	5	8	13	3	2	4	—	2	1	1	—	1	21	4	—
Minor Interruptions	27	16	39	21	—	2	7	5	7	26	3	5	—	—	—	2	—	63	26	—
No Loss of Supply	28	36	11	34	3	5	5	3	13	19	8	6	1	10	—	—	—	65	7	—
Total Break-downs	73	125	81	61	7	12	20	21	23	47	15	11	3	11	1	2	1	149	37	83

DAMAGE TO GRID LINES DUE TO BARRAGE BALLOONS.

Major Interruptions	55	27	38	54	15	22	53	16	2	—	2	3	12	6	3	4	5	35	39	—
Minor Interruptions	97	14	36	75	3	3	19	12	8	17	5	14	48	3	6	5	8	68	92	—
No loss of Supply	100	22	8	49	23	12	21	6	19	11	5	3	18	3	2	10	3	61	80	—
Total Break-downs	252	63	82	178	41	37	93	34	29	28	12	20	78	12	11	19	16	164	210	196

DAMAGE TO OTHER TRANSMISSION AND DISTRIBUTION SYSTEMS DUE TO ENEMY ACTION.

Major Interruptions	0	68	93	104	85	47	21	64	46	68	11	7	3	3	4	4	4	47	23	55
Minor Interruptions	280	340	426	97	116	35	6	32	33	26	10	11	9	2	2	8	8	83	58	47
No Loss of Supply	177	64	82	4	—	1	—	10	4	6	0	1	—	—	—	—	1	—	3	11
Total Break-downs	29	472	601	205	201	83	27	106	83	100	21	19	12	5	6	12	13	130	84	113

DAMAGE TO OTHER TRANSMISSION AND DISTRIBUTION SYSTEMS DUE TO BARRAGE BALLOONS.

Major Interruptions	4	4	9	52	6	16	41	20	8	3	2	1	16	3	16	5	6	27	27	25
Minor Interruptions	108	159	54	64	10	25	20	9	10	3	5	3	18	1	13	17	5	73	87	8
No Loss of Supply	—	7	—	3	—	1	1	—	—	—	—	1	—	—	1	—	1	2	7	7
Total Break-downs	112	170	63	119	16	42	62	29	18	6	7	5	34	4	30	22	12	102	121	40

1942 and 1943.—Until the coming of the flying-bomb attack in 1944, there was only spasmodic raiding, this had little effect on the general position of national supply. By the end of March, 1942, only 25 700 kW of plant remained immobilised due to enemy action; by the end of June the figure was 11 000 kW, excluding 2 500 kW d.c. plant at St. Martin's Lane, which it was not intended to repair. In the next quarter, to September 30, plant outage increased to 45 500 kW—Brighton 40 000 kW, and Eastbourne 5 500 kW, the results of sneak raids. At December, 1942, the plant immobilised was 38 000 kW. A year later 15 000 kW was out of action.

1944/45.—In the summer of 1944 the flying bomb and the V2 made their appearance, and though damage was caused at some stations, including Croydon, good supplies were maintained. At the end of September there was 39 000 kW of plant out of commission due to enemy action—33 000 kW at Croydon and 6 000 kW at Southwark. By the end of the year the Croydon plant had been made available again, but there was still 3 000 kW out at Southwark. During this period there had also been an incident caused by a rocket, at Hornsey. It fell about 30 yards away from the generating station and caused structural damage to the turbine house, the boiler house and cooling tower. The plant, rated at 4 000 kW, was not seriously damaged, but it was under repair and not being used at the time. It had been used for generating only at peak load periods in the winter months, and it was decided to close down the generating station altogether. No attempt was made to put the plant into commission again. Actually this is not taken into account, and the plant out of action at December 31, 1944, was 3 000 kW at Southwark.

This word-picture of how the grid system stood up to all that the enemy could do is obviously not as well painted as it would have been had space conditions not been so acute. A number of towns have of necessity been omitted, such as Exeter, Grimsby, Bath, Norwich, Nottingham, York, Eastbourne, Manchester, Dover, Folkestone, Deal, Southend, and others, and these will, it is hoped, bear no ill-will by our exclusion of them.

VE-Day Plus

A Review of the Expansion Which Awaits the Industry

WITH what is probably the major war effort now over, the official cessation of organised resistance in Europe permits us to look around and see what faces the industry in the years to come. For some time the war against Japan will possibly occupy some of the attention of the industry, but with the danger of air-raids removed, and black-out restrictions withdrawn, whatever calls are made to meet the needs of the Pacific war can now be met in conditions more favourable than any permitted during the last six years.

It has been evident for some time past that the industry was not going to allow VE-Day to find it in a state of unpreparedness and the industry is as largely ready for eventualities, as it was at the beginning of the war for "incidents." Committees have for some time been sitting with a view to diverting technical advancement along channels most likely to be beneficial, while considerable headway has been made in developing the all-electric idea in the domestic world.

For some time the industry will suffer the disadvantage of shortage of supplies, but whatever materials are released will no doubt be put to good use in replacing some of the worn out plant, and supplying appliances for which the demand was never greater. The output of the industry will for some while yet be confined to designs of already well tried types of equipment in order to satisfy immediate wants, but with the release of more materials the chances of new cookers, refrigerators, etc., finding their way to the market will improve with each passing month.

The immediate future of the industry is largely wrapped up in housing, and though there is evidence of a great deal of controversy with respect to plugs and sockets, ring mains, and so on, the industry is well able to fulfil its obligations once the building trade gets back to normal. We have during the last two years or so, published articles based on interviews with the electrical chiefs of local authorities, and these show in all cases a commendable appreciation of developing the electrical idea. We have, too, in the same period published details of a number of electric kitchens of independent design, and these again show that the industry is not prepared to let development progress at a tempo any slower than it is willing to allow. The industry, brought to its toes by six years of gigantic war effort, is now poised and ready to launch its whole energies in an electrical drive unprecedented in its history.

The industry has too, in the last few months demonstrated its ability to attack the export markets of the world, for while being willing to manufacture for overseas trade it has commendably shown its recognition of the difficulties which cover such trade like a smoke screen. Ways and means of overcoming these difficulties are being considered, and equipment specially suited to the export field is being designed. The formation of the British Export Trade Research Organisation is representative of the spirit which permeates the industry where overseas markets are concerned, and recent Board of Trade figures show that the industry does not intend wasting any time.

Future of Supply

One of the major problems which the industry has to solve is concerned with distribution, and the policy of the supply industry. On both these points, various opinions have been expressed in the form of reports to the Ministry of Fuel and Power, and though a measure of agreement is apparent, a certain amount of political influence seems to have crept in. This is regretted, for where politics are concerned the industry has in the past gained little more than increased legislation, when more freedom of action would have allowed even further progress to be made.

In the field of electrification of industry, the war must be held responsible for the introduction of electric drive in many places where before 1939 it was hard to enter, and for this reason the prospects of increasing industrial load seems hopeful. In the coal mining industry recommendations have been made for the increased use of electricity, and where new mines are to be worked, it has been urged that their operation be all electric.

Though a review of the future in this way is inclined to persuade that the years ahead will be filled with easy development, it must not be overlooked that whatever progress is made will only be possible in the face of intense competition put up by rival fuel interests. We have not the slightest fear of the future, nor the least doubt of the enormous expansion which will be brought about in the industry, but with these convictions is appreciation of the fact that contrary to what the war-time planners would have us believe, the years ahead will be a period of hard work and sacrifice in order that the leeway lost during the war may be overtaken. Not until that leeway has been made good can the industry hope to put into effect the many new conceptions of electrical service which it has in mind. At home and in the export markets, competition henceforth will be keen, and whereas in the last six years a measure of co-operation between the fuel interests has been exercised, this will soon be replaced by attack, in order that each may capture the other's business. Activities abroad indicate that overseas manufacturers of electrical equipment intend to enter the arena of export trade with their fists uncovered, and it would be well if those who do not yet already realise the position, were to appreciate the fact that in competition with the goods produced in this country for sale in the home market, will be, too, products of foreign-make brought to this country as imports.

On the subject of rural electrification much has already been written and even more could be said. Certain authorities have indicated their intention of making an all-out effort to improve the position, while the industry as a whole has already expressed sympathy with more positive action in that direction. The problem is, however, filled with financial difficulties which though yet to be faced should not be insoluble. Much good work has already been done in rural areas, and much more will no doubt be brought about so long as the industry is left to find its own solution. The danger of Government boards and political issues, to which the recent months have given birth, is one which will, however, need careful watching.

Rural Electrification

The prospects of the electrical industry are enormous, but in their enormity is a danger that some may take expansion too much for granted. What the industry has to gain it will have to fight for—first for freedom from bureaucratic controls, and then for sales which will be disputed by other fuel interests, as well as the manufacturers of foreign appliances. The industry has during the last two years made wide preparation for expansion but not until the aftermath of the war has passed over can those preparations be put into effect. In the meanwhile the industry will be busy with the bringing up to date of its power stations, the replacement of worn-out plant and machine tools, the repairing and supplying of standard domestic appliances, the re-establishment of peace-time street lighting and so on, and while doing these things it is to be hoped that the prosperity which they will bring will not be allowed to eclipse the ambitions which the industry has declared to be its goal.

A football match between married and single members of the contracts department of A. Reyrolle and Co., Ltd., at Hebburn-on-Tyne, in aid of the Electrical Industries Benevolent Association, resulted in a win for the bachelors by 6 goals to 4.

Multi-Step Transformer Cores

Optimum Design Proportions

By O. I. BUTLER, M.Sc., A.M.I.E.E.

THE use of cores of " stepped " section, in order to fill the space within the circular coils to give as high an iron space-factor as possible, has become standard practice for the majority of medium and large-sized transformers. The coil diameter, and therefore the copper-loss, is thereby kept down to a minimum for the cross-sectional area of core used. Further, since circular coils can be wound at more or less constant tension, a tightly packed winding with a high copper space-factor is obtained. In addition, the use of circular coils gives the greatest degree of rigidity under short-circuit conditions; the alternative rectangular type of coil tending to be moved by the short-circuit forces such that it assumes the circular shape.

The proportions of a single-step core to give maximum iron section are well-known, and are given in most text-books on transformer design. However, the proportions of multi-step cores for maximum iron section appear to be less common knowledge, and at least one comprehensive text-book on design erroneously suggests that the centre and outer plates should follow the proportions used for single-step cores. Also, some designs use a multi-step section which is not completely symmetrical, and thereby fail to obtain the truly optimum design. Since it is fairly common in the larger-sized transformers to use as many as four steps, it is of interest to establish the theoretical proportions which give the maximum core section for multi-step designs in general.

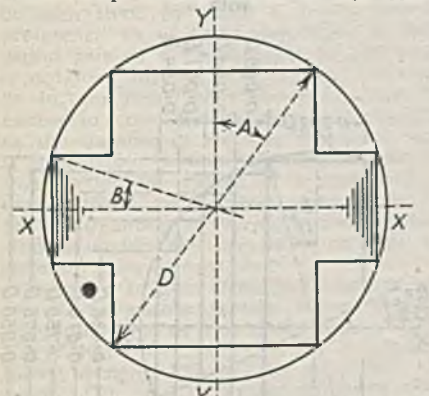


Fig. 1.—Section of single-step core, symmetrical about axes XX, YY only

(1) Single-step Cores.—The fact that symmetry is essential to obtain the optimum proportions may be proved by taking the simple case of the single-step core (see Fig. 1) and avoiding any initial assumption that the angles A and B are equal. If the

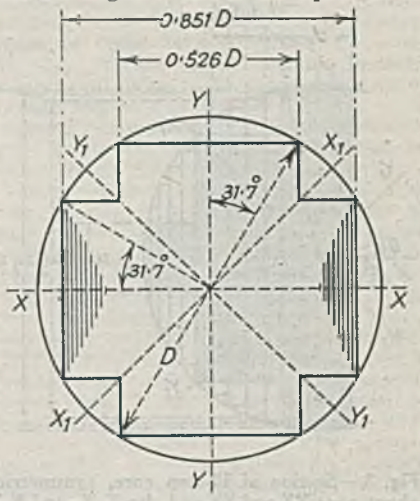


Fig. 2.—Section of single step core, symmetrical about axes XX and YY and also X_1X_1 and Y_1Y_1

diameter of the circumscribing circle is D, the net iron section of the core is given by

$$S = kD^2 \sin A \cos A + kD^2(\cos B - \sin A)\sin B$$
$$= \tfrac{1}{2}kD^2(\sin 2A + \sin 2B - 2\sin A \sin B)$$

where k represents the ratio of the net iron section to the gross section of the core.

The conditions for maximum value of S are that

$$\delta S/\delta A = 0$$

and $\delta S/\delta B = 0$

That is,

$$\cos 2A = \cos A \sin B \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

and $$\cos 2B = \sin A \cos B \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

From eqtn. (1),

$$\cos^2 2A = (1 - \sin^2 A)\ (1 - \cos^2 B)$$
$$= \cos^2 A - \cos^2 B + \sin^2 A \cos^2 B \quad . \quad (3)$$

whilst, from eqtn. (2)

$$\cos^2 2B = \sin^2 A \cos^2 B \quad . \quad . \quad . \quad . \quad . \quad . \quad (4)$$

From eqtns. (3) and (4), by subtraction,

$$\cos^2 A - \cos^2 B$$
$$= (\cos 2A - \cos 2B)\ (\cos 2A + \cos 2B)$$
$$= 2(\cos^2 A - \cos^2 B)\ (\cos 2A + \cos 2B)$$

That is,

$$(\cos^2 A - \cos^2 B)\ (1 - 2\cos 2A - 2\cos 2B) = 0$$

Hence, either $\cos^2 A = \cos^2 B$

i.e., $$A = B \quad . \quad . \quad . \quad . \quad . \quad . \quad (5)$$

or $2(\cos 2A + \cos 2B) = 1$

It will be found that the latter equation fails to give a real solution. Substituting

the real solution of A = B in eqtn. (1) gives $2\cos 2A = 2\sin A \cos A = \sin 2A$

i.e., $A = B = \frac{1}{2}\tan^{-1} 2 = 31°43'$,

Thus a maximum value of S for the single step case is obtained only when the core section is completely symmetrical, as in Fig. 2. It is, therefore, reasonable to assume that the maximum value of S for multi-step cores also is obtained when the core section is completely symmetrical, as shown in Fig. 3.

(2) Optimum Multi-step Cores.—For the case of the 2-step core, as given by the shaded area of Fig. 3, we have

$$S/D^2 = 2\sin\theta\cos\theta - \sin^2\theta + (0.707 - \sin 0)^2$$
$$= \sin 2\theta - 1.414\sin 0 + \tfrac{1}{2} = S_2 \text{ say} \quad . \quad (6)$$

Evidently, from Fig. 3, the values of S/D^2 for 4, 6, 8 and 10-step cores are given respectively by

$$S_4 = S_2 + 2[\sin(45° - a) - \sin 0]$$
$$[\cos(45° - a) - \cos 45°] \quad . \quad . \quad (7)$$

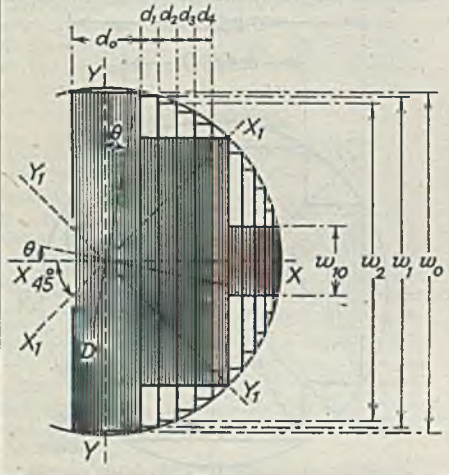


Fig. 3.—Section of 10-step core, symmetrical about axes XX and YY and also X_1X_1 and Y_1Y_1

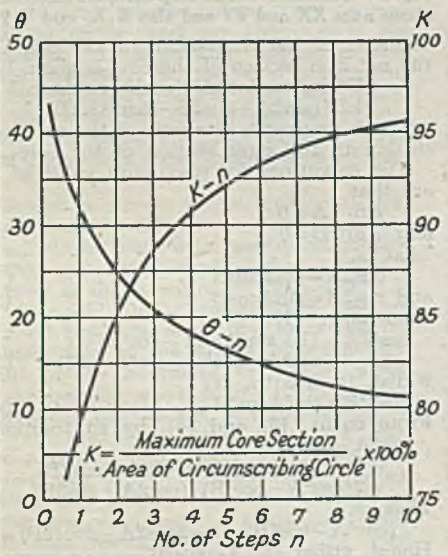


Fig. 4.—Variation of maximum core section and optimum angle θ with number of steps

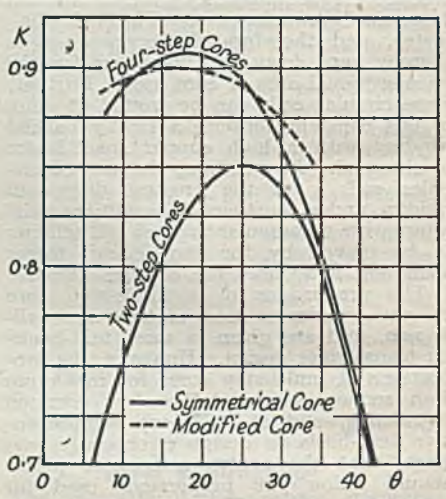


Fig. 5.—Variation of percentage core section with θ

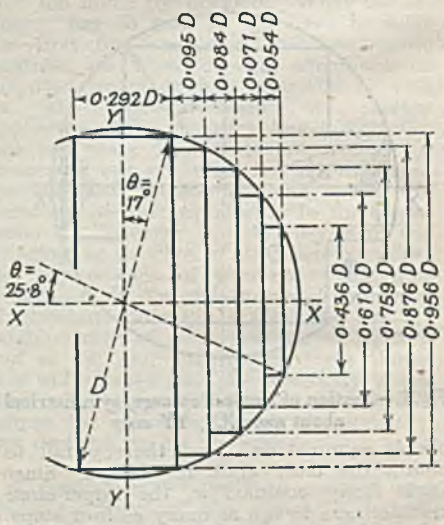


Fig. 6.—Section of 4-step core, symmetrical about axes XX, YY only

$$S_6 = S_4 + 2[\sin(45° - 2\alpha) - \sin 0] \\ [\cos(45° - 2\alpha) - \cos(45° - \alpha)] \quad . \quad (8)$$

$$S_8 = S_6 + 2[\sin(45° - 3\alpha) - \sin 0] \\ [\cos(45° - 3\alpha) - \cos(45° - 2\alpha)] \quad . \quad (9)$$

and $$S_{10} = S_8 + 2[\sin(45° - 4\alpha) - \sin 0] \\ [\cos(45° - 4\alpha) - \cos(45° - 3\alpha)] \quad . \quad (10)$$

where $\alpha = (90° - 2\theta)/n$ for each of the n-step cores.

The value of θ which gives a maximum value of S in each case can be determined by solving the equation $dS_n/d\theta = 0$. The results are shown in graphical form in Fig. 4.

These optimum values of θ have been used to determine the maximum possible core section of each of the n-step transformers, and the results shown in Fig. 4 as a percentage of the area of the circumscribing circle of the core. It will be seen that, by using a 4-step core in preference to a single-step core, a very useful gain of approximately 12 per cent. is obtained for the iron section. It may be further noted that the percentage increase in core section rises less sharply as the number of steps is increased, and it is probable that any further increase in iron section for values of n greater than five is likely to be more than offset by the disadvantage of having to manufacture and assemble the increased number of different sizes of core plate.

TABLE 1.

WIDTH AND STACKING DEPTH OF CORE PLATES AS PERCENTAGE OF CIRCUMSCRIBING CIRCLE DIAMETER, FOR MAXIMUM CORE SECTION.

	No. of Steps.					
	0	1	2	3	4	5
w_0	70·7	85·1	90·5	93·3	94·9	95·9
w_1	—	52·6	70·7	79·8	85·1	88·4
w_2	—	—	42·4	60·2	70·7	77·4
w_3	—	—	—	36·1	52·5	63·3
w_4	—	—	—	—	31·5	46·8
w_5	—	—	—	—	—	28·4
d_0	70·7	52·6	42.4	36·1	31·5	28·4
d_1	—	16·2	14·1	12·1	10·5	9·2
d_2	—	—	9·9	9·8	9·2	8·3
d_3	—	—	—	6·7	7·2	7·0
d_4	—	—	—	—	4·9	5·5
d_5	—	—	—	—	—	3·7

In order to give some indication of the loss of available section when a non-optimum value of θ is used, the curves of Fig. 5 have been compiled for 2 step and 4-step designs. It will be seen that the value of θ may be varied from the optimum figure by approximately $\pm 4'$ without the loss of core section exceeding 1 per cent.

The various core plate widths and stacking depths to give maximum iron section have been determined as a percentage of the circumscribing circle diameter, and are given in Table 1 for reference purposes; the dimensions w_n and d_n being defined by Fig. 3.

3. Modified Multi-step Cores.—In practice, the total stacking depth ($=w_0$ in Table 1, from symmetry of the core section) when $n>2$ is likely to leave insufficient clearance, between the end laminations and the circumscribing circle, for the core-retaining clamping plates and bolt heads. If the required clearance is expressed as a fraction ρ of the circumscribing circle diameter D, and is greater than the available clearance of the truly optimum design, it follows that the angle subtended at the centre of the circumscribing circle by the outside laminations must be fixed at the value $\varphi = \cos^{-1}(1-2\rho)$. Evidently, it remains to determine a new value of θ, and modified values of the widths and stacking depths of the stepped laminations, such that a maximum core section is obtained under these less symmetrical conditions.

In order to obtain an indication of the loss of core section occurring under the latter conditions, the case of a 4-step core with $\rho = 0.05$ (and therefore $\varphi = 25°50'$) has been considered, as shown in Fig. 6. The corresponding optimum value of θ has been calculated and found to be 17°, as compared with the value of $\theta = 18°22'$ given in Fig. 4. The values of core section for both $\theta = 17°$ and non-optimum values of θ have been further calculated, and are shown as a broken line in Fig. 5. It will be seen that, provided the new optimum value of θ is used, an almost negligible reduction of core-section from the truly maximum value occurs.

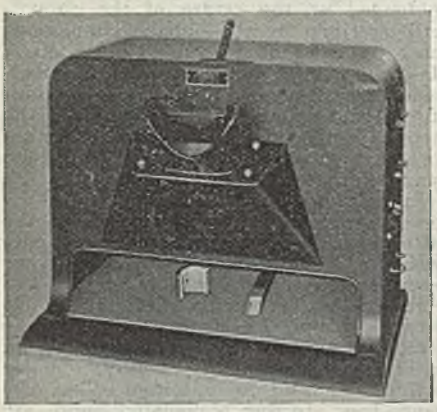
4. Cores with Vent Ducts.—To complete the investigation of core dimensions for maximum iron section, the case where the packets of laminations are separated by one or more vent ducts has been considered. Without going into great detail, it may be stated that, in general, the proportions given in Table 1 may be closely adhered to, even when one or more ventilating ducts are used, without appreciable reduction of the core section from that corresponding to the possible optimum arrangement for the particular number of vents included in the design.

Ashton-under-Lyne.—The T.C. has discussed the disposal of the generating plant at the Wellington Road power station. The Electricity Committee gave one firm an option of three months for the purchase of the plant for £12 000, subject to the condition that they were able to dispose of the plant as a going concern. Coun. Lewis T. Wright, chairman of the Electricity Committee, told the Council that it seemed to him unlikely they would get £12 000 for the plant, but the Council would be advised to sell it for scrap if there was a possibility of getting a higher figure.

Fluorescent Crack Detection

An Effective Method of Exposing Surface Defects

AMONG the several methods of crack detection now being practised, that involving fluorescent indication is rapidly becoming popular in many fields. A simple



Inspection cabinet with Metrolux fluorescent crack detection equipment

and effective equipment for the purpose has been developed.

The apparatus consists of the inspection cabinet, shown in the illustration, together with a tank unit approximately 2 ft. by 2 ft. 6 in. in plan, divided into three equal compartments for impregnating, cleaning and drying, respectively. The impregnating tank contains a solution of fluorescent material with an additional constituent to increase penetration. It is recommended that at least an hour should be allowed for soaking the components in this tank. The components are then dipped in the cleaning tank to remove all the solution adhering to the surface. Finally they are covered with fine wood sawdust in the drying tank and left there for about 15 minutes to dry the surface thoroughly, leaving the fluorescent fluid in any cracks. After any clinging sawdust has been removed with a dry brush the pieces are ready for examination, and are introduced into the aperture in the inspection cabinet. A mercury vapour discharge lamp inside the top of the cabinet flood-lights these specimens collectively with ultra-violet light, and in a few minutes any cracks in the surface are shown up vividly by fluorescence. If it is desired to devote particular attention to an individual case, the lever at the top is moved to cause a lens to swing into position beneath the discharge lamp and thus focus the rays on to the required point, resulting in increased fluorescence. Since ultra-violet rays ordinarily are not visible, the sound surfaces are seen very dimly, so that any fluorescent markings stand out in acute contrast. Injurious short-wave radiation from the discharge lamp is removed by a black glass filter envelope round the lamp. Reflected ultra-violet rays also are objectionable on two counts, namely: prolonged exposure of the eyes to these rays gives rise to eyestrain and certain internal parts of the eye may fluoresce, thus causing some fogging of the vision. For these reasons the eye-piece is provided with an ultra-violet filter which helps also to accentuate the fluorescent markings.

The equipment is compact and easy to operate, and, after comparatively little practice, highly effective and reliable results can be obtained. The hooded design of the cabinet dispenses with the necessity for a dark room or other such special provisions. The fluid baths are provided with lifting trays to facilitate handling the components. A low consumption, electrical heater is fitted to the tank to maintain the fluorescent solution at the most suitable temperature. It should be emphasised that the process cannot be hurried; the periods for soaking and drying specified above are the minimum, and if increased will often give still more satisfactory results.

Applications of System

Fluorescent crack detection is applicable only to cracks in the surface, and obviously can give no indication of entirely sub-surface, or internal, faults. The method, however, is capable of dealing with many materials and shapes hitherto beyond the scope of non-destructive testing. It also replaces some of the more complicated and laborious tests which have necessarily been applied to non-magnetic materials. In short, magnetic and non-magnetic metals and alloys, plastics and ceramics, and other solids can be examined for surface cracks by Metrolux fluorescent crack detection equipment. It will expose surface cracks, folds or porosity in metals, cracks in ceramics or plastics, non-adhesion of bearing linings and location of leaks in vacuum equipment (e.g., glass-metal seals).

Consett (Co. Durham).—The U.C. has asked the North-Eastern Electric Supply Co., Ltd., to furnish details as to the number of hired wiring agreements still in force in the district with details as to when these will expire.

Electrical Personalities

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

Mr. F. Mitman and **Mr. R. W. Richards** have been elected to the board of the Brush Electrical Engineering Co., Ltd.

Mr. and Mrs. J. Lindley Thompson celebrated their silver jubilee on Friday, May 4, and they received an illuminated address from the employees of the Lindley Thompson Transformer and Service Co., Ltd., and the Langley Welding Co. Ltd.

Messrs. W. Dean and **P. L. Crawford** have been appointed directors of Burco, Ltd.

Mr. R. J. Hunt has been appointed a director of Ransomes, Sims and Jefferies, Ltd.

Miss Caroline Haslett, director of the Electrical Association for Women, has been appointed a director of the Disabled Persons' Employment Corporation, Ltd., a Government-sponsored organisation entrusted with the welfare of disabled ex-Service men who are unfit for normal employment.

Poplar B.C. Electricity Committee has appointed **Mr. W. T. Andrews,** constructional and development engineer, as chief engineer assistant at a salary of £810 a year.

Sir James S. Pringle, late Director of Electrical Engineering for the Admiralty, has undertaken, with the permission of the Admiralty, to act in an advisory capacity for the Metropolitan-Vickers Electrical Co., Ltd.

Mr. H. J. Thompson, joint managing director of Thompson Brothers (Bilston), Ltd., has been appointed chairman and managing director in place of the late Mr. F. S. Thompson. **Mr. J. W. Meredith,** a director, has been appointed assistant managing director.

At the annual general meeting of the Society of Irish Electrical Traders, **Mr. H. H. Lauder** (Irish Driver Harris Co., Ltd.) was re-elected president, and **Mr. F. V. Mulligan** (Mulligan Bros.) was elected vice-president.

Consequent upon his appointment to the board of West London and Provincial Electric and General Trust, Ltd., **Mr. J. Wyatt Williams** has resigned from the secretaryship of the company. **Mr. H. Welsford** has been appointed secretary.

Sir James West, has retired from his post as chief architectural adviser to the Ministry of Works. He was a member of the British Building Mission to the U.S.A. in 1943.

Col. H. J. Wellingham, one of the senior officials of Cable and Wireless, Ltd., is leaving London shortly to discuss with military and communications officers, the re-establishment of telecommunications in the Far East, the speeding of delivery of S.E.A.C. Forces' telegrams, and the development of the London-Bombay photo-telegraph circuit. He will visit India, Ceylon and Burma.

Mr. H. M. Sutherland has been appointed an employee director of the Davy and United Engineering Co., Ltd.

Mr. O. S. Puckle has left the research department of A. C. Cossor, Ltd., which he joined in 1932, to become chief engineer and a director of R. F. Equipment, Ltd.

Mr. J. Hogg has been appointed chairman, and **Mr. C. E. Pearson,** vice-chairman, of the North-East (Tyneside) branch of the Institute of Welding.

Mr. Frank Brockhouse has resigned from the board of the Albion Drop Forgings Co., Ltd., and **Mr. J. R. Brockhouse** has been appointed to succeed him.

Mr. William Clare, Mr. Edwin Hallas and **Mr. Thomas J. Makin** have been appointed to the board of the Brightside Foundry and Engineering Co., Ltd.

Mr. Leslie McMichael has been elected an honorary member of the Radio Society of Great Britain. He was a co-founder of the society and has been hon. secretary.

Mr. Arthur Willis was the recipient of a long service testimonial presented by the English Electric Co., Ltd., from whose Stafford works he retired on pension after 48 years' service. The presentation was made by Mr. J. W. C. Milligan, manager of the Stafford works.

Brig.-Gen. R. T. Legge has been appointed to the board of Britannic Electric Cable and Construction Co., Ltd., a member of the Philco group of companies. He is also chairman of British Mechanical Productions, Ltd.

Mr. William Rayner Allcock, deputy borough electrical engineer, Stockport, has been appointed borough electrical engineer, to succeed **Mr. G. H. Oldroyd,** as from August 25 next.

Mr. Thomas Coates has been appointed deputy city electrical engineer, Liverpool, at a salary of £1 400, rising to £1 700. He has been in the service of the electricity undertaking since 1935, latterly as senior engineer's assistant, and is 37 years of age.

Obituary

Mr. T. R. Renfree, senior technical sales engineer, the British Electric Transformer Co., Ltd., on April 30. Born at Redruth, Cornwall, he took his electrical training at Kings College, London. After a short period on the educational staff at Kings College, he was for some years with the British Westinghouse Co., Ltd. He joined the B.E.T. in 1907.

Potential Export Markets

Commercial Conditions in British E. Africa

THE sixth of the twenty-six reports of the Department of Overseas Trade reviewing commercial conditions abroad deals with British East Africa. The first five, issued by the Stationery Office in March, covered the U.S.A., Bolivia, Brazil, Chili and Peru, and abstracts were given in THE ELECTRICIAN of March 23.

The territories of British East Africa comprise the Colony and Protectorate of Kenya, the Protectorate of Uganda, the mandated territory of Tanganyika and the Protectorate of Zanzibar.

In 1938, Kenya and Uganda purchased 471 tons of electrical machinery and parts thereof to the value of £66 217, of which 354 tons, value £50 483 came from the United Kingdom; 15 tons, value £2 536, from Germany; 89 tons, value £10 326, from Belgium; 9 tons, value £1 735, from the U.S.A.; and 4 tons, value £1 137, from other countries. In the same year Tanganyika bought 266 tons of electrical machinery and parts, value £39 124, of which 122 tons, value £17 766 came from the United Kingdom; 131 tons, value £19 366 from Germany; 4 tons, value £762, from the U.S.A.; and 9 tons, value £1 230, from other countries. Of the £252 000 worth of electrical machinery and apparatus, including cables and wires, telegraph and telephone instruments and apparatus, and wireless apparatus, imported into British East Africa in 1939, imports to the value of £150 000 came from the United Kingdom; the other chief suppliers being Belgium, U.S.A., Germany and the Netherlands.

Availability of Supply

Supplies of electric power are comparatively small, nor has it been possible in recent years, says the report, to undertake extensions though the supply company has projects in view. Electric power installations are few and heavily loaded, so much so that (for domestic users) only small wattage equipment is allowed to be connected. Any extensive industrial development entailing a large power demand would, therefore, be out of the question until war-time restrictions on the supply of new power station plant were removed, and then only if the demand for new power facilities were general.

Public works and the development of public utilities have been unavoidably postponed throughout British East Africa, except in the small Zanzibar Protectorate where no project of major importance was held up by the war. The erection of electricity plant designed to augment the power supply in the Nairobi area, at a cost of between £200 000 and £300 000 has been postponed; post-war electrical development elsewhere in East Africa will depend on conditions of load and demand at the time and may be affected by any restrictions in the United Kingdom upon the issue of capital or any difficulties in obtaining capital. In general, it would appear that considerable development and plant replacement will be urgently required as soon as possible after the war.

Public Address

THE last I.E.E. informal meeting of the session was held on April 23, when Mr. P. G. A. H. Voigt, opened a discussion on "Electrical Aids to Public Speaking."

Mr. Voigt said it was usual to see people addressing the public, hidden behind an array of microphones but he advocated something far less conspicuous, and showed two small microphones, one of which was a ribbon type made for laboratory use. An important factor was the loud-speaker, for, in his view, the audience should not be aware that electrical aids were being used.

In the discussion, attention was drawn to the value of attenuating the lower frequencies in speech, it being pointed out that when the human voice was amplified beyond its original intensity, the lower frequencies were proportionally louder and tended to mask the higher frequencies. Complaint was made that not enough had been done to improve public-address systems and that only a few really good installations existed. It was mentioned that some speakers relied too much on the microphone with unsatisfactory results. To remedy this it was recommended that speakers using a microphone should endeavour to address themselves at least to the two front rows of the audience, as in this way the effect throughout the hall would be improved.

The idiosyncrasies of stage performers in the use of microphones and loud-speakers received considerable attention and the suggestion was made that the management of a circuit of theatres or music-halls would be well-advised to engage a sound-engineer as a permanent member of the staff.

The question of overcoming the acoustic shortcomings of the hall or room rather than those of the person talking was regarded by one speaker as the real problem, and the control of reverberation time was also mentioned.

I.E.E. Annual Report

Record Increase in Membership

A RECORD increase in membership during the year is announced by the Council of the I.E.E. in their report for the 1944-45 session, presented at the annual general meeting of the institution yesterday (Thursday). The number of elections for all classes during the year was 2 639 compared with the previous highest aggregate of 2 552 in the last session. There were 5 113 applications for election and transfer. There are 12 568 corporate members on the register.

The total membership of the Measurements Section, to which 62 new members were admitted during the year, is now 1 088. Eight meetings, including one discussion meeting, were held, with an average attendance of 98.

The Transmission Section, which has a membership of 1 767, held seven meetings, with an average attendance of 99.

Changes in Bye-laws

Referring to the revision of the bye-laws, the Council state that the changes made in the constitution of the Council have been designed, not only to cope with increasing duties and work, but also to ensure an even more effective contact with the widespread activities of the institution.

The Council have decided to issue a news letter from time to time to those members of the institution who are overseas, or who, being at home, do not receive Part I of the JOURNAL, as it is felt that this step will be of value in bringing to their attention details of the institution's activities which might otherwise escape their notice.

The Post-War Planning Committee have made arrangements for a form to be circulated to graduates and students of the institution who are serving in the Forces or engaged in work of national importance, in order that they may be given the opportunity to obtain suitable advice concerning the further technical education and practical training which will be necessary to enable them to qualify as corporate members. It is intended to give as much credit as possible to training gained in the technical branches of the Services.

The work of drafting the codes of practice dealing with electrical matters, which was deputed to a specialist committee under the chairmanship of Mr. P. V. Hunter, has made further substantial progress. The framework of sub-committees and panels set up following the expressed intention of the main Codes Committee to secure representation of all the electrical interests concerned, has proved an effective arrangement.

The three senior engineering institutions and the British Standards Institute have agreed on the manner in which codes of practice falling outside the sphere of the independent Codes of Practice Committee can be initiated, prepared and promulgated.

In response to a request from the Postmaster-General, the Council have reconstituted the Committee on Electrical Interference with Broadcasting as the Committee on Radio Interference. The chief task of the new committee is to review the recommendations contained in the earlier report; and to consider the desirability of modifications resulting from the introduction of new forms of high-frequency equipment capable of causing or liable to suffer from interference.

Acceding to a request from the Air Registration Board, the Council have constituted a committee to undertake the preparation of regulations for the electrical equipment of civil aircraft. At the request of the Air Ministry, the Council have agreed to set up a committee to formulate technical airworthiness requirements for the design and installation of radio equipment in civil aircraft.

The Council have adopted a suggestion that a posthumous portrait of the late Oliver Heaviside, F.R.S., Faraday Medallist, should be acquired while there are still some of his contemporaries alive who could advise the painter. The artist who has been commissioned to produce the portrait is Francis Hodge, and it is expected that it will be ready in the autumn.

COVENTRY ELECTRIC CLUB

At the Coventry Electric Club's meeting on May 1, Mr. G. A. P. Jewiss, a member, read a paper on "The Fully Automatic On-Load Tap Changing Transformer." It was illustrated by slides and a colour film.

The author pointed out that with the growth of power stations and transmission systems, the internal reactance, years ago, was kept as low as possible to keep the voltage drop to a minimum, but reactance was now recognised as a valuable aid in limiting short circuit currents. To overcome the voltage drop due to this reactance and to obtain the desired flexibility of voltage control under normal variations of load, it was increasingly necessary today to be able to adjust the transformer voltage ratio with the transformer on load.

A brief historical survey covered the evolution of the present day equipment and showed that with mercury switches in conjunction with copper-to-copper contacts maintenance had been reduced.

I.E.E. Measurements Section

Influence of Engineering on Post-War Reconstruction

THE importance of the specialised sections in the corporate life of the Institution of Electrical Engineers, was stressed by Mr. T. G. N. Haldane, a vice-president of the institution, who was the guest of honour at an informal luncheon held by the Measurements Section on May 3.

Spirit of the Times

Dr. W. G. Radley, chairman of the section, presided over a gathering of about 300 and in "toasting" the guests, said he felt that a word or two was justified on the nearness of the day towards which they all had been working for the last five and a half years. He thought they could celebrate in a spirit of thankfulness the imminent successful termination of a war which at one time seemed likely to bring civilisation, as we understood it, down in ruins; but as they had been reminded so often by the Prime Minister, such celebration was not to mark the termination of their efforts. There was very much ground to be recovered, and that was as true of those fields for which electrical engineers were responsible as it was of every other. There had to be untiring effort and co-ordination between all of them. Within their own institution there were almost unexampled opportunities for that mutual help which would be necessary to restore to a large part of mankind those amenities of civilised life which people had learnt to associate with electrical engineers, whether they be connected with transport, tele-communications, or domestic installations. By the terms of its charter the institution was called upon to promote the advancement of electrical science and engineering generally and to assist that end by facilitating the exchange of information among its members. In order to further that, specialised sections had been set up from time to time to cater for groups of members having particular interests, and among those specialised sections the Measurements Section might claim to be unique in that the progress of all those branches of electrical engineering which were the particular concern of the other sections of the institution was dependent to some extent upon the Measurements Section's advance in technique and ability.

Mr. Haldane, in reply, said: The importance of the specialised sections was very much in the minds of the Council. They wanted to see such sections playing an ever-increasing part in the corporate life of the institution; and, indeed, the whole activities of the institution were now very closely bound up with those of the specialised sections. One wanted to see practically the whole membership of the institution registered with one or another of the four specialised sections. The importance in the corporate life of the institution of the specialised sections was being recognised more and more in various ways. The recent revision of the bye-laws gave each of the specialised sections increased effective representation on the Council in that both the chairman and past chairman were now members of the Council with voting power. With regard to Premiums, it had now been so arranged that there could be no possible doubt that papers read before specialised sections were on an exactly equal footing with those read before non-specialised sections.

Now we had emerged from the dark tunnel of five years of warfare, the future naturally was obscured, but there could not be the slightest doubt that the reconstruction of the post-war world was going to depend to a tremendous extent on engineers and engineering and for that reason the part to be played by the Measurements Section was going to be of tremendous importance, partly because of the remarkable growth of the general influence of engineering on world affairs and partly because we were going to pass, initially through a period of great shortage, and in grappling with that shortage problem he felt that measurement of all sorts and kinds was going to be very important. For instance, if we were to get the maximum benefit from the restricted supplies of coal in the next few years, there must be the very best possible instrumentation at power stations.

Mr. H. W. Grimmett (chairman of the Transmission Section) also replied, and the toast of "The Chairman" was proposed by Mr. H. L. Kirke (chairman of the Wireless Section).

London J.E.A.—At the meeting of the London and Home Counties J.E.A. on Thursday, May 3, it was reported that the West Ham B.C. had submitted to the authority a copy of their application to the Electricity Commissioners for consent to the extension of the Council's generating station by the installation of one 60 000 kW turbo-alternator with the necessary boiler and auxiliary plant, switchgear, buildings and land, at an estimated cost of £2 428 455. The capital cost represents £40.5 per kW installed. On present day prices this will amount to £32 per kW when the whole extension totalling 180 000 kW is completed.

Electricity Supply

Mansfield.—The Electricity Committee has obtained sanction to borrow £3 050 for mains for the 11 000 V.

Bolton.—The Electricity Committee is seeking sanction to borrow £655 373 for power station extensions and £9 050 for coal handling plant.

Mansfield.—The Electricity Committee is to provide supply to 20 bungalows being erected by the Woodhouse U.D.C. at housing estates at a cost of £794.

Hull.—The Housing Committee has arranged for the electricity department to maintain the electrical equipment at temporary houses at a charge for labour and materials estimated at 3.85d. per house.

Manchester.—The Street Lighting Committee of the Manchester Corporation appointed to consider the question of modernising the city street lighting, has invited the Electricity and Gas Committees to prepare memoranda indicating their views on certain aspects of the matter.

Bolton.—It has been decided to apply to the Electricity Commissioners for consent to borrow £655 373 for extensions at Back-o'-th'-Bank generating station (£513 150 for plant and £142 223 for buildings and civil engineering works).

Wallasey.—The Water Committee is to modernise the pumping system at Seaview Road waterworks, either by Diesel oil, coal, gas, or electric machinery at an estimated cost of £11 000, and extend water softening plant at a cost of £10 000.

Tynemouth.—The Electrical Engineer is to make inquiries as to the commitments which would be involved in the event of the purchase by the Corporation of that part of the undertaking of the North Eastern Electric Supply Co., Ltd., which lies within the borough.

Southwark (London).—The Electricity Committee recommends the purchase from the Poplar electricity undertaking up to 1 500 d.c. 20 A pre-payment meters at 30s. each and that these be converted from 1d. coin to 1s. coin calibration at an estimated average cost of 10s. per meter.

Power in North Wales.—At the meeting of the North Wales and South Cheshire Joint Electricity Authority at Llandudno, Lieut.-Col. James Rankin, director and general manager of North Wales Power Co. and Electricity Distribution of North Wales, reported on the progress of the two concerns during the war years. He said 120 miles of new h.v. lines and 80 miles of new l.v. distributors had been constructed. New supplies had been made available to 237 farms. The maximum demand on the power company's system for the year of 1939 was 38 900 kW, but by the end of 1943, the peak year, the demand had increased to 87 950 kW, an increase of 126 per cent.

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.

Louth Electricity Department, May 11.—Supply of (a) e.h.t. cables, (b) l.t. cables, (c) e.h.t. truck type switchgear and (d) transformers. Particulars from the Borough Electrical Engineer, Electricity Department, Cannon Street, Louth.

Woolwich Electricity Department, May 11.—Supply of one turbine-driven feed pump. Specification from the Borough Electrical Engineer, Electric House, Powis Street, Woolwich.

Woolwich Electricity Department.—May 11.—Supply of 22 kV and 6.6 kV switchgear. Specification from the Borough Electrical Engineer, Electric House, Powis Street, Woolwich.

Long Eaton Electricity Department, May 12.—Supply and erection of main h.t. switchgear. Specifications from Mr. J. B. Feltham, Electra House, Market Place, Long Eaton; deposit £1 1s.

Birkenhead Electricity Department, May 14.—Supply and delivery of (1) e.h.t. and l.t. p.i. cables (2) r.i. cables, (3) meters, and (4) general stores over a period of 12 months. Particulars from the Borough Electrical Engineer, Craven Street, Birkenhead.

Swansea Waterworks Department, May 16.—Supply and erection of electric pumping plant. Specification from the Borough Water Engineer, Guildhall, Swansea.

Salford Electricity Department, May 26.—Supply and delivery of 36 steel street lighting standards. Particulars from the City Electrical Engineer, Frederick Road, Salford, 6.

Dunbar, B.C., June 9.—Supply, delivery and installation of street lighting equipment, including poles, lanterns, wiring, and control gear. Specifications from the Burgh Surveyor, Town House, Dunbar.

Industrial Information

E.D.A. Bulletin.—Among the features in the April number are a message from the new chairman, Mr. F. Newey, descriptions of electric labour-saving kitchens at Paisley and Liverpool, and an "all-electric" kitchen installed in a school by the Cannock electricity department.

Carrots in Overcoats.—This description of a tasty dish is contained in the May number of the "Cheerful Rationing" card issued by the E.A.W. In addition to several other new recipes, a menu is given for a packed lunch that is bound to give satisfaction and enjoyment, and there are suggestions for sandwich fillings.

Note for Contractors.—A ruling has been received by the E.C.A. from the Ministry of Works to the effect that the installation of fluorescent lighting is licensable under the Control of Civil Building Order, but that it is not necessary to include the cost of the fitting (e.g. discharge lamp and control gear) in the cost of the work to be licensed.

Maintenance of Electric Tools.—A manual on the selection, application and maintenance of portable electric tools, prepared by the service department of their electric tools division, has been published by Buck and Hickman, Ltd. It deals with many types and sizes of portable electric tools and should be of great assistance to users.

House Service Units.—The Engineering Supplement to Siemens' Magazine for February/March deals with combined house service units and post-war models produced by the company, one of which has already been described in THE ELECTRICIAN. The company has also issued a price list, No. Z 156, giving the specifications of two cabinet types—one for use with a quarterly meter and the other for use with a prepayment meter. Both are suitable for flush or surface mounting.

N. Scotland Hydro Board.—The first report of the North of Scotland Hydro-Electric Board states that, in addition to the constructional schemes which were published in 1944, others were surveyed and investigated and they would be published from time to time. In the aggregate the annual loss on distribution schemes would be very large and it would have to be covered by profits earned in other directions. Efforts were being made to interest large power users in taking hydro-electric supplies.

Rugby Engineering Society.—The report of the proceedings of the society for the 1943-44 session, contains the Presidential Address, "Engineering Training (with particular reference to the electrical industry)," by C. Grad, and papers read before the society on "Design and Manufacture of Radio Valves," by J. Donegan; "High Quality Sound Reproduction," by J. Moir; "The Mechanical Properties of Glass," by Dr. J. Holland; "Production Technique of Industrial Plastic Mouldings," by T. H. Richardson; "The Making and Testing of Structural Steels," by Dr. L. Reeve; and "The Boulton Paul Electro-hydraulic Aircraft Gun Turret," by R. M. McRobb.

War Bulletin.—The eighth issue of the periodical published by the County of London Electric Supply Co., Ltd., and associated companies contains an announcement that a committee has been formed to deal with the numerous inquiries received relating to the reinstatement of employees on their discharge from the Forces. The "Forces' Post" covers many pages of interesting news with illustrations, "News from Home" is even more extensive, and there are the last reports of the various units composing the 54th County of London (C.L.E.S.C.) Battalion of the Home Guard.

New Export Selling Group.—A new company, the British Engineers' Small Tools and Equipment Co., Ltd. (Bestec) has been formed to develop the export sales of the Brooke Tool Manufacturing Co. Ltd., the Coventry Gauge and Tool Co. Ltd., A. A. Jones and Shipman, Ltd., F. Pratt and Co. Ltd., Taylor, Taylor and Hobson, Ltd. and E. R. Watts and Son, Ltd. The company's finances are to be provided by its constituent members. The organisation will supplement existing agency arrangements, and satisfactory existing export or overseas agents of the firms concerned will not be displaced, but will have the assistance of this new company. Mr. H. H. Harley, chairman and managing director of the Coventry Gauge and Tool Co. Ltd. is the first chairman and Mr. H. P. Potts, director of A. A. Jones and Shipman Ltd. is vice-chairman. Mr. H. S. Holden, managing director of the Brooke Tool Manufacturing Co. Ltd., Mr. K. G. Pratt, director of F. Pratt and Co. Ltd., Mr. D. R. Stanley, director of E. R. Watts and Son Ltd., and Mr. Mark H. Taylor, managing director of Taylor, Taylor and Hobson, Ltd., are also on the board. Office accommodation has been taken at Buckingham House, Buckingham Street, Adelphi, London, W.C.2, and showroom accommodation will be opened shortly.

Company News

TECALEMIT LTD.—Intm. div. 6%, less tax (same).

SHAWINIGAN WATER AND POWER.—Div. 22 cts., payable May 25.

KITCHEN AND WADE, LTD.—Sec. intm. 12½% (same); mkg. 25% (same).

BRITISH VACUUM CLEANER AND ENGINEERING CO. LTD.—Intm. div. 12½% (same).

METROPOLITAN ELECTRIC CABLE CONSTRUCTION CO., LTD.—Fin. div. 10% (5%) mkg. 15% (7½%).

RANSOME AND RAPIER.—Fin. div. 4% tax free (same), mkg. 6% (same). Net pft. 1944 £29 603. (£25 186).

RAWLPLUG CO. LTD.—Fin. div. on ord. 30% (same), mkg. 40%, less tax, for 1944. Net pft. £65 830 (£65 314).

UNITED FLEXIBLE METALLIC TUBING CO. LTD.—Sec. intm. on ord. 9%, makg. 15% (div. 12% and bonus 3%).

RICHARD JOHNSON AND NEPHEW LTD.—Fst. and fin. on ord. 9% (same). Net pft. to Mar. 31, £44 797 (£42 523).

MARCONI INTERNATIONAL MARINE COMMUNICATION CO.—Fin. div. 5% (same), mkg. 7½%, less tax. Net pft. for 1944, £90 138 (£93 392).

WEST LONDON AND PROVINCIAL ELECTRIC AND GENERAL TRUST.—Fin. 4% (same), less tax, mkg. 6% (same). Net. pft., to Mar. 31, £12 836 (£12 383).

BABCOCK AND WILCOX LTD.—Fin. div. on ord. 6% (same), mkg. 10% plus bonus 2%. Pft. for 1944, £647 214 (£638 583), before provdg. for inc.-tax.

NORTH BRITISH LOCOMOTIVE CO. LTD.—Div. on ord. 5%, for 1944. Net pft. is stated to be £42 343 after taxation £150 000 and £50 000 for res. Carry-fwd. £51 380.

WM. BEARDMORE AND CO. LTD.—Net tradg. pft. has decreased by £13 397 to £206 023. Deb. int. and fees take £28 678 £29 752) and divs. take £73 625 (same). War contings. receive £100 000 (same, blce. fwd. £254 262 (£250 542).

SANGAMO WESTON LTD.—After prov. taxn. £31 944 (£54 121), deprcn. £22 403 (£25 451), defd. reprs. nil (£3 500), etc., net pft. 1944 £28 379 (£30.560), plus £136 837 (£118 090) brot. in, div. 5% (same) £11 813, fwd. £153 403.

NEWMAN INDUSTRIES, LTD.—Fin. div. of 12½%, plus bonus of 2½%, mkg. with intm. 22½% for 1944. Net pft. before tax is stated as £82 652 (£70 978). Provn. for tax takes £52 250 (£41 000), the div. on redeem. pref. £6 000 (£5 370), on prefd. £1 800 (same), and distributn. on ord. £20 250 (£18 000). leavg. £20 366 (£18 014) carried fwd.

HEATRAE LTD.—Net pft. to Feb. 28, £15 192 (£11 312). Pref. div. £1 500 (same). To stk. res. nil (£2 500), defd. repairs £1 000 (same), off freehold property to an even £30 000 £720 (£516), off plant and machinery to £1 £3 590 (£219), gen. res. £2 000 (nil), div. 12½%, less tax, on ord. £6 250 (same), to employees' pol. prems. nil (£250), to furniture ond fittings nil (£461), fwd. £7 500 (£7 368).

Company Meeting

BRUSH ELECTRICAL ENGINEERING CO. LTD.—At the annual meeting held at Loughborough on May 1, Sir Ronald W. Matthews said that in the post-war years there would be a heavy demand for the company's products, particularly for engines, public transport vehicles and power plant. The demands made upon power plant installations during the war-time and their almost continuous use made is very necessary for a heavy replacement programme to be undertaken at the earliest possible moment. Their company would be in a position to make its valuable contribution towards this replacement programme. To these demands must be added those from export markets.

Metal Prices

	Monday, Price.	May 6. Inc.	Dec.
Copper—			
Best Selected (nom.) per ton	£60 10 0	—	—
Electro Wirebars ... „	£62 0 0	—	—
H.C. Wires, basis ... per lb.	9 7/8d.	—	—
Sheet ... ... „	11 1/16d.	—	—
Phosphor Bronze—			
Wire(Telephone)basis „	1s. 0 7/16d.		—
Brass (60/40)—			
Rod, basis ... ... „	—	—	—
Sheet „ ... ... „	—	—	—
Wire „ ... ... „	11d.	—	—
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 ... ... „	£26 10 0	—	—
Foreign or Colonial „	£25 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity) ... „	£303 10 0	—	—
Wire, basis... ... per lb.	3s. 10d.	—	—
Aluminium Ingots ... per ton	£35 0 0	—	—
Spelter... ... ... „	£25 15 0	—	—
Mercury (spot) Warehouse ... ... per bott.	£69 15 0	—	—

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

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.*

R. J. KEMP AND CO. LTD., Coalville, elec. engrs.—Apr. 16, assignment, securing to Lloyds Bank Ltd. £2 500 (not ex.), charged on contract moneys. *——. Mar. 25, 1943.

TELEPHONES AND RADIO COIL WINDING CO. LTD. (formerly Tuskite Tube Manufacturing Co. Ltd.), Hanwell.—March 30, £500 deb., to R. Harrison, Maidenhead; general charge. *Nil. Dec. 31, 1943.

WRIGHT AND WEAIRE LTD. London, N., engineers and scientific instrument manufacturers.—April 17, deb. to Barclays Bank Ltd. securing all moneys due or to become due to the Bank; general charge. *£250. Dec. 5, 1944.

Satisfaction

G. N. HADEN AND SONS LTD. London, W.C. heating and electrical engineers.—Satisfaction April 19, of debs. registered Jan. 31, 1921, to the extent of £49 000.

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.*

ROBINSON Harry, 16, White Bank Avenue, Brennington Road, Stockport, wireless engineer. £18 10s. 10d. Feb. 27.

WALL, Wm., S., 242, Woolwich Road, Upper Abbey Wood, S.E.2, electrician, £50 4s. 1d. Dec. 20.

A. BARTON (ENGINEERS) LTD., R/O Engine Works, St. Helens Junction. £32 13s. 7d. Mar. 10.

DAVIS, A. G., 16, Cedar Road, Hampton Wick, electrical contractor. £12 8s. 9d. Mar 9.

BUTLER, Geo., Cumbac, Marine Drive, East Wittering, electrical dealer. £21 19s. 10d. Feb. 23.

STALLWOOD, Harold, 11, Grove Crescent, Colindale, electrician. £13 19s. 6d. Feb. 27.

PRICE, Jno. L., 53, Harlington Road, Hillingdon, electrical engineer. £14 12s. 2d. Mar. 6.

SCARBOROUGH, Edgar H., 50, Amersham Rise, Aspley Estate, Nottingham, wireless repairer. £13 2s. 6d. Feb. 14.

Applications for Discharge

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. Date of hearing, May 31, 1945, 12 noon, The Court House, Church Street, Brighton.

Notice of Intended Dividend

ELECTRICAL UTILITIES LTD., Rosedale Works, Rosedale Road, Richmond, Surrey. Claims to be sent by May 15, 1945, to Mr. Charles Leslie Walker, liquidator, 10-11, Park Place, St. James's Street, S.W.1.

Coming Events

Saturday, May 12.

I.E.E., LONDON STUDENTS' SECTION.—Visit to the Sperry Gyroscope Co., Ltd., Brentford. *2.30 p.m.*

INSTITUTE OF MUSICAL INSTRUMENT TECHNOLOGY.—Northern Polytechnic, Holloway, N.7. "A Homophonic or Single-Note Electronic Musical Instrument with a Photo Electric Cell as Playing Manual," demonstration and lecture, Dr. W. Saraga. *5 p.m.*

Monday, May 14.

I.E.E., LONDON STUDENTS' SECTION.—London, W.C.2. "A.C. Generator Protection," D. S. Daoud. To be read by P. W. Castle and G. Lyon. *7 p.m.*

Tuesday, May 15.

I.E.E., RADIO SECTION.—London, W.C.2. Discussion, "The Characteristics of Luminiscent Materials for Cathode-Ray Tubes," C. G. A. Hill. *5.30 p.m.*

ILLUMINATING ENGINEERING SOCIETY.—Institution of Mechanical Engineers, London, S.W.1. Annual meeting. *5 p.m.*: "Daylight and Its Penetration into the Sea," Dr. W. R. G. Atkins, *5.30 p.m.*

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.—E.L.M.A. Lighting Service Bureau, Savoy Hill, London, W.C.2. "Winning Entries in Branch Papers Competition, 1944-5, by Authors. *6.15 p.m.*

Wednesday, May 16.

RADIO INDUSTRIES CLUB OF WALES AND MONMOUTHSHIRE.—Park Hotel, Cardiff. Luncheon address. "Radio—Past, Present, Future," W. E. Warrilow. *1 p.m.*

Thursday, May 17.

BRITISH INSTITUTION OF RADIO ENGINEERS.—11, Upper Belgrave Street, London, S.W.1. "The Measurement of Cable Characteristics at Ultra-high Frequencies," F. Jones and R. Sear. *6 p.m.*

Friday, May 18.

I.E.E., MEASUREMENTS SECTION.—London, W.C.2. Lecture, "Magnetic Materials," Sir L. Bragg. *5.30 p.m.*

It is well worth your while to spend a few minutes with our representative working out how much extra profit you make by selling Atlas Lamps. Atlas dealers get extra good discounts, generous rebates, attractive sales aids and perfect freedom to stock whatever make of other good lamps they like. Our advertising—appearing in every main thoroughfare and regularly in the National and Provincial daily and evening papers and magazines—is creating bigger sales for you. Write for terms to-day.

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