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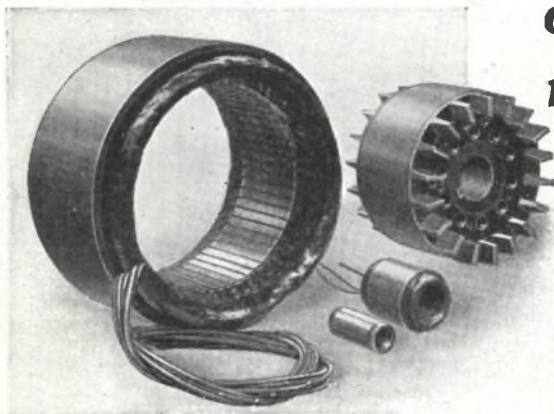
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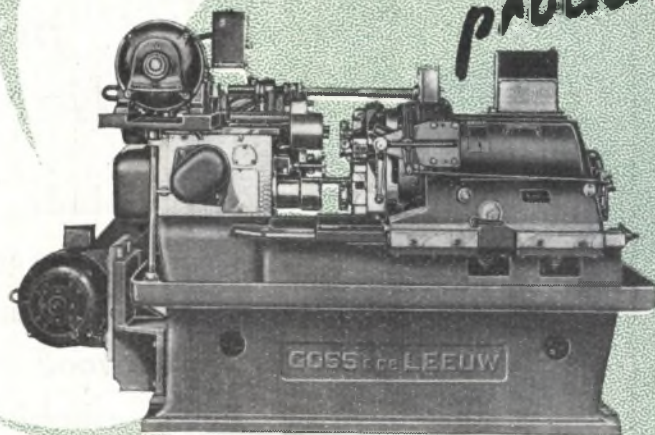
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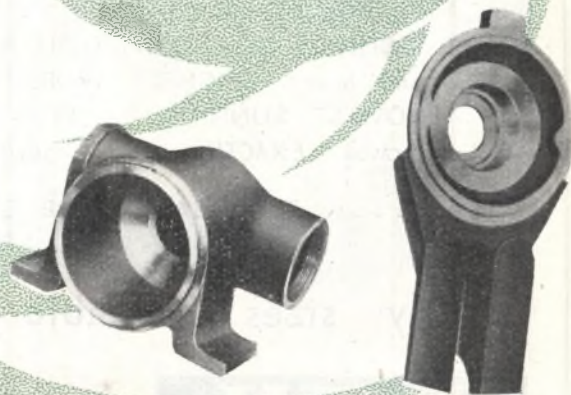


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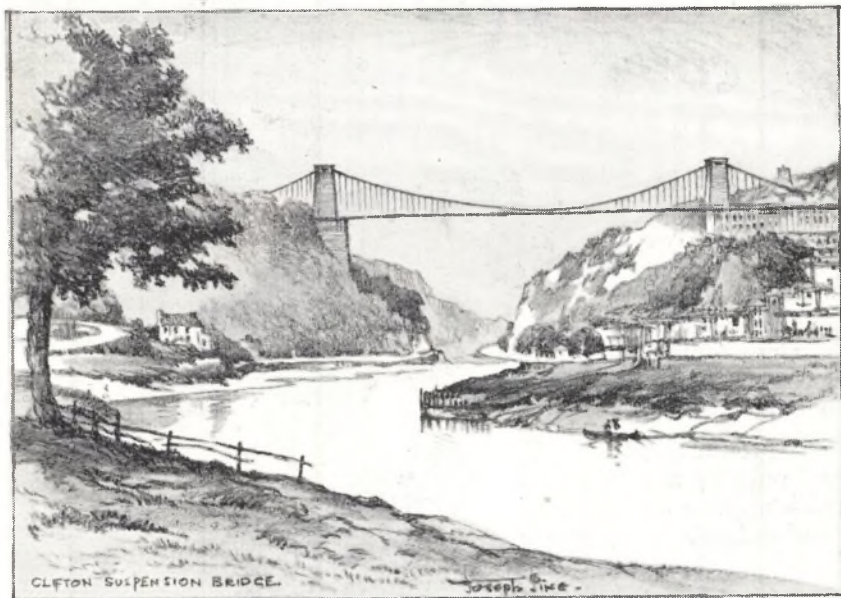
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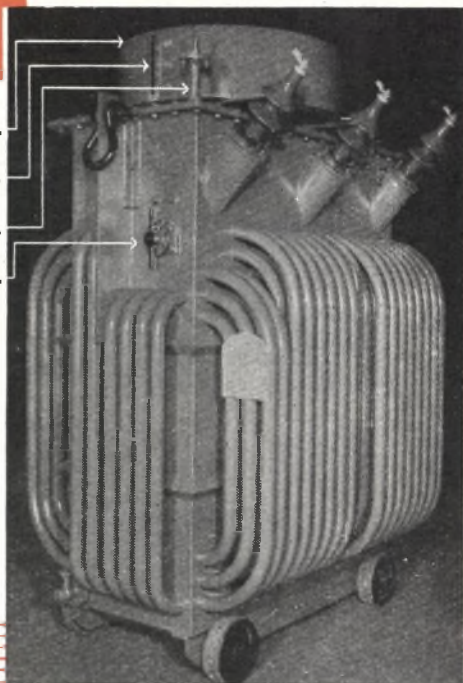
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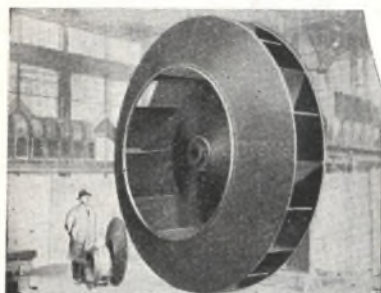
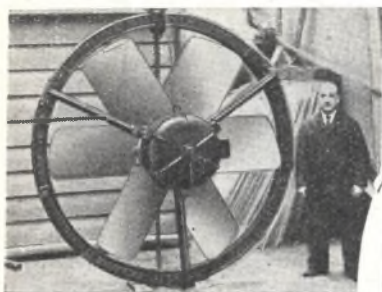
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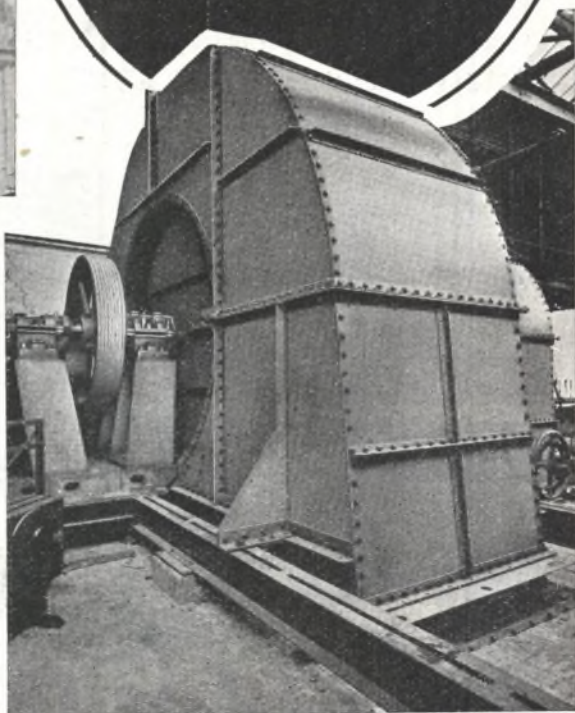
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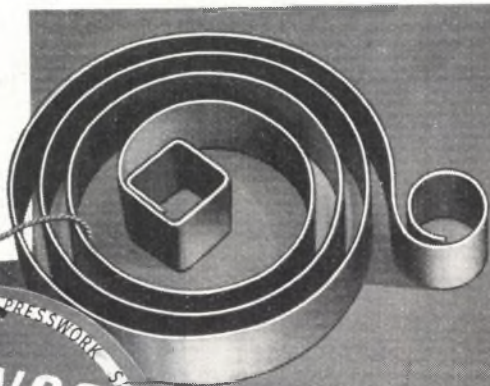


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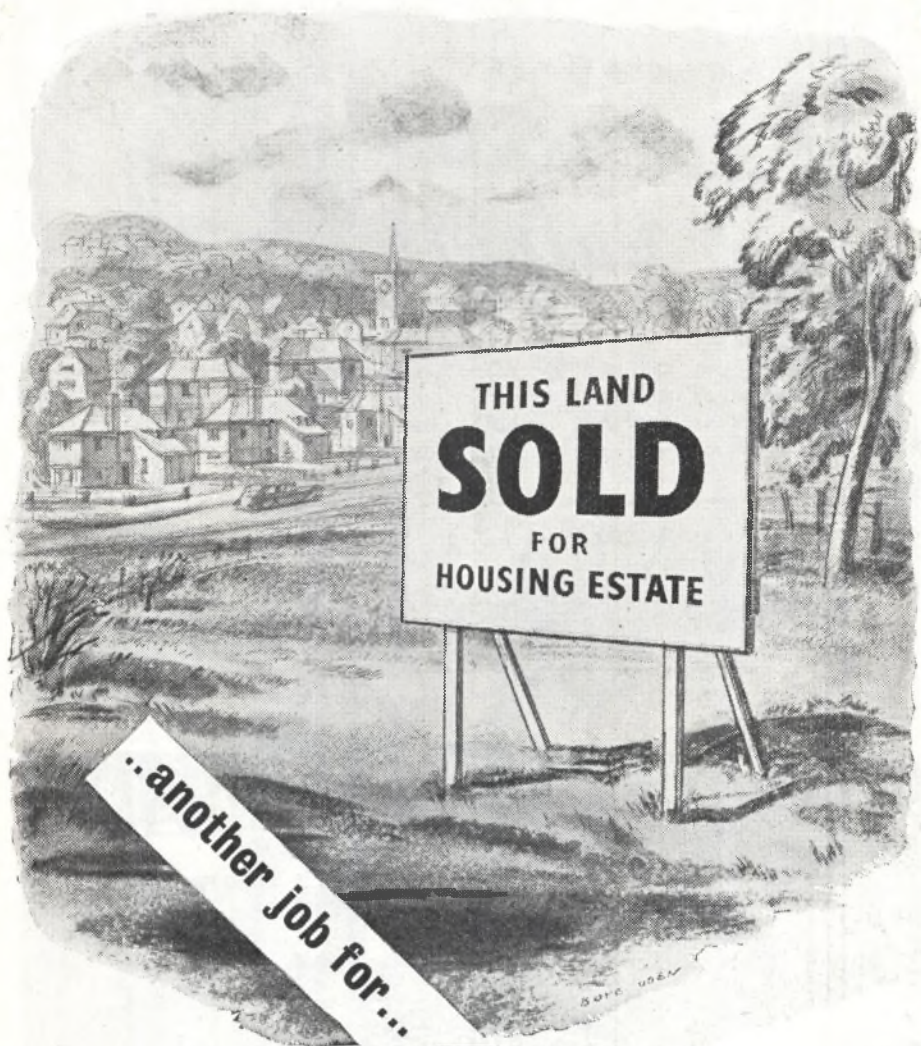
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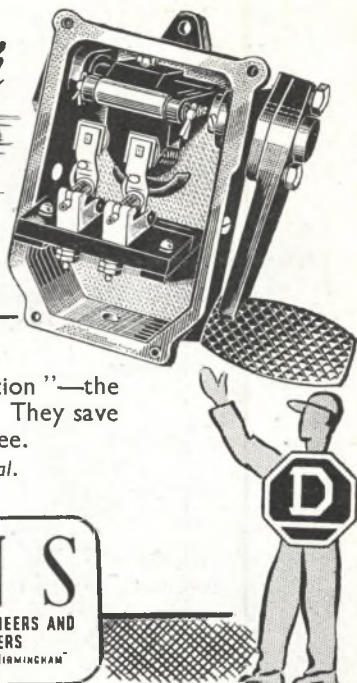
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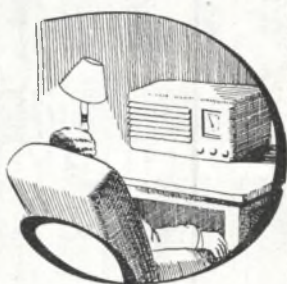
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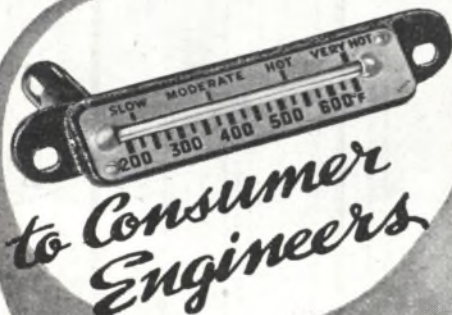
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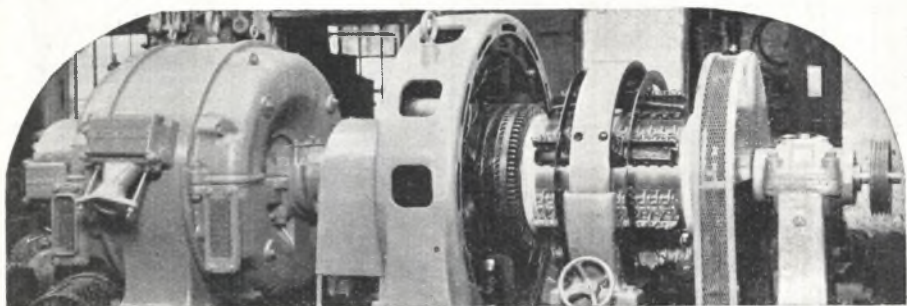


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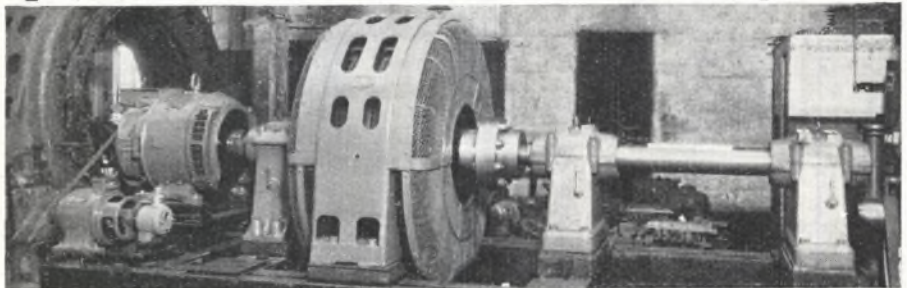
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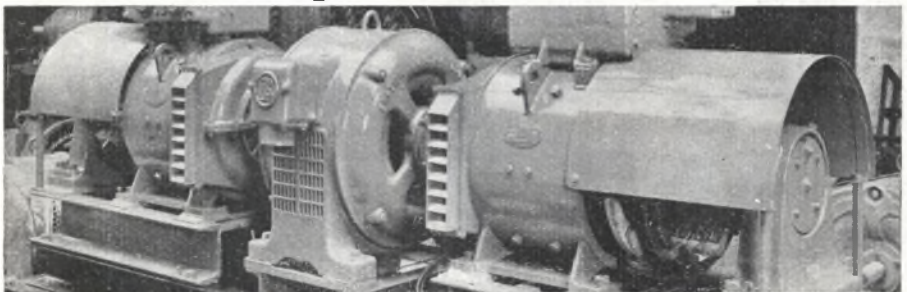
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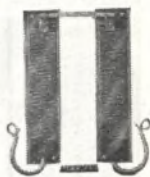
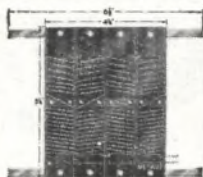
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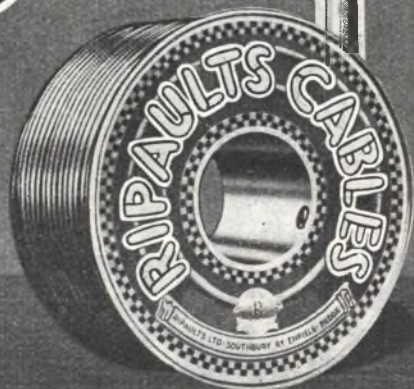
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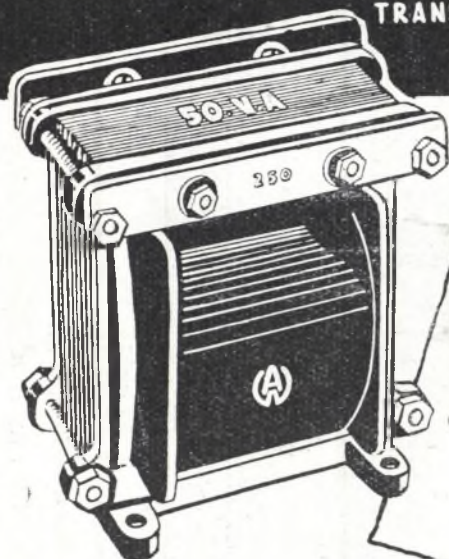
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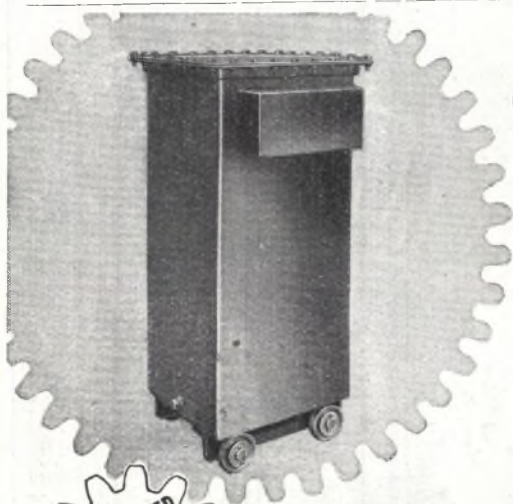
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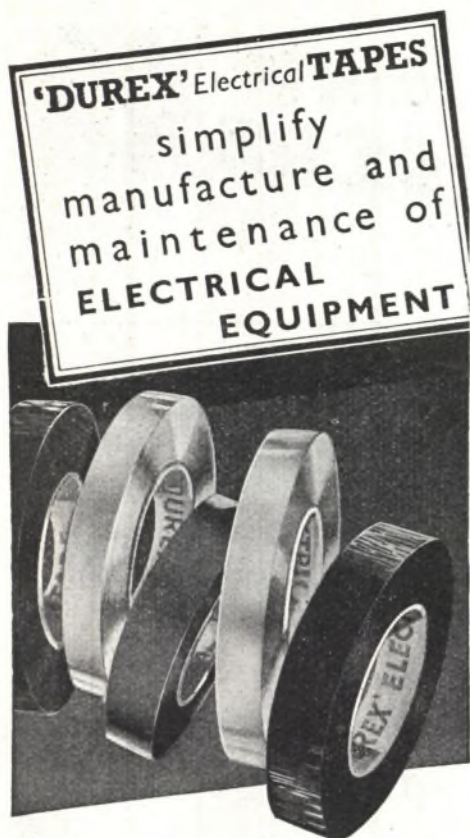
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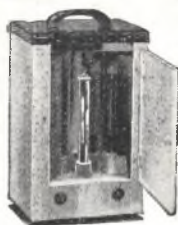
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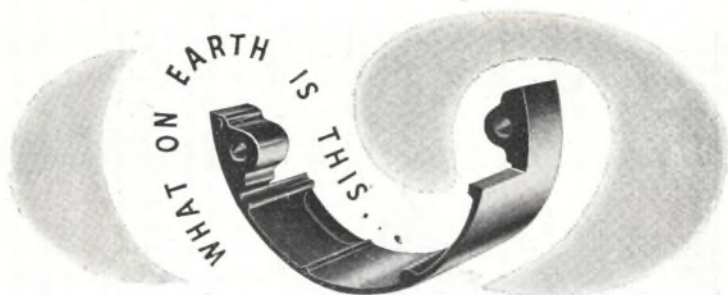
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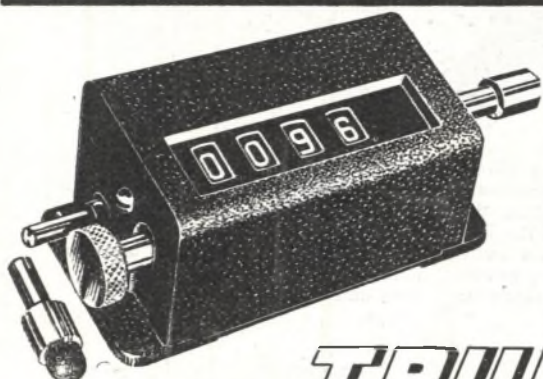
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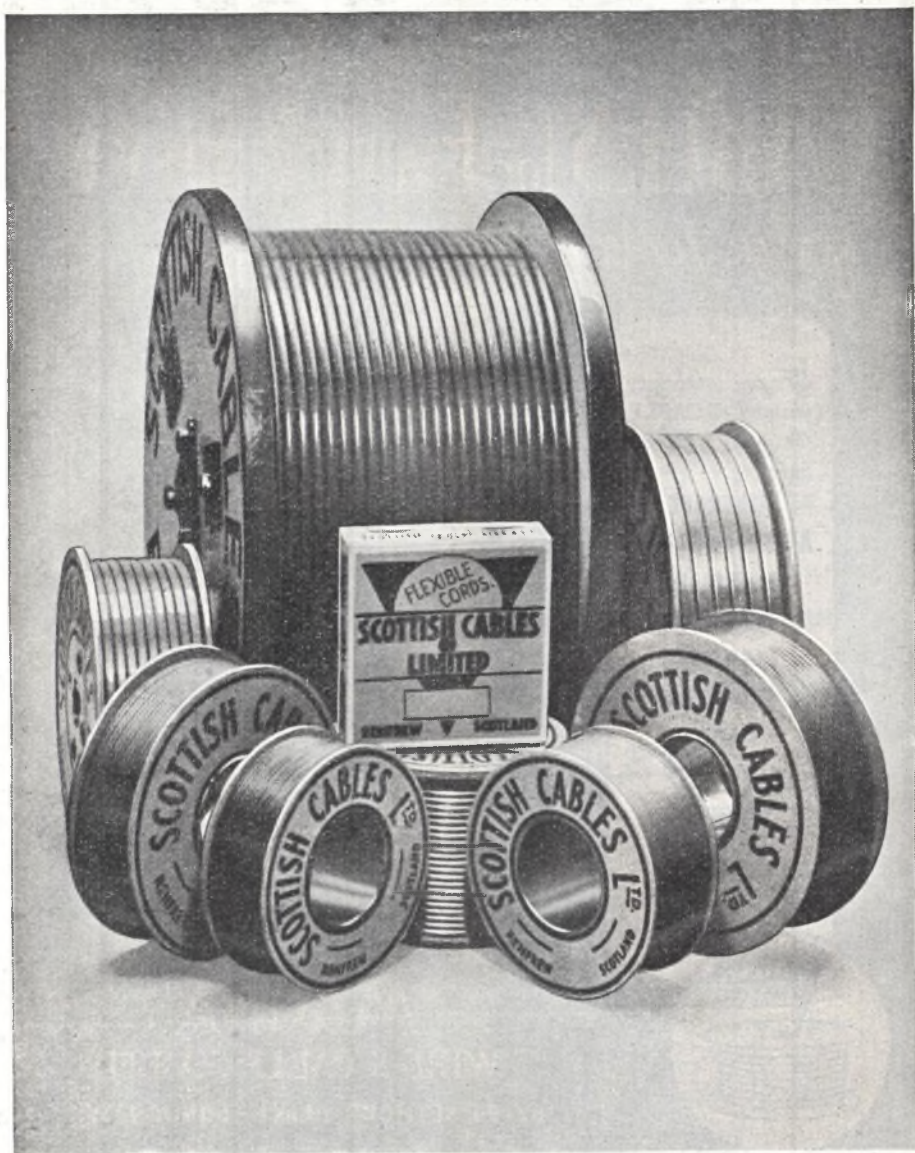
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Crisis Plans

SOME details of the plans designed to overcome the economic crisis and which will have an appreciable effect upon the electrical industry were outlined in THE ELECTRICIAN of October 17, and an amplification of them was given in the House of Commons last week when the Minister for Economic Affairs made his début.

The chief concern of the industry is felt to be the result which the capital construction programme is likely to have upon the replacing of heavy electrical equipment, for though it was understood a fortnight ago that power station extensions would not be seriously interfered with, some qualification of the position must now be accepted. It is as yet too early to say how deep will be the cut into the equipment programme, but it is to be sufficiently severe to warrant the publication of a White Paper wherein, it is anticipated, will be given details which in effect will limit power station extensions to 1 500 MW in 1948, 1 600 MW in 1949, and 1 150 MW thereafter.

These figures do not, in fact, represent any substantial change in programme until the year 1950 is reached, but after that date extensions scheduled at 2 306 MW for commissioning in 1951 will be reduced by 806 MW, and the 1 617 MW extensions scheduled to be in operation by 1952 will be reduced by 117 MW, a loss of potential generating capacity of 923 MW over the two years. Against this reduction in power station expansion, the less economic North of Scotland hydro-electric projects will, it is expected, be allowed to go forward,

under some rearrangement of the order in which they are to be completed. Apart from the 2 500 MW shortage in generating capacity from which the industry is already suffering, the time cannot be long delayed before the country will feel even more seriously than now, the effects of the over-age plant which is building up, and which, due to the growing demands made upon it is likely to break down more often and for longer periods. By the time the year 1950 is reached, the over-age plant still in commission may well be over 1 000 MW, and any restriction upon the power station extension programmes for the two following years and perhaps longer, will aggravate the position. The industry had hoped that it would be rid of its generating plant problem by 1951, but the latest plans of the Minister for Economic Affairs appear to have in them the possibility that the problem may not by then be even near solution.

Tax on Electricity ?

THIS week and earlier, a number of influential sections of the Press have suggested, with a greater or less degree of enthusiasm, the imposition of a tax on electricity consumption. The first voice to be raised was that of "The Times," on October 11; the following week, "The Economist" called for "a heavy tax," and last Sunday, the editorial comments in "The Observer" contained the statement that the Cabinet is now considering proposals from the Ministry of Fuel and Power "to impose a serious tax—above certain maximum levels of consumption—on the use of electricity and gas in the home." In a letter published in "The Times" of October 15, which met with general approval, this journal set out four of many reasons why such a tax should be rejected. The arguments used were those well known to the industry, and require no detailed repetition in these columns, where it need only be said that they stressed, first, the extreme hardship which would be caused and, secondly, the almost certain unworkability of any system of taxation designed to take account of varying needs. It is understandable, however, that many outside the industry, who realise little of the difficulties involved, should feel attracted to a tax which appears both to promise a reduction of consumption

to safe levels and to exert a useful deflationary effect. This suggests that more may be heard of the idea between now and the Autumn Budget, and the industry must do all in its power to prevent its gaining official acceptance.

Atomic Energy

THERE has during the last year or so been much loose talk with respect to the application of atomic energy to power generation, and though those best qualified to speak have tried to keep public enthusiasm in check, the talk still goes on. The evidence which led the Select Committee on Estimates to recommend an immediate independent inquiry into the construction of the atomic energy research station at Harwell, has now been published, and many of the national newspapers when dealing with it, did so in way which might lead their readers to think that the prospects of atomic power were more practical than experimental. The report which accompanied the published evidence made it clear that as a result of delays in engineering supplies and other causes, work at the station was some six months behind schedule, and with the export drive claiming the attention of the electrical as well as other branches of the engineering industry, the chances of expediting the building of the station appear remote. Nor is the prospect of quick results any better in America, if the Chairman of the Atomic Energy Commission is to be believed.

Nuclear Research in U.S.A.

SPEAKING of the work in progress in atomic energy research in the United States, Mr. DAVID LILIENTHAL, estimated recently, that it would take eight to ten years to produce even a practical demonstration of atomic industrial power, though it was possible that within a year or two an experimental lamp might be energised by electricity generated by plant using atomic energy. So far as conventional power sources are concerned, however, atomic drive is still a long way from being a practical proposition, and it is well to bear in mind in connection with it—as Prof. J. D. COCKROFT recalled last June—that it took electrical science and technology over 50

years to develop from Faraday's discovery of electro-magnetism to the first electricity undertaking, and a further fifty odd years to develop the industry to its present state. The development of atomic energy for fuel purposes may not necessarily be so long in reaching equally practical dimensions, but any suggestion that its applications to peacetime pursuits are nearer than many years of expensive and continuous research is unwarranted.

Electrical Export Target

THE target set by the Government for electrical exports, exclusive of heavy machinery, is £4.3 million per month by the end of 1948, and how near the industry is to hitting it, is shown by the tabulated details of nine months' trading given in this issue. As recorded in *THE ELECTRICIAN* last week, shipments of electrical goods and apparatus during September reached the healthy total of £4.8 million, and adding to that figure the value of heavy machinery exported, the grand total was £7.5 million. For the nine months January-September, the shipment of electrical goods and machinery reached in value £54 493 549, compared with £36 628 208, for the corresponding period of 1946, indicating thereby, that given the materials and freedom from serious load shedding, the industry is not only likely to reach the monthly export target set for next year, but may exceed it by a substantial amount.

B.E.A. and its Personnel

OF particular interest to those engaged in the supply industry are the remarks made by Lord CITRINE, chairman of the B.E.A., in his addresses at the E.D.A.-E.A.W. conference held in London last week. As reported in *THE ELECTRICIAN* of October 24, reference was made to the immediate future of both the E.D.A. and the E.A.W., and details of some of the initial steps being taken by the Authority to carry out the obligations laid upon it by the Electricity Act with respect to personnel in the industry, appear to throw doubt on the suggestion that showroom staff may be brought under the service councils dealing with all kinds of employees. This is based on the fact that there has seemingly, already

been created a council representative of all grades of employees, from chief engineers to the humblest worker, and on November 14 the Authority will be discussing the future with that body. In this connection it is interesting to note that in Lord CITRINE'S view, the obligation of the Authority under the Act, to look after the welfare, education and training of the persons employed in the industry will, if properly observed—as he is sure it will—result in a standard of service in the industry as a whole, even higher than that already attained. As evidence of the intention of the B.E.A. to bring this about, Lord CITRINE drew attention at the conference luncheon to the fact that applications for the post of chief education and training officer in the labour relations department of the Authority have already been invited.

Registration of Contractors

THE rift which last year caused the National Register and the E.C.A. to part company is apparently, setting up a certain amount of misgiving in the industry. The reasons for the rift and the views of both sides have already been published in *THE ELECTRICIAN*, so beyond recalling the fact that both bodies have at heart the safety of the public, reference to the past is not called for. The aims and objects of the National Register and the E.C.A. so far as the registration of contractors is concerned, are much the same; the latter, however, has more than a sneaking regard for compulsory registration. The National Register, on the other hand, while not in any way opposed to compulsion favours the voluntary method, since the Government has refused to entertain any support of compulsory measures. The disagreement which has arisen between the two bodies is now beginning to make its mark on the contracting industry as a whole with, we feel, no compensating advantage. There are being built up in the contracting industry two schools, one supporting the National Register and the other the E.C.A., and unless something is done to bridge the gap between them, some people may become even less concerned than now—we regret to say—as to whether the contractor they engage is technically qualified or not.

Portrait—Dr. C. C. Garrard



THE resident director of the extensive works of the General Electric Co., Ltd., at Witton, Birmingham, Dr. C. C. Garrard, claims that he became an engineer by accident. As a boy at the Central Foundation Schools of London, Cowper Street, E.C., with the prospect of a career in a city merchant's office, he was attracted by the activities of a number of young men who could be seen through the windows of the mechanical engineering laboratory of the old Finsbury Technical College—which abutted on the playground—engaged upon fascinating experiments with various kinds of machines. This led to his winning an entrance scholarship and becoming a student in the Technical College under that remarkable triumvirate of professors—Silvanus P. Thompson, John Perry and Raphael Meldola. Having passed through the electrical engineering department, in the final examination of which he ran neck and neck for first place with J. M. Donaldson, he took the advice of Prof. Thompson to enter the new sphere of electro-chemistry and remain another year to acquire more knowledge of chemistry under Meldola. Securing one or two more scholarships to provide the means, Garrard then went to the new laboratory founded by Nernst at the University of Göttingen, which specialised on the subject.

The theories of electrolytic dissociation of Arrhenius, Van t'Hoff and others were

While a boy at school Dr. Garrard observed through a window, activities of the students in the mechanical laboratory of the old Finsbury Technical College, and was attracted by them. This interest led to his winning an entrance scholarship and becoming a student under Silvanus Thompson, John Perry and Raphael Meldola. Further scholarships took him to Göttingen where he studied electro-chemistry, among other things, and gained a Ph.D.

then very much discussed, and the question of whether the same laws applied to solid and fused electrolytes as to aqueous ones arose. Nernst gave this problem to Garrard to solve, and he published a paper in the "Zeitschrift für Anorganische Chemie" which aroused considerable controversy, but the conclusions of which have never been disproved. Nernst at that time conceived the idea that a solid electrolyte (such as a solid solution of yttria and erbia in zirconium oxide) which had a very high melting point, might be used as the filament of an electric lamp. He patented the idea and got the A.E.G. to take it up. Garrard, whatever his contribution may have been, made nothing out of it except an appointment as private assistant to the professor at a salary of £5 a month during the last year of his stay at Göttingen, where he gained the degree of Ph.D. and subsequently a position as an engineer with the Nernst Electric Light Ltd., of London.

An introduction by his old friend Silvanus Thompson to Sebastian de Ferranti resulted in Dr. Garrard being placed in charge of the experimental department which was started at Hollinwood, with R. H. Parsons as an assistant. After seven years of interesting work there, Dr. Garrard sought another sphere of activity. This he found at the old Peel Works of the G.E.C., where he took over the switch department, then in an embryo stage and which soon afterwards was transferred to Witton. He did not know very much about switchgear then, but apparently the late George Tucker, who at that time published THE ELECTRICIAN, thought he did, for he asked Dr. Garrard to write a book on the subject. Dr. Garrard has been with the G.E.C. ever since 1908, a period of 39 years.

Codes of Wiring Practice

How the Codes Are Drawn Up in Draft and Final Form

THE Codes of Practice Committee for the Electrical Equipment of Buildings, convened by the Council of the Institution of Electrical Engineers, on behalf of the independent Codes of Practice Committee, has so far undertaken work on 26 Codes of Practice affording guidance on various aspects of electrical installation practice and of these, eleven codes have already been promulgated publicly as drafts for comment.

INTEREST AND COMMENT

In view of the interest in the comments of "Supervisor" in THE ELECTRICIAN of October 10, it may, therefore, be of further interest to recapitulate the stages through which a code passes before its publication in final form.

The Electrical Codes of Practice Committee having agreed that the preparation of a given code of practice is desirable, appoints a small sub-committee, of members having detailed acquaintanceship with the various aspects of the matter, to prepare a draft code. When this work is completed the draft is submitted in the first place to the parent Electrical Code Committee, who consider not only the material it contains, but also the relationship of its clauses to the other electrical codes for which they are responsible.

The draft code, embodying any amendments which may have been made, is then transmitted to the Engineering Services Sectional Committee of the independent Codes of Practice Committee, who scrutinise the draft on its intrinsic merits and in its relation to all the other codes dealing with the provision of engineering services in buildings. It is customary, when a draft code is under discussion by the Engineering Services Sectional Committee, for the chairman of the sub-committee which prepared the first draft to be present, and to answer any technical questions which may be raised.

Authority is then given for the code, with any amendments which may have been introduced at this stage, to be published in printed form and to be placed on sale by the British Standards Institution as a draft for comment; at this stage a period of forty days is allowed for interested organisations or persons to make known their views on its recommendations. That this promulgation is no empty formality can be gauged from the fact that on the Code entitled—Choice,

Installation and Maintenance of Electric Wiring Systems (for Power, Lighting or Heating Circuits in Buildings)—307 individual comments were received, while that on Electrical Installations (General) gave rise to 477 comments.

Until recently the comments were collated centrally by the Codes of Practice secretariat, but as part of a plan to expedite the issue of the final versions, the Institution of Electrical Engineers has recently undertaken the collation of the comments that are received on the electrical codes.

The comments thus collated are reviewed by the sub-committee responsible for the preparation of the original draft of the code, and, after discussion, amendments are introduced to give effect to the comments which are supported; and note is taken of the reasons which may have led the sub-committee to reject any other comment or comments.

The amended code with the note of action taken on the comments received then goes successively before the Electrical Code Committee and the Engineering Services Sectional Committee, who, if thought fit, recommend to the independent Codes of Practice Committee that it be published in final form as a British Standard Code of Practice.

I.E.E. REGULATIONS

Questions are often asked about the relationship between the electrical Codes of Practice now in preparation and the Regulations for the Electrical Equipment of Buildings, published by the I.E.E. Electrical Codes of Practice in no way run counter to the provisions of the Wiring Regulations, which represent a body of regulations governing electrical installation practice with the object of securing safety from the risk of fire or shock. Whilst the regulations may be regarded as setting out minimum requirements to be observed for safety, the electrical Codes of Practice can go further in their encouragement of good practice, and may well recommend the adoption of methods showing some improvement in points of detail over those provided for by the requirements of the regulations proper. It is important to realise that the opposite situation cannot arise, and that the Codes of Practice will never recommend a practice in itself inadmissible under the Wiring Regulations.

ELECTRICAL OVERSEAS TRADE

EXPORT FIGURES RISE BY OVER £1 000 000 IN SEPTEMBER

THE total value of electrical exports rose from £6 427 292 in August to £7 478 798 in September—an increase of £1 051 506—but this was less than the July aggregate of £7 543 178. For September last year the figure was £4 023 381, while the monthly average for 1938 was £1 829 198. Imports of electrical goods dropped in value from £336 442 in August to £326 514 in September. For the nine months ended September 30 shipments overseas of electrical goods and machinery reached in value the substantial total of £54 493 549, compared with £36 628 208 for the corresponding period last year, and £16 462 803 for three-quarters of 1938.

Last month the number of domestic radio sets exported was 35 716, against 31 036 in August, 32 953 in September

last year, and the monthly average of 7 053 in 1938; valves and cathode-ray tubes, 389 560 in September, compared with 287 768 in August, 280 509 in September last year, and 183 826 in 1938; electric bulbs and discharge lamps, 2 178 707, contrasted with 2 322 499 in August, 2 055 856 in September last year, and 1 638 099 in 1938; generators, 2 364 tons, against 989 tons in August, 712 tons in September last year, and 858 tons in 1938; motors, 1 110 tons, compared with 1 216 tons in August, 1 057 tons in September last year, and 927 tons in 1938; other electrical machinery, 3 240 tons, contrasted with 3 528 tons in August, 1 124 tons in September last year, and 1 935 tons in 1938; welding machinery and electrodes, 583 tons, against 815 tons in August and 509 tons in September last year.

	Monthly average, 1938	IMPORTS Month ended September 30, 1946		Monthly average, 1938	EXPORTS Month ended September 30, 1947	
	£	£	£	£	£	£
Submarine cables ...	—	—	—	17 289	80 053	76 361
Other telegraph and telephone wires and cables ...	—	—	—	71 803	133 061	343 523
Electric cables, wires, etc.—	—	—	—	—	—	—
Rubber insulated ...	—	—	—	—	—	—
With other insulation ...	31 246	1 614	9 929	117 533	220 387	603 927
Radio receiving sets ...	10 148	9 529	617	153 256	347 879	350 577
Radio long distance telegraph and telephone equipment ...	9 243	1 874	3 642	36 755	334 336	425 656
Radio and television transmitters, communication and naviga- tional aid equipment... }	47 870	269 858	13 233	242 716	417 474	704 582
Other descriptions ...	—	—	9 476	28 296	60 937	104 388
Transmitting and industrial valves ... }	10 893	8 924	29 227	57 848	132 248	303 348
Other electronic valves ...	—	—	—	41 272	24 442	22 525
Electric furnace carbons ...	4 054	1 010	83 795	—	68 532	106 209
Other electric carbons ...	2 301	2 532	6 114	—	—	—
Electric bulbs and discharge lamps ...	10 265	1 112	4 712	49 440	81 674	105 478
Other lamps, lighting appliances and fittings ...	38 662	792	4 609	48 565	170 977	319 747
Batteries and/or cells, primary ...	3 549	62	874	13 572	51 343	56 204
Accumulators ...	—	—	—	48 647	126 249	210 851
Parts and accessories ...	—	—	—	—	42 664	57 857
Heating apparatus and elements	—	—	—	14 064	49 753	96 058
Other heating equipment ...	—	—	—	16 600	46 685	113 784
Commercial electrical instru- ments and parts ...	32 057	8 208	16 733	15 878	45 228	87 386
House service meters ...	—	—	—	15 791	40 406	126 265
Other descriptions of instruments	—	—	—	9 612	24 503	83 269
Electro-medical apparatus ...	—	—	—	3 038	13 178	17 963
X-ray apparatus, vacuum tubes and parts ...	9 734	6 069	25 527	4 881	33 595	52 092
Insulating cloth and tape ...	—	—	—	7 038	30 861	32 047
Other insulating materials ...	—	—	—	12 305	44 302	74 995
Other articles ...	52 980	8 723	25 463	108 083	265 986	348 671
Generators and parts ...	—	—	—	157 150	289 176	953 217
Motors and parts ...	26 033	2 893	13 696	145 045	265 367	379 594
Other electrical machinery ...	14 455	5 200	71 901	355 663	353 600	864 034
Vacuum cleaners and parts ...	—	—	—	26 662	81 067	269 496
Other portable appliances ...	24 627	1 160	4 093	10 394	37 330	27 989
Welding machinery (including electrodes) other than tube making ...	—	10 256	2 873	—	110 088	160 705
Total ...	328 117	339 816	326 514	1 829 198	4 023 381	7 478 798

University Engineering Research

I.E.E. Transmission Section Chairman's Address

IN his Chairman's Address before the I.E.E. Transmission Section, on October 22, Pro. W. J. John (Queen Mary College, London University) gave an account of the electrical engineering research work conducted by three of the five students who had, during the past session at the college with which he is connected, prepared Ph.D. theses.

The first thesis which Prof. John summarised was entitled "Lichtenberg Figures, their Characteristics and Practical Application." A klydonograph, he explained, consisted of a photographic plate separating two electrodes. Lichtenberg figures or klydonograms were produced when an impulse voltage was applied between these electrodes. The thesis described various kinds of figures and stated that the two factors mainly responsible for the kind of figure produced, were the crest value of the voltage and the steepness of the wave-front. A "normal" figure was produced when the crest value of the impulse voltage was comparatively low. At a higher value of the crest voltage a different figure (called a Toepler figure) was produced. To produce a "normal" figure it was also essential that the impulse voltage should have a very steep front; if the front were less steep, a different figure called a "slip" figure, was produced. Toepler figures could be either "normal" or "slip," depending on the steepness of the front: intermediate figures were formed at crest voltages between those at which normal and Toepler figures were produced, and they might be normal figures or slip figures, depending on the steepness of the wave-front.

In practically all cases, the klydonograms showed "inverse" figures near the electrode, and it was demonstrated that these were formed whenever the slope of the voltage wave ($\frac{dv}{dt}$) changed sign. In-

verse figures were useful in indicating the presence of high-frequency oscillations superimposed on the impulse wave. Experimental work proved that the diameter of the normal or slip figure was reduced when the impulse wave was "chopped" on its front. "Chopping" on the tail had no effect on figure diameter, and it was therefore concluded that the wave-front alone determined this quantity.

Until Toepler figures appeared, the diameter of the figure gave a fairly accurate

measure of the crest voltage, and it had been claimed that the klydonograph was superior to the cathode-ray oscillograph for determining in field work the exact instant of "chopping" and the magnitude of the voltage then existing. It was also suggested that the instrument could be of great assistance in determining the breakdown voltage of insulating materials.

Dealing with the second thesis, which was called "A Theoretical and Experimental Study of the Interstage Phenomena in the Marx-Type Impulse Generator," Prof. John said that in all impulse generators it was difficult to obtain a smooth wave free from superimposed oscillations. A study of these formed the major portion of the work. Two impulse generators, both of the "controlled" type, were used in the experimental work. In the theoretical work, the action of the multi-stage generator was considered in two parts; namely, the charging process and the discharge process. Considering first the charging process, for both generators the voltage across the first stage, the voltage across the final stage and the total charging current were determined and plotted, as functions of time. Considering next the discharge process, a method due to Elsner was described for determining as a function of time the voltage on the various stages after discharge began. It was found that this method gave results which did not agree very well with oscillographic records. In an attempt to obtain better agreement, a new analysis was developed, which yielded mathematical expressions for the various stage voltages. These expressions were complicated, but gave results without a prohibitive amount of labour, and the thesis gave calculated voltage/time curves during the discharge process for the various stages.

"The Mechanism of Dipole Orientation in Pure Dielectrics" was the title of the third thesis. The work so far completed on this subject, Prof. John said, had resulted in the formulation of a theory explaining the mechanism of dipole orientation based on the concept of a visco-elastic model. The experimental work had been of a preliminary character and had demonstrated the possibility of studying restricted dipole orientation in the solid state, by using concentrated, solid solutions of polar substances in paraffin wax. Further work now in progress was expected to throw light on the problem of molecular interactions in polar substances.

Training in the Supply Industry

B.E.A. TO APPOINT EDUCATION AND TRAINING OFFICER

THE E.D.A.-E.A.W. second post-war conference for housecraft advisers, senior demonstrators and saleswomen in the electrical industry which, as was reported in our last issue, opened at Caxton Hall, Westminster, on October 22, continued there on Thursday, and at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London, on Friday morning, concluding, after a luncheon at the Connaught Rooms, Great Queen Street, Kingsway, with an informal discussion and tea at the E.A.W. headquarters, 35, Grosvenor Place.



LORD CITRINE speaking at the luncheon

There were about 150 delegates from all parts of the country.

Reference to the proposed appointment of a chief education and training officer in the labour relations department of the B.E.A. (advertised in *THE ELECTRICIAN* of October 24) was made by Lord Citrine, chairman of the Authority at the luncheon at the Connaught Rooms. Mr. V. W. Dale, general manager and secretary, E.D.A., presided and mentioned that Lord Citrine had told him it was almost certain that they would be holding their conference next year.

Addressing the delegates, Lord Citrine said they had thought a lot about the future and had been wondering about themselves and what it might mean for them. That morning they probably had seen some small evidence of what the Authority was trying to do, in the advertisement for a chief education and training officer. If that implied anything it meant there were going to be others. They on the B.E.A. intended, if they possibly could, to develop a thorough system of training from top to bottom of the organisation. Where education ended and training began it was difficult to say. A trained man or woman must in some sense be an educated man or woman within the limits of the subject. Their faculties had been aroused and they had been trained to apply their intelligence to what they had been taught.

If he had his way he would make everyone, except mental defectives, in the

country go through a university training, because he believed it would be to the benefit of the vast mass of humanity to have that training of the mind that would enable them to appreciate and understand the problems of life.

Within the B.E.A. and the supply industry, they would be limited in what they could do, but so far as he was concerned, he was determined that the best opportunities that were available—whether they be through summer schools, week-end schools, training schools, whatever they be—were going to be at the disposal of the personnel in the industry because he knew it would be to the benefit of those persons in their careers and operations and to the benefit of the community. They might say: "How do we know this is going to materialise? It might not be approved by the Central Authority." On the Central Authority there were twelve members, one of whom was in America at the moment; they were different types of people of different experience and it would take time to weld them together until they got a single broad purpose in mind on some of those subjects; he was, however, perfectly satisfied that the men and the woman who had been chosen for the Authority were capable of seeing the possibilities put at their disposal.

As far as humanly possible, in all our industries, we should try to awaken in the minds of everyone the question: "How can I make my best contribution as an individual to the success of the service that I am engaged in and all that it means to the community?" At least, in the electrical industry they would pride themselves on their own personal qualities. They (the delegates) had the job of exposition; the job of interpreting in a very large measure the purpose and the desires of the Central Authority. In London the Authority would be remote in every sense from the electricity consumers. The housecraft advisers, demonstrators and saleswomen would meet the housewife who was looking for the means of making her lot a little bit brighter, and they would have the job of dealing with any perfectly justifiable complaint. On them would depend how well those individual consumers would understand the purpose behind that great industry and what the Authority was trying to do.

Miss Norvick, of the E.A.W., deputising for Dame Caroline Haslett, who had another engagement, thanked Lord Citrine for his address.

About Transformers*

by G. O. CASTELL, M.I.E.E.

A TRANSFORMER oil, in order to comply with the appropriate B.S.I. specification No. 148, must be a pure hydrocarbon mineral oil; the sources of the greater part of the world's present supply are Russia and the United States. In earlier days, vegetable oils of various types were used, but they showed a marked tendency to "gum up" quickly in service and the loss due to evaporation was high; for these reasons their use has been long discontinued.

Crude petroleum, from which transformer oil is refined, is a material of a most complicated and variable nature, and samples from different sources and indeed from different wells in the same oil field show a wide divergence in their molecular structure.

The carbon atom about which all the organic materials of the world are built, exhibits a tremendous propensity to combine with the atoms of other elements, especially hydrogen, oxygen and nitrogen, and with other carbon atoms, into large and complicated molecules, ranging from the long straight chain of the paraffin molecule to the ring formations of the benzene group of molecules, and including various combinations of these molecular forms; some stable, others, unfortunately for the transformer engineer, unstable, or as they are usually termed, unsaturated. Thus, although all crude oils consist predominantly of hydrocarbons, they still vary widely in their nature, as do the properties of the products which can be obtained from them by refining.

COMPOSITION OF OIL

A crude oil may contain oxygen, nitrogen and sulphur up to 5 per cent. and inorganic matter up to about 1 per cent.; water in actual solution will not exceed one-quarter of 1 per cent., although from some wells the crude will come up in the form of a water and oil emulsion of which water may form one-quarter of the total. In these cases the crude is generally subjected to a dehydrating process at the oil field before being sent to the refinery. All these impurities are of little consequence as they can be removed; it is the type of the hydrocarbons, or rather of the predominant hydrocarbons, since a sample containing only one type may be regarded as unobtainable, which determines the nature of the final products and their suitability for any particular purpose. It must be remembered that transformer oil forms only a

small proportion of the final products, even from the most suitable crude.

After dehydration, where that is necessary, the crude is subjected to fractional distillation, following which the various fractions are refined with acid, alkalines, absorbents, solvents, or combinations of these methods.

FRACTIONAL DISTILLATION

Distillation forms the cheapest part of the process, and by improved methods modern refiners seek to obtain the maximum effect in this sphere before passing on to the chemical processes. The distillates obtained from an average crude petroleum can be roughly classified as follows: volatiles, which are given off first at the lower temperatures, the products of which go to the manufacture of solvents, alcohols, chemicals, explosives, dyes, perfumes, varnishes and paints, etc.; light distillates which contribute to the manufacture of soaps, aviation and automobile fuel and lamp oil; intermediate distillates which include household and industrial fuels and Diesel oil; heavy distillates which produce among other things transformer oil, switch oil, lubricating oils and various waxes; residue from which is obtained lubricating greases, materials for roofing and flooring, rubber substitutes, asphalts and cosmetics.

Sulphuric acid is the oldest and probably still the most commonly used chemical reagent in the refining of oils. It forms a comparatively cheap treatment and its effects are easily controlled by varying the temperature, the acid concentration and the time of application. The acid when applied has the effect of causing impurities, including water and some of the unstable hydrocarbons, to form an acid sludge. The acid is added to the oil in several stages, the first additions being small in quantity; the mixture is agitated, allowed to settle, and as much as possible of the acid sludge is withdrawn between each fresh application of acid.

The disposal of the acid sludge offers a difficult problem to the refiners; the sludge obtained after treating transformer oil is light and of comparatively low viscosity. It can be used as it stands for the first treatment of residues, or sulphuric acid can be regenerated by a fairly simple process of hydrolysis with water and recon-

* Parts I, II, III, and IV of this series were published in THE ELECTRICIAN of August 15, 22, October 3 and 17, respectively.

centration. The heavier sludge is not easy to handle; a simple but wasteful method is to burn it, but corrosion in the plant and the fact that a considerable amount of sulphur dioxide is released, which would probably devegetate the district, introduce fresh problems. There are in existence several patents covering methods of processing the acid sludge to obtain various by-products such as bitumen, insecticides and fertilisers, the residue usually being a low grade fuel.

Following the acid treatment the oil is generally, but not invariably, washed with a small quantity of water. An alkaline reagent, of which sodium hydroxide is typical, is then applied in much the same manner as that described for the acid treatment. This is designed to remove such impurities as hydrogen sulphide and those organic acids which might normally be found in the crude oil; the alkali also eliminates certain undesirable residue left behind by the sulphuric acid treatment. Sodium hydroxide is the alkali most generally used, but most of the better known alkalis have been tried and used to some extent; an aqueous solution is most commonly used, but other solvents have been used in special cases. Following the alkali treatment the oil is washed with water.

Refining by absorption is a comparatively slow and costly method but it yields very good results. Oils so treated are usually more stable chemically, less liable to oxidation and have a reduced tendency to emulsify with water; all qualities of great importance in a transformer oil. Absorption treatment can be applied immediately following the treatment with

sulphuric acid, dispensing with both the washing and the alkali process; or the whole of the refining, following distillation, can be restricted to the use of absorbents, with excellent results. Some refiners use this method for their transformer oils, believing that the increase in cost is justified by the higher quality of the product obtained.

The absorbents used are of three types; the organic, which includes the various activated charcoals and carbons; the synthetic, of which silica gel is a typical example; and the mineral, which includes the fullers earths, magnesite and alumina, among others.

There are various ways of applying the absorbent method; the absorbent may be very finely divided and then mixed with oil and kept agitated for a certain length of time before being separated by filtering. The oil may be allowed to percolate through a bed of the absorbent by gravity, or the oil may be passed through a somewhat similar bed while in the vapour stage. Finally, the absorbent can be added to the crude and the oil distilled away from it.

After the absorption properties of the material have been exhausted by use, it is thoroughly drained of oil, washed with a solvent, treated with steam at high pressure and finally ignited and burned off. It is then fit for further use in the refinery and shows no loss of efficiency. It is usual to arrange for a continuous process and to have the absorbent material discharged straight from the kiln in which it is burned off, into the refining plant, since in this condition it is highly dehydrating and will pick up moisture unless special care is taken.

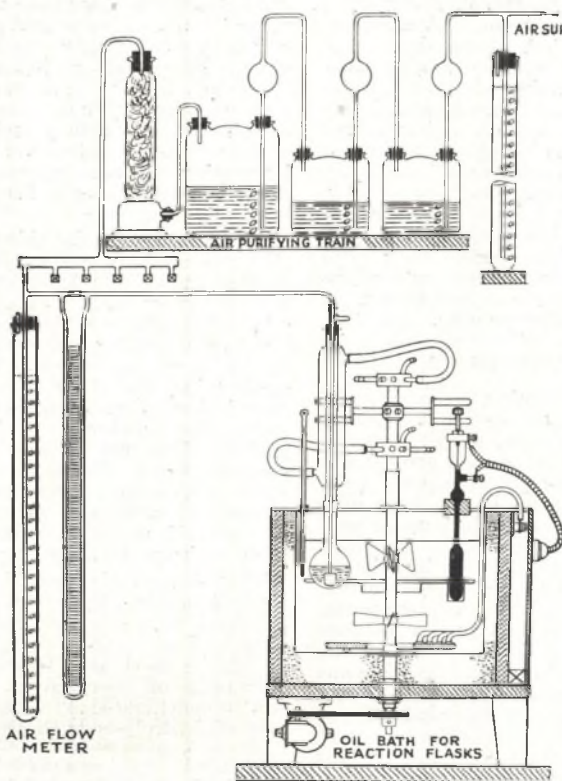


Fig. 1.—Apparatus for sludge test

The use of solvents in refining is a method which has recently come into common practice for the treatment of the lighter petroleum fractions, but their application to transformer oils and lubricants is still small. The method is simple in theory; a suitable solvent for one or a group of impurities is chosen and introduced into the oil which is being refined; after mixing the combination is allowed to settle into layers and then separated. The particular impurities in question will come away with the solvent from which they can be recovered by distillation and the solvent is available for further use almost without loss. The impurities although deleterious in oil, may be useful in other spheres, in which case they can be recovered without having been attacked chemically and can be applied to any purpose for which they are suitable.

The oil with which a transformer is filled has to provide a fluid medium which will convey the heat from the core and coils to the surface of the tank, from whence it is dissipated into the air; it must at the same time provide an insulation of very high value in all the cooling ducts in and around the windings. To comply with both these requirements and at the same time obtain an oil with a reasonably useful life, it is necessary to consider a number of inherent characteristics, desirable values for most of which are detailed in B.S.I. specification No. 148. The most important of these are discussed below in turn.

B.S.S. 148 recognises six grades of oil; two classes A and B and in each class three types distinguished by the low temperature at which they cease to pour; thus six in all. During the late war, however, supplies were perforce restricted to one grade and it seems highly probable that this condition will be voluntarily maintained, and the following remarks have been written on this assumption.

Electric Strength.—This is defined by the voltage at which the oil breaks down between a standard gap. This test is an indication of the condition of an oil rather than its quality; almost any oil would provide figures superior to those specified if it were in good condition. It is difficult to obtain an oil which is absolutely dry but the presence of comparatively large quantities of water will not greatly affect the voltage breakdown value if the oil is otherwise clean; in the handling and utilisation of transformer oil cleanliness must be the watchword at every stage.

Commercial oil inevitably contains a certain proportion of foreign matter in the form of tiny fibres held in suspension, these become soaked with moisture and then the

voltage breakdown value is greatly reduced; the presence of carbon particles in the oil has the same effect. In the presence of organic acids or acidic sludges, water which would normally be held in suspension immediately becomes an emulsion and again the voltage breakdown value suffers; it is important to see that at no time do any of these factors reduce the breakdown value to less than that specified in B.S.S. 148.

Tendency to Sludge.—All hydrocarbon oils will oxidise more or less, according to their type, and this process is accelerated by elevated temperatures, free access to oxygen and by various catalysts of which copper is the best known. One of the results of oxidation is the formation of sludge which varies in consistency from a light coloured flocculent formation suspended in the oil, to a black asphaltic deposit on the core and coils. The formation of sludge increases the viscosity of the oil, tends to close the cooling ducts and as, in addition, any deposit is a poor conductor of heat, the general effect is to increase the working temperature of the transformer. The effect is thus cumulative; as the temperature rises the sludge formation is speeded up and unless the user's maintenance programme includes regular filtering of the oil and cleaning when necessary, the transformer is well on the way to a failure. It has been suggested that the oil contains, in solution, sufficient oxygen to start the process of oxidation, which once started will be self-maintained. This is disputed and in any case the excellent service records of transformers fitted with conservators and, in America, transformers hermetically sealed would prove that such an effect, if it exists at all, must be very small. The best safeguard against oil trouble of this nature is the specification of oil conservators, regular maintenance, and research on the part of the manufacturer to ensure that no material included in the transformer shall be an active catalyst. The sludge value of an oil is defined in B.S.S. 148 as the amount of solid deposit formed in 100 grammes of oil after being kept at 150° C. for 45 hours while air is bubbled through it at the rate of .07 cu. ft. per hour, all in the presence of copper foil to act as a catalyst. The sludge value is the chief difference between grade A and grade B oil in B.S.S. 148; grade A oil has a much lower sludge value and it is recommended for use in transformers which are expected to work near the maximum temperatures permitted by B.S.S. 171. Unfortunately, the experience of transformer users in the years immediately preceding the war did not justify this distinction, and it is unlikely that oils will be ever again refined to the degree necessary to achieve the sludge value specified for grade A oil.

Acid Value.—B.S.S. 148 specifies that transformer oil shall contain no inorganic acid and that organic acids present shall not require more than .2 milligrammes of potassium hydroxide per gramme of oil to become neutralised. Both conditions are easy to meet when supplying new oil. It is, of course, necessary to know that oil is in good condition before it is used for filling a transformer, but unfortunately the values obtained do not give a reliable indication of how an oil will behave in this respect after a few years of service. The formation of organic acids is another by-product of the process of oxidation; the mechanism of their formation is obscure and beyond the scope of this article, but the results of their formation, in the form of corrosion, are only too familiar to many engineers. It is less well recognised that the organic acids provide a further danger in their presence a small quantity of moisture, which would normally cause no trouble, will become emulsified and may so lower the electric strength of the oil that a breakdown which will not necessarily be attributed to the true cause, may occur. The measures suggested as a safeguard against sludge formation are equally efficacious against acid formation.

Flash Value.—Transformer oil gives off some vapour when it is heated and this emission increases as the temperature rises. The flash point is defined as that temperature at which the vapour above an enclosed oil bath will just ignite when a naked flame is applied. The flash point specified by B.S.S. 148 is 145°C ., a temperature which would never be reached under ordinary conditions. The flash point of an oil can be reduced by local hot spots in the transformer, by a continuous static discharge in the oil such as might take place if a clamping structure normally held at earth potential became unearthed, and by an electric arc. All these things may have the effect of cracking the oil and drastically reducing the flash point; a case can be quoted in which an earthing strip ran at a very high temperature due to a high impedance earth fault on the transformer, the fault current being just insufficient to operate the protection. As a result the flash point of the oil was found to be less than 20°C . and the danger of a fire or an explosion due to some simple cause, before this fact was discovered, must have been very great though in this case it was fortunately avoided. The flash point of the oil should be a routine maintenance test and if a fault has occurred, or trouble is suspected in a transformer, the flash point should be checked immediately.

Viscosity.—The efficiency of the heat transfer from the transformer to the tank depends upon the density, specific heat and the viscosity of the oil. The two

former characteristics are inherent in the oil and can be changed but little; the viscosity can be controlled over quite a wide range and from the engineer's point of view the lower the better. This quality is, however, tied up with others, notably the flash point and generally any attempts to lower the viscosity results in a lower flash point; the value specified in B.S.S. 148 may be regarded as an optimum figure. The viscosity value is defined as the length of time which a certain quantity of oil takes to pass through a certain standard orifice. The specified value in B.S.S. 148 is given at a temperature of 15.5°C . and although curves are included in the specification showing the general shape of the viscosity temperature characteristic, they do not form part of the specification and cannot be regarded as part of a supplier's guarantees. The transformer designer is chiefly interested in the oil viscosity in the higher temperature ranges, and although the average oil does not depart far from the above-mentioned curves, a manufacturer should occasionally check his supplies to ensure that no wide discrepancy creeps in.

Evaporation Loss.—The loss of oil by evaporation at normal transformer temperatures is very small and it is very unlikely that the oil level will fall sufficiently, from this cause, to interfere with the transformer cooling. A periodical check on the oil level of all transformers should be made but any discrepancy discovered is most likely to be due to a slight leak having developed. Oil vapour and air can form an explosive mixture but this danger can be disregarded in healthy transformers; such accidents as have occurred in the past have been, in the author's opinion, invariably due to a lowering of the flash point of the oil caused by one of the reasons discussed earlier in this article.

Pour Point.—The cold test, that is the cold temperature at which an oil ceases to pour, is one of the characteristics by which the various grades of oil covered by B.S.S. 148, differ. If one grade only becomes the standard practice in this country, the pour point will be fixed most probably at -30°C . and this will adequately cover all transformer applications in the British Isles.

Freedom from Moisture.—Transformer oil must be reasonably free from moisture to be suitable for service and B.S.S. 148 recognises the crackle test as an acceptance test in this respect. When a small quantity of oil is heated to boiling point in a test tube or when a metal rod heated to dull red heat is inserted into a container of oil, no crackling, indicating the presence of free moisture, may take place. Although

this test may sound a little rough and ready, an operative, with very little practice, quickly becomes remarkably accurate when using this method.

Fig. 1 shows the apparatus set up for the sludge test; an exact description of all the standard tests is beyond the scope of this article but B.S.S. 148, or the publications on testing methods issued by the Institution of Petroleum are available; both contain full details. The illustration has been chosen as an example of the rigid control necessary to obtain consistent and reproducible results in any tests involving transformer oil. The method of taking oil samples is exactly specified; the copper foil catalyst, to be seen in the bottom of the reaction flask, is controlled not only as to size but to position and even as to the method and amount of preliminary cleaning which it has to receive. The air, which is bubbled through the flask at a fixed rate, has to be dried and

purified in a specified manner; the air purifying train consists of successive flasks containing an aqueous solution of silver nitrate, an aqueous solution of potassium hydroxide, pure sulphuric acid and finally, a glass wool filter. The oil bath used to heat the reaction flasks is electrically heated, thermostatically controlled to 0.5° C. and mechanically agitated. The inlet temperature and the temperature rise of the water supplied to the condenser have to be kept within specified limits. The method of separating the solid deposit and obtaining its weight is likewise exactly specified. This forms a good example of the work done by our oil chemists in devising and carrying out tests to control the quality of the oil supplied to transformer manufacturers and users, oil which by its complex nature makes a standard production difficult to achieve.

(To be continued)

Domestic Electrification in U.S.A.

THAT even in America the individual is not always given freedom of choice of fuel was stated by Miss Joan Whitgift in the course of a paper on "Some Aspects of Domestic Electrification in the U.S.A.," read at the Institution of Electrical Engineers, London, on Thursday, October 23. As the holder of the first Caroline Haslett Trust Travelling Exhibition, Miss Whitgift spent three months, mainly in the Eastern States of America, studying domestic electrical development and equipment.

Mr. Percy Good, president of the I.E.E., introduced the lecturer to the audience who were largely delegates to the E.D.A.-E.A.W. conference for housecraft advisers and demonstrators.

Miss Whitgift said that in the U.S.A. no equipment was rented, but hire-purchase was in operation. American women bought apparatus for its appearance and took its efficiency for granted. Cookers were always of the horizontal type, streamlined and easily taken to pieces for cleaning. More small appliances for cooking food were used in the homes than in this country, and they were not run off the cooking circuit. The popularity of frozen foods in America was influencing the design and capacity of refrigerators and a new piece of equipment was the home freezer. Kitchen sinks were made by the manufacturers of electrical equipment, having on one side a washing-up machine and on the other an ordinary sink containing a disposal unit which ground up all kitchen waste and disposed of it down the drain. Many manufacturers were pro-

ducing three cabinets combined in what appeared, when closed, to be a well-constructed white bench, containing respectively, a clothes washer, a dryer and an ironer—three pieces of equipment considered to be essential to modern homes. As in England, the tendency was towards a combined kitchen-living room with a utility room adjoining, and many supply authorities and manufacturers had set up kitchen planning bureaux to advise the public.

The home economics women of the U.S.A. were very highly skilled, taking a home economics degree after a 4-year university course, and often continuing study for a further two or three years. They had gained the complete confidence of the general public, and had done much to improve the standard of all things manufactured for the home.

In reply to questions, Miss Whitgift said she did not see any British-made electrical domestic equipment, but the Americans were interested in anything new produced here. Cookers and washing machines in the U.S.A. cost about £60 each. She had seen American equipment, claimed to be safe, that did not come up to British safety requirements. In Philadelphia there was a fixed charge of 6s. 2d. per month, plus .99d. on all units used, for domestic consumers. In other places the tariffs were about the same.

Lantern slides were shown, illustrating American planned kitchens, as well as domestic appliances.

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. P. J. TIERNEY as chairman, Mr. H. J. Guthrie, vice-chairman, and Mr. J. D. Ferguson, past chairman, were elected at the annual meeting of the Irish centre of the I.E.E.

MR. FRANK A. VAUGHAN, a director of British Oil Engines (Export) Ltd., with whom are associated the Brush Electrical Engineering Co., Ltd., has set out on an eighteen months' tour of the Near and Far East for the purpose of visiting existing agents and concluding new agreements.

MR. T. E. H. BIRLEY, overseas representative of B.I. Callender's Cables, Ltd., was, on October 16, presented with the Order of the American Legion of Merit (Degree of Officer) by Major-General Clayton Bissell, United States Military Attaché at the American Army Headquarters in London. The award was made in recognition of Mr. Birley's work from 1942 to 1945 as assistant secretary on the War Cabinet secretariat in Washington, where he served with the rank of group captain under Field Marshal Sir John

chester, from September 29 to October 1. Leading parts were taken by Barbara



Scene from the play "We Proudly Present," produced by the M-V Dramatic and Operatic Society

Trevor, Mary Matthias, Ann Buchanan, Justine Cavanagh, Brian Riley, Michael Fitzgerald and Harold Carter, and they and the society's senior producer, Harry Matthias, are to be commended upon the success achieved.

MR. RLAZ AHMAD, director of Pakistan's broadcast service, flew to London to see our radio equipment. He is in charge of a three-year plan to build new transmitters at Karachi and Hyderabad, Sind, and is authorised to spend £200 000. Having seen leading British manufacturers, Mr. Ahmad has flown to America to see what that country has to offer. On his return to London he will decide which equipment is to be installed in Pakistan.

LT.-COL. T. WALMSLEY is taking up the appointment in South Africa of managing director of Dorman and Smith (Pty.), Ltd., a new company, which will be a subsidiary of Dorman and Smith, Ltd., and DS Plugs, Ltd., of Manchester. Col. Walmsley, who received his early training with the Southport electricity department, was for twenty-four years on the staff of British Insulated Callender's Cables, Ltd., as a contracts engineer, and then as manager of their contracts estimating department. His war service with the Royal Corps of Signals included over five years in Middle East and Europe.

MR. SYDNEY ROBERTS, sales personnel manager, for Hoover, Ltd., has been appointed field sales manager, a new post created by the company to relieve



MR. T. E. H. BIRLEY receiving the decoration of the American Legion of Merit

Dill. The importance of his work was recognised in 1946 by the award of the O.B.E.

The Metropolitan-Vickers Dramatic and Operatic Society, chose as their first production for the 1947-48 season, Ivor Novello's comedy, "We Proudly Present," which was played to full houses at the M-V. Club Theatre, Trafford Park, Man-

Mr. C. H. Crowlie, sales manager, of some of his increasing responsibilities. Mr. Crowlie's activities will be largely devoted to planning and sales administration.

MR. A. McWATT GREEN has been appointed by Ekco-Ensign Electric, Ltd., as their sales representative for Western Scotland (excluding Glasgow).

MR. A. J. HUSSEY has been appointed manager of the repairs and rewinding department of the Johnson Engineering Co. Since 1930 he has been with Batwin Electric Motors, Ltd., in their works and service department.

MR. T. COUNTER, upon his retirement from the service of the Wessex Electricity Co. after 46 years, has been presented with a set of bowls woods and a cheque, whilst a bouquet was given to Mrs. Counter. The presentations were made by Mr. R. B. Brown, general manager.

MR. E. DINSDALE has been appointed by A. Reyrolle and Co., Ltd., as district engineer for mining equipment in their Glasgow office. He succeeds Mr. W. Rochester, who has been appointed chief electrical engineer for the Central East area of the Scottish division of the National Coal Board.

MR. A. E. CUTTER, after eighteen years' service, the last seven years as publicity manager, with the Consolidated Pneumatic Tool Co., Ltd., has relinquished that position to take up the appointment of advertising manager with Blaw Knox, Ltd. Mr. Harold S. Parsons, assistant publicity manager with the Consolidated Pneumatic Tool Co., Ltd., since November, 1945, has been appointed publicity manager as from October 1.

MR. R. HUNTER (marine engines), Mr. E. Leslie Brooks (heavy engines), Mr. R. F. Norris (medium engines), and Mr. J. C. Gale (small engines), have been appointed by Associated British Oil Engines, Ltd., as divisional sales managers, each with a separate team of sales en-

gineers, to handle different classes of trade. Each is directly responsible to the general sales manager, Mr. A. P. Quarrell.

MR. E. C. HALLAM, manager of the Wantage, Berks, branch of the Wessex Electricity Co., has been elected secretary of the Wantage National Fuel Economy Committee.

DR. MATTHEW LUCKIESH, director of the General Electric Co.'s lighting research laboratory, of Cleveland, Ohio, has been awarded the I.E.S. Gold Medal in recognition of "meritorious achievement which has conspicuously furthered the art or knowledge of illuminating engineering." The medal was presented to Dr. Luckiesh by Mr. G. K. Hardacre, I.E.S. president, at a banquet in connection with the I.E.S. 1947 National Technical Conference in New Orleans in September.

MR. J. H. WILLIAMS, of J. T. Williams and Sons, Bermondsey, left £59 376 (net £59 296).

MR. A. T. PEACOCK, a director of Peacock and Waller, electrical engineers, Hinkley, left £9 633 (net personalty £9 550).

MR. J. F. BREEN, late managing director of the Mersey Insulation Co., Ltd., left £26 136, net £26 008.

Obituary

A memorial service for Sir Leonard Pearce, whose death was announced in our last issue, will be held at Westminster Chapel, Buckingham Gate, S.W.1, at 12 noon on Tuesday, November 4.

MR. GILBERT JACKSON, lamp representative, attached to the Liverpool branch of Philips Electrical, Ltd., on October 19, aged 42 years.

THE EARL OF LYTTON, a vice-president and past president of the B.E.D.A., on October 25, aged 71 years. He was chairman of Central London Electricity, Ltd., London Associated Electricity



The audience at one of the lectures in the 49th illumination design course at the E.L.M.A. Lighting Service Bureau, 2, Savoy Hill, London

Undertakings, Ltd., and of the London Power Co., Ltd.

MR. CLAUDE GREENER CADMAN, late engineer-in-chief, Post and Telegraph Department, Malaya, on October 22. He was a member of the I.E.E. and of the I.Mech.E.

MR. R. W. YOUNG, who had been with the S. W. and S. Electric Power Co. and its associated companies for 44 years, on October 14. After an initial period with the Birmingham and Midland Tramways Co., he joined the S.W. and S. Co. as sub-station installation engineer and held that post until about 1935, when he was given charge of the switchgear construction department in the company's workshops at Bromsgrove.

MR. W. FERRER, divisional engineer for the Northern division of the S.W. and S. Electric Power Co., on October 14. He had seen 34 years' service with the company, first in the Smethwick power station, followed by a period, from 1928 to 1938, as frequency change engineer, when he was responsible for carrying out standardisation of frequency in that part of the company's area where the supply was given at 25 cycles. This included the heavy industrial area of Smethwick, Oldbury, Dudley, and Halesowen. From 1938 until 1946 he occupied the post of power consumers' engineer at the central office, and was then divisional engineer from 1940 until his death.

MR. H. J. ALLCOCK, on October 24, aged 50 years. He was educated at

Taunton School and University of Wales from which he graduated in 1921, obtaining his M.Sc. in 1932. He served as a captain in the Royal Welch Regiment during the 1914-1918 war. After completing a college apprenticeship with the Metropolitan-Vickers Electrical Co., Ltd., he was appointed technical liaison engineer with Westinghouse Co.,

U.S.A. He joined the staff of Callender's Cable and Construction Co., Ltd., in 1927 as a technical assistant and was appointed process manager in 1937. In 1941 Mr. Allcock organised Government war-time requirements, and was the first chairman of the Cablemakers' (War Emergency) Technical Committee. In 1942 he took up duties with the M.A.P. as Director-General of Communications Equipment

and resigned in 1943 owing to ill-health. He resumed his duties with the Callender Co. as controller of the Northern factories in 1944. Following the amalgamation with British Insulated Cables, Ltd., Mr. Allcock was appointed deputy to the production director of British Insulated Callender's Cables, Ltd. His professional activities were wide and varied, and he was the author of "The Nomogram," published in 1932. Shortly before his death he had been engaged in the preparation of the report of the Joint Committee on Practical Training in the Electrical Engineering Industry, of which he was deputy chairman, and he was due to present the report as a paper to the I.E.E. on November 20. He was a member of the I.E.E., the I.Mech.E., and the Am.I.E.E. He was a director of Radiogramophone Development Co., Rotunda, Ltd., the Steadfast Rubber Co. (England) Ltd., United Insulator Co., Ltd., Electric Panels, Ltd. Cremation took place at Golders Green on October 28. A memorial service will be held at the Church of St. Mary-le-Strand, Strand, on Tuesday November 4, at 3 p.m.

Individualists' Society

THAT an iron curtain had been dropped between Britain and the outside world was asserted by Mr. J. Gibson Jarvie, chairman of United Dominions Trust, Ltd., in a luncheon address to the Society of Individualists and National League for Freedom in London, on October 23. Whether the past was made up of "good old days" or "bad old days," history, he said, compelled all to admit that under the system and conditions which our present dictators professed to hate, their forefathers had built the greatest empire the world had ever known. But those days, good or bad, were gone. To-day we were a slave people in an island concentration camp, cut off from the rest of the world.

An iron curtain had been dropped between us and all other nations. We could do no act, nor engage in any business without a "by-your-leave" from some State servant. Newsprint had been cut in order to muzzle the Press and other criticism. Industries had been nationalised, but without any obvious advantage. The first step to recovery, said Mr. Gibson Jarvie, was to get the present Government out of office, which might happen sooner than some people expected. There must be a new Government and the first act of that Government must be to cut every restrictive control and allow enterprising and able men to make good at their own jobs.



MR. H. J. ALLCOCK

Book Reviews

Electricity, Principles, Practice, Experiments. By CHARLES S. SISKIND. (New York and London: McGraw-Hill). Pp. 448. Price 13s. net.

The first duty of a good teacher is to present his subject in a clear and interesting style. Prof. Siskind has certainly fulfilled this requirement in the present volume. The subject is treated from a highly practical standpoint in an easy, readable style and is amply illustrated with good clear diagrams and a few well-chosen photographs. Although the treatment is elementary in character, it covers a wide ground and a large number of numerical examples are given and practical experiments described.

To electrical men who are used to a more academic style, there will appear to be a lack of precision in many statements and definitions, but a beginner who reads carefully through the book and tests his knowledge after each chapter by answering the numerous questions and working the examples, will undoubtedly acquire a general understanding of electrical principles and some facility in solving quite a variety of the simpler problems that arise in everyday electrical engineering.

The distinction made between "instruments" and "meters"—the one is said to measure or indicate and the other to record or register—may puzzle a beginner who immediately afterwards sees references to *ammeters*, *voltmeters* and *wattmeters*, especially when, later, it is stated that in a certain case a voltmeter will register about 1.5 V.

In Chapter 111 on Direct-Current Electric Circuits and Measurements, the only illustration and description of a watt-hour meter is that of an a.c. 60 cycle meter, which may confuse the reader. Many other criticisms of detail may be made, such as the explanation of the sine wave, which might have received more care, though not necessarily more space. Another example is a statement on p. 131, Exp. 13—"Note that as the resistance is decreased, the current will increase, *just the reverse of the conditions existing in the series circuit, Exp. 12.*" The *italics* are the reviewer's. Just what had the author in mind?

Again, in questions at the end of Chapter IV it is asked "By how many degrees does the current lag behind the voltage in a series R/L circuit?" No ratio of R/L is given. A printer's error has apparently occurred on pp. 296 and 297 where diagrams 122 and 123 should be interchanged.

In Chapter VIII on Motors, the de-

scriptions are brief, but simple and clear explanations of fundamental principles—particularly those relating to the action of the shaded pole and repulsion motors—are especially to be commended. Only a brief reference is made to polyphase systems and motors, pp. 397 to 404. After the final chapter there is a list of American educational films on electrical subjects, followed by an appendix containing "Brief Histories of Great Men in Electrical Science and Important Electrical Developments." In the list of the latter one reads with some amusement (but not without appreciation) "1929—The first automatic waffle iron was developed."

Altogether, the book is good value and fulfils its avowed purpose which, in the author's words, is "to present the general elementary principles of direct- and alternating-current electricity, to show how these principles apply to the construction and operating characteristics of the more common types of circuits, devices, and machines, and to illustrate how these principles may be verified by the performance of simple experiments with easily obtainable and readily constructed apparatus."—T. A. L.

Plastics for Electrical and Radio Engineers (2nd edition), by W. J. TUCKER and R. S. ROBERTS. (Kingston, Surrey: The Technical Press, Ltd.) Pp. 167, with 28 Figs. and 18 Tables. Price 15s. net.

The applications of plastics in the electrical and radio industries has increased so greatly since pre-war days, and the variety of materials available is now so vast, that the task of combining in one volume, a survey of the more important compounds and a guide to the design of electrical components embodying plastics, is formidable. In this, however, the authors have achieved an appreciable degree of success. Their book, of which this is the second edition, forms an excellent general introduction to a complex subject, and contains much information of value, equally to the student and to the manufacturer. After a short account of the molecular construction of plastics, the book opens with comprehensive notes on the better known materials—this chapter including an up-to-date account of silicones—and then passes to a valuable section on the assessment of electrical properties. Extracts are quoted from the relevant B.S. specifications and methods are described of determining such properties as resistivity, power factor and permittivity. There follows a guide to the choice of materials,

in which advice is given on selecting a plastic for a particular task which will be both adequate for operational needs and yet not unnecessarily increase the cost of the finished product. The chapters so far described occupy just over half the book. The remainder deal mainly with matters such as compression, injection and transfer moulding, extrusion and radio-frequency dielectric heating. The two final chapters are devoted to protective coatings, these including waxes, resins and silicone varnishes, and with enamelled, sleeved and coaxial cables. The book is well illustrated and the inclusion of 18 tables in which the electrical and mechanical properties of a wide range of materials are set out for easy reference is a useful feature.

The Foreman's Guide, by R. B. HOVEY. (London: Sir Isaac Pitman and Sons.) Pp. 65. Price 4s. 6d. net.

In forming a link between management and work-bench, the foreman fills a position the importance of which it would be hard to exaggerate at the present day. Mr. Hovey's little book, of which this is a second edition, can be read with profit both by those whose task it is to appoint foremen from the ranks of industry and by those who hold, or aspire to hold, the position themselves. The author rightly takes the view that the foreman who will get the best from his men is one who tempers discipline with encouragement, and he gives numerous instances of how this may

be done. A typical example is "give your men credit for doing their best, and if a mistake is made put it down to forgetfulness or inexperience, but if the error is repeated in a deliberate way then you can act with a clear conscience." The first-class foreman, Mr. Hovey as a company director would probably agree, is born rather than trained, but in industry to-day the demand for good leaders far exceeds the supply. Those who wish to take advantage of this shortage may derive considerable benefit from the author's advice.

Industry and Research FEDERATION OF BRITISH INDUSTRIES. (London: Sir Isaac Pitman and Sons.) Pp. 136. Price 10s. 6d. net.

On March 27 and 28, 1946, a conference, convened by the F.B.I. to discuss "the dependence of progressive industry on research and the application of science in promoting industrial efficiency and competitive power in world markets, with a higher standard of living," was held in London. More than 1 400 delegates from home and overseas attended, and the event was marked by several notable speeches delivered by leading industrial and scientific personalities. The proceedings of the conference have been gathered together in this book, which contains the full text of the papers delivered, as well as a summary of the discussions at each of the last three sessions.

750 MW Rhodesian Power Scheme

A PLAN for building a 750 MW hydro-electric plant on the Zambesi River was announced last week by Sir Miles Thomas, vice-chairman of the Nuffield Organisation. The scheme, which would be part of a larger project for producing steel in Africa, had already been approved in principle by the Northern and Southern Rhodesian Governments and the John Brown and Thomas Firth interests in Sheffield, the parties mainly concerned, and would involve the construction of a dam 300 ft. high enclosing 53 million acre-feet of water. This should be sufficient, Sir Miles said, to provide a constant flow and level out the difference between the river's outflow in the dry and rainy seasons. It was calculated that current would be supplied at less than a farthing a unit, and the scheme would also enable many hundreds of thousands of acres to be brought into cultivation through irrigation, thus increasing the food productivity of the country.

Sir Miles emphasised the necessity for

development in Africa, including the processing of raw materials at site. There was no point, he said, in shipping natural ore and materials such as chrome in its raw state over an expensive rail, port and sea system to a country thousands of miles away for processing. The ample supply of electricity given by the Zambesi scheme would enable the iron-ore that was abundant in the district to be refined, and only the semi-finished products exported. It had been calculated that the cost of ingots produced by this method would be 25 per cent. or more, below the present-day prices. The money invested in transportation and in the erection of plants for processing African materials would pay Imperial dividends. When preliminary explorations and analyses of mineral deposits had been completed—stage one of the exploitation had already been finished—the Northern and Southern Rhodesian Governments were to provide £9 million each and the steel interests £5 million.

Westmorland Rural Network

I.E.E. NORTH-EASTERN CENTRE CHAIRMAN'S ADDRESS

AN interesting account of the rural supply company (Westmorland and District E.S. Co., Ltd.) of which he is a director, was given by Col. G. G. Mallinson in his Chairman's Address to the I.E.E. North-Eastern Centre on October 13.

After opening his address with a tribute to some of the engineering achievements of Tyneside and the North-East Coast, in particular the new turbo-electric ship propulsion machinery recently developed by Parson's and Reyrolle's, Col. Mallinson said that his company was formed in 1933 to take over an order dated 1932; they were the third owners, previous holders apparently shrinking at the bleak financial prospects. Interesting problems were numerous, and but for private enterprise it was doubtful if the undertaking would have been started. This rural area comprised some 700 miles with a population of about 47 000, or about 67.2 per sq. mile. The average population per sq. mile in all rural parishes in Great Britain was 115—roughly double that in Westmorland. The country covered by the undertaking ranged from the desolate Shap Fells to the beauty spots of the Lake District and the Eden and Lune Valleys.

Construction began in June, 1933, and a supply was first given in September of that year. There were at the end of 1946 9 399 consumers connected, representing a connected load of 39 000 kW. The topography of the area necessitated splitting the system into two areas, north and south. In the north, the demand was 3 230 kW and in the south, 3 704 kW. Last year, 24 million units were sold, of which bulk supplies accounted for seven million, and the undertaking was supplying 488 farms. There were 85 yds. of line per consumer and the approximate annual consumption per head was 515 units, compared with 970 units in the country as a whole.

FEEDER SYSTEM

Bulk supply was taken from the C.E.B. at Penrith in the north and Kendal in the south. The supply at Penrith was at 10 500 V, and duplicate feeders ran from the C.E.B. lines by 11 kV lines and cables to the company's sub-station at Clifton Cross. At Kendal, the bulk supply was taken from a C.E.B. 132/33 kV sub-station, and thence by duplicate underground 33 kV three-core Hochstadter type cables to the company's main sub-station at Holme Drive. They had installed

three 2 000 kVA transformers at Kendal, and at both main sub-stations automatic switchgear was fitted, since the stations were unattended. The general layout of the h.t. system was by two ring mains, north from Clifton Cross and south from Kendal, and the nine lines were run at 11 kV with 22 kV insulators throughout.

It was known that the northern area was very susceptible to lightning storms, and a continuous earth wire over the conductors of the o.h. lines was thus incorporated in the design. This ensured considerable protection from lightning damage, but bird-loading had on occasion brought the wire down to earth level. In the south, the continuous earth wire was carried under the conductors.

SWITCHING STATIONS

Explaining that the network comprised 300 miles of h.t. mains and 150 miles of l.t., Col. Mallinson said that there were 16 switching stations on the system, seven in the north ring and nine in the south, and they contained circuit-breakers of 600 A, 100 MVA breaking capacity, manually operated. Protection was shunt trip-operated directional and non-directional over-current and earth leakage fault relays. Solenoid auto-reclosing mechanism had been fitted on the main feeder breakers in both areas. The C.E.B. had allowed them to fit a Petersen coil in the southern area, and the expense had been thoroughly justified. In the north, they had recourse to lightning arrestors of the crystal valve type.

Originally, pole-mounted distribution transformers were connected solidly to the line. This soon gave trouble, and now every transformer was connected through a "D" fuse; these had been very successful. On some remote spur lines they had installed a modification of this apparatus with a repeater action allowing a second fuse to come into action when the first operated. To overcome excessive voltage drop, h.t. 3 000 kVA voltage regulators were provided.

Dealing with the consumers, Col. Mallinson remarked that they had had difficulty in the early days in getting people electrically-minded. They naturally had had to offer a hired wiring scheme, and at first about 80 per cent. of these did not provide sufficient revenue to meet charges. The difficulty was overcome by presenting an electric iron to each h.w. consumer, and in one quarter all the installations began to be remunerative.

Electricity at the Dairy Show

DISPLAY OF EQUIPMENT AND VEHICLES AT OLYMPIA

THE wide application of electricity to the varied operations associated with dairy farming and the bottling and distribution of milk, is illustrated by the extensive and comprehensive display of equipment and electric vehicles to be seen at the sixty-first annual show of the British Dairy Farmers' Association, which opened at Olympia, London, on Tuesday morning and will conclude this (Friday) evening. There are nearly 200 trade exhibitors, most of whom have electrically-operated appliances on their stands.

Demonstrations of the working of milking machines, bottle washing, filling and capping machines dealing with thousands of bottles per hour; the sterilising of churns and other utensils; cooling, the latest refrigerating and air-conditioning equipment and many other processes are being watched with interest by constant streams of visitors.

Electrical aids to the poultry breeder, such as incubators, brooders, egg grading and egg testing apparatus were inspected with interest.

The British Electrical Development Association have a stand at which information and advice is given on all possible uses of electricity on the dairy farm and enlarged photographs of typical installations are displayed.

The General Electric Co., Ltd., are showing a range of electric sterilising chests, a churn stool, a dairy steaming unit, two steam raisers, a water heater and a selection of Osram lamps. G. W. B. Electric Furnaces, Ltd., have on view steam raisers and electrode boilers of the Autolec type.

A comprehensive display of electric refrigeration equipment incorporating the latest developments in milk cooling apparatus, dairy cold rooms, service cabinets, condensing units, domestic refrigerators and ice cream store cabinets is staged by Frigidaire, while Kelvinator, Ltd., the Hertford Refrigeration Co., Ltd., the Lightfoot Refrigeration Co., Ltd., L. Sterne and Co., Ltd., and York Shipley, Ltd., are staging typical examples of their products.

Battery electric vehicles for a variety of uses claim considerable attention. Among those exhibited are "Brush-Bred" delivery models and a Brush "Pony" truck on the stand of Henlys, Ltd.; vans from 15 to 40 cwt. by Victor Electric Vehicles; Douglas A.C.M. 10-15 cwt. and 20 cwt. vans by Douglas (Kingswood), Ltd.; the Wilson M.W. series of vehicles

and battery chargers by Partridge Wilson and Co.; the "Manulectric" pram by Sidney Hole's Electric Vehicles; and the "Electruck" by T. H. Lewis, Ltd. Traction batteries, as well as stationary batteries and emergency lighting equipment, are displayed by the Tudor Accumulator Co., Ltd.

Other exhibitors include the Alfa-Laval Co., Ltd. (milk processing machinery); the Aluminium Plant and Vessel Co., Ltd. (pasteurisation plant, storage tanks, and so on); R. A. Lister and Co., Ltd. (electric sheepshearing and cattle clipping equipment, pumps, Diesel-electric generating sets); Short and Mason, Ltd. (industrial process instruments); and the U.D. Engineering Co., Ltd. (heavy duty equipment for milk processing plants, including refrigerating, bottle washing, filling, capping, can washing machines and conveying equipment); Graham-Enock Manufacturing Co., Ltd. (pasteurisation, refrigeration, bottle and crate washing and conveying systems); Cherry-Burrell, Ltd. (milk pasteurising, and bottle-filling equipment).

Housecraft Advisers

SPEAKING at the second annual general meeting of the Association of Electrical Housecraft Advisors, held on Saturday, October 25, the Chairman (Miss M. G. Gosse) recalled that the main reason for forming the association had been to provide a negotiating body that would be representative of the experienced and trained women of the industry. It was, therefore, a matter of great concern to them that numerically they could not claim this representation at present.

As an instance of the type of change now taking place in the industry, which made it more than ever necessary for them to increase their membership as quickly as possible, the Chairman mentioned a wage council that was in process of formation. That meant, she explained, that whatever their qualifications, they would all be classed by the council in the same category as saleswomen in the electrical departments of large stores. Fortunately, the B.E.A. had lodged a protest. Their association should have been in a position to back that protest, but with their present membership they would not have a chance of being heard.

Concluding, the Chairman said she would like the Electrical Development Association to realise that the hard work done by the committee set up to bring to the notice of the industry the importance of giving housecraft advisors, salaries commensurate with their status was appreciated.

Equipment and Appliances

Conduit Connector Box

With an elongated shape intended to give it certain advantages in appearance and space-saving over conventional round connector boxes, the pressed steel "Connectabox" made by Metway Electrical



The Metway conduit connector box

Industries, Ltd., of King Street, Brighton, 1, is a development likely to interest wiring contractors. The box is designed to take $\frac{5}{8}$ in. or $\frac{3}{4}$ in. close joint conduit, but can also be used for screwed conduit installations. The makers recommend the use of "Screwit" connectors in association with the new box.

Magnetic Tachometer

A development of the A.T. speedometer, known as the A.T. hand tachometer, is now being manufactured by A.T. Instruments, Ltd. (a subsidiary of Smith's Industrial Instruments, Ltd., of London, N.W.2). Of the compensated magnetic type, the mechanism comprises a rotating permanent magnet which influences an aluminium alloy drum carrying the pointer, the drum and pointer assembly being controlled by a return hair-spring. A speed range of 0-50 000 r.p.m. is provided by a gearbox



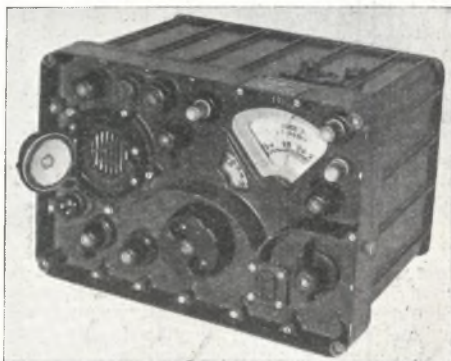
The A.T. magnetic tachometer and case

carried in the casing, and a second design, with a speed range from 0-10 000 r.p.m., is now nearing the production stage. The incorporation of an idler gear and rocking arm in the drive automatically provides unidirectional drive to the operating magnet irrespective of the direction of rotation of the driven shaft, while another provision is a push-button control to lock the indicating pointer at any desired speed,

tee the accuracy of the instrument to within $\pm \frac{1}{2}$ per cent. over the normal range of ambient temperatures. The driven spindle has a hardened square end for use as a driving centre at low speeds, while, in addition to detachable male and female rubber centres, a disc is supplied for measurement of surface and cutting speeds.

Waterproof Receiver

A new general-purpose communications receiver, weighing only 21 lbs. and capable of operating, according to its makers, Philips Electrical, Ltd., even when totally immersed in water, has recently been de-



Philips waterproof communications receiver

veloped. It is suitable for a.m. or f.m. reception and has a built-in speaker and provision for headphones. The circuit comprises: one stage of r.f. amplification; mixer and local oscillator; three stages of i.f. amplification—the last stage acting as limiter and discriminator on f.m.—and second detector. Two a.f. amplifying valves are connected in push-pull and a beat-frequency oscillator is connected to the control grid of the last i.f. valve. The receiver will work over the wave-range 1-20 Mc/s in four bands.

Coal Meter Development

A counting mechanism indicating the quantity of coal delivered to mechanical stokers directly in weight, instead of, as previously, in terms of volumetric units which had subsequently to be converted into weight, is a development of the Lea Recorder Co., Ltd., of Cornbrook Park Road, Manchester, 15, for attachment to their range of Romer-Lea coal meters. The well-known principle on which the meters operate is that of a length of chain—

usually about six ft.—immersed in the coal in a vertical or semi-vertical chute. Coal running down the chute drags the chain with it, while the free end of the chain passes over a sprocket on the counter. The meters require calibration in terms of chute dimensions and, where the new weight-indicating unit is fitted, further adjustment is necessary.

Fused Tee Boxes

The merits of the fused tee boxes introduced this year by the Bowthorpe Electric



A Bowthorpe tee box

Co., Ltd., the makers state, are that the wiring contractor has at his disposal an overhead bus-bar wiring system at an economical cost, making use of conduit and cable as purchased from his normal supplier, while, as a result of the light weight smaller supports are needed, less frequently spaced than with other methods. The boxes, which are of pressed steel fixed by two screws, are fitted with Sloydlock rewirable fuses and incorporate a specially designed insulated line tap which is fully shrouded and will accommodate 7/.064 in.-7/.029 in. cables. The sizes available range from 250 V, 5 A, to 500 V, 30 A.

J. and P. Foremen

THE annual dinner of the J. and P. Foremen's Association was held at the R.A.C.S. Restaurant, Woolwich, on October 17. Mr. G. Leslie Wates, chairman and joint managing director of Johnson and Phillips, Ltd., was in the chair, supported by Mr. W. Glass, joint managing director, Mr. R. W. C. Reeves, a director, and the committee of the association. The guests included members of the J. and P. management; also Messrs. J. B. Dean, W. F. Randall, B. H. Musgrave, (directors) and F. Leighton (works manager) of the Telegraph Construction and Maintenance Co., Ltd.

Mr. S. Simmons, chairman of the Foremen's Association, coupled the name of the company with that of Mr. Wates in his toast of "The Chairman," and spoke of the close co-operation achieved during the past year as a result of the regular monthly meetings which the foremen had

had with the departmental managers.

Responding, Mr. Wates mentioned that he had recently seen a diary kept in 1877 by Mr. Johnson, one of the founders of the company. It was refreshing, he said, in these exceedingly difficult times to note the many resemblances between that time and the present. Even then the company had many contacts with the Telegraph Construction and Maintenance Co., and it was also interesting to see that the combination of the letters "J" and "P" in the now familiar manner of the "J. and P." trade mark had its beginning in that diary of Mr. Johnson's.

A smoking concert followed the dinner.

Illuminating Engineers

IN a lecture before the Liverpool Section of the Illuminating Engineering Society, on October 21, Mr. J. N. Aldington, of the Siemens Research Laboratories, Preston, spoke on "The Evolution of an Electric Lamp." The various stages of evolution from a simple discharge tube through high-voltage tubes and hot-cathode tubes to an interesting new development were described, and mention made of the way in which new lines of development and research were made possible by fundamental work on emission phenomena which led to a major step forward with the introduction of the hot-cathode lamp.

The possibilities of cold-cathode lamps were, however, by no means exhausted, and the field of research was further extended after the lapse of some years as a result of the development in the Siemens laboratories of a range of high-current flash discharge tubes of very high light output and by a study of their characteristics. This led the author to conceive the possibility of producing a high-current arc condition in some of the rare gases and he has been able to translate this into practical form as a new light source termed the "gas arc."

The theoretical considerations leading to this development and the practical difficulties which were overcome in the course of the work were described and it was emphasised that the gas arc is a stage in a continuous evolutionary process. With it a high light output can be obtained from quite small units, for example, a 10 kW lamp measures only some 2 x 20 cms. It is essentially a low-voltage high-current device producing light by complex atomic and temperature processes which give a dominant continuous emission in addition to the characteristic rare gas spectrum. Its colour is close to that of daylight and in one water cooled embodiment the emitted flux contains very little heat radiation.

Electricity Supply

Accrington.—Authorisation has been received from the C.E.B. for the erection of the £5 000 000 station at Huncoat, and the date of completion has been advanced from the winter of 1950 to that of 1949.

Darwen.—A loss for the year ended March 31 of £4 550, despite an increase of 4 per cent. in units sold, is attributed by Mr. A. Watson, electrical engineer, to the coal shortage and bad weather early this year. Last year's loss was £465. Revenue was £84 000 (against £79 000), and working costs £76 999 (against £68 191).

Bolton.—It has been decided by the Electricity Committee to engage two consulting engineers to supervise the extensions at the Back-o'-th'-Bank generating station, subject to the Commissioners' consent to the work proceeding. The engineers will receive 5 per cent. of the actual cost for the first £1 000 000 and 4½ per cent. of the actual cost between £1 000 000 and £2 000 000.

Salford.—Total sales of electricity in the undertaking during the year ended March 31, 1947, were 156 million units, an increase of 11.68 per cent. over the previous year. Contributing largely to this figure was a rise of nearly 13 million units in sales at the all-in domestic rate, which accounted for 63 270 000 units of the total. Units generated during the year totalled 84 374 000, against 81 054 000, and units imported from the grid came to 93 426 000, against 77 702 000. The maximum load on the undertaking was 51 812 kW (50 368 kW) and the undertaking load factor was 37.9 per cent. (34.8 per cent.). With an income of £731 903 (£672 393) and working costs of £644 624 (£534 013), the undertaking made a gross profit of £87 279, compared with £138 380, which resulted in a net loss for the year of £19 145, compared with a profit in the previous year of £23 320.

Cornwall.—A new fluorescent street-lighting scheme, carried out by the British-Thomson Houston Co., Ltd., was commissioned in Fore Street, Saltash, on October 20. The switching-on ceremony was performed by the Mayor of Saltash, and was attended by representatives from many of the principal cities and towns in the South-West, together with members of the company. The installation, which is illustrated above, consists of six Mazdalux fluorescent lanterns mounted on special concrete utility columns at a height of 25 ft. and spaced, three to either

side of the road, at intervals of approximately 120 ft. The lanterns are of silicon-aluminium alloy construction and are de-



Six Mazdalux street lanterns, recently installed in Saltash, Cornwall

signed for use with three 80 W 5 ft. lamps; the necessary auxiliary gear is assembled in the lantern. Lamp and reflectors are protected from dust and weather by a translucent plastic cover clamped to the body of the lantern. There are hinged covers at each end, but it is only necessary to remove one of these for lamp changing and starter switch maintenance. A correspondent reports that despite the total light output of 5 700 lumens per lantern, there is a marked absence of glare and freedom from undesirable shadows. The large light source gives a very wide and even illumination over an area comprising the road, kerb, pavement and the lower parts of adjacent buildings. The lanterns are so designed that two of the lamps in each may be switched off, leaving a single lamp operating for late night "economy" lighting.

Bedford.—Work on the proposed new 120 MW station at Goldington, on the eastern side of the town, is due to start some time after April, 1948, it is announced, and Mr. P. G. Campling, present chief engineer and manager of the local undertaking, will direct the scheme. Messrs. Merz and McLellan have been appointed as consulting engineers and Sir

Alexander Gibb and Partners will act in connection with the civil engineering works. The first stage of the station will consist of two 30 000 kW turbo-alternators and three 300 000 lbs. per hr. boilers. In his annual report for the year ending March 31, 1947, Mr. Campling states that a net loss of £25 038 (compared with £975 in the previous year) arises largely from a special discount of 15 per cent., which amounted to £19 651, on consumers' accounts in respect of the March quarter. The total income of the undertaking increased from £429 235 to £457 365. During the year 39 930 600 units

(35 103 000) were generated by the undertaking, and a further 69 873 700 units (57 624 600) were imported from the C.E.B. Total units sold in the undertaking were 94 466 478, compared with 81 478 642. The maximum demand on the generators was 19 100 kW, against 19 200 kW, and the m.d. on the undertaking was 31 370 kW, against 27 230 kW. The undertaking load factor was 39.3 per cent., compared with 38.1 per cent. The capacity of the present generating station is 23 300 kW. The total number of consumers is now 28 291, representing 89.8 per cent. of the premises in the supply area.

New Zealand Storm Damage

VERY heavy damage caused to the distribution system by a single storm is reported in the annual statement of the Hutt Valley (N.Z.) Electric Power Board for the year ending March 31, 1947. Eight of the nine 11 kV feeders within the undertaking were affected, states Mr. I. R. Robinson, engineer and general manager, and secondary distribution and service line damage was also extensive. In all, approximately 1 400 faults, ranging from lines broken by falling trees to blowing of consumers' fuses, were recorded during the night of February 14 and the following day.

The shortage of coal, coupled with abnormally low water supplies, made severe load reductions necessary throughout the country during the winter months of 1946, the report states, and a system of disconnections of the Board's feeders in turn was inaugurated. It was also necessary to reduce voltage. In March, 1947, hydraulic conditions worsened, and to meet the need for a drastic reduction in consumption, the Board ordered that all domestic water heating should be restricted to use only between the hours of 10 p.m. on Fridays to 7 p.m. on Mondays. The use of radiators in offices and commercial concerns was prohibited, and street lighting hours were reduced.

Concern is expressed in the report, at the steady decrease in the surplus of revenue over expenditure, the figures for the last three years having been: 1945, £19 001; 1946, £17 586; 1947, £10 988. The revenue per unit sold decreased from .651d. in 1946 to .632d. in 1947, although net revenue from sales increased over the same period from £225 159 to £242 262. Other comparative statistics for the undertaking show that total units sold per consumer increased from 4 297 to 4 496 per annum between 1946 and 1947, while total units sold rose, over the same period, from 83 million to 92 million. The maximum

load was 22 713 kW in 1947, compared with 20 274 kW, and the undertaking load factor experienced a small drop from 51.47 per cent. to 49.96 per cent. Serving a population of 70 400, the undertaking has 20 451 consumers, at a density of 54.25 consumers per route mile of line. Water heating (mainly domestic) accounted for 37.6 per cent. of the total units sold during the year.

I.E.E. London Students

AT the meeting on October 20, Mr. A. E. M. Hickin, as chairman of the London Students' Section, presented a paper on radio wave propagation. He described the various factors which influence the propagation of waves, such as absorption by the earth, deflection by the ionosphere, deflection by the atmosphere, scattering or absorption by solids or liquids in the atmosphere, and absorption by atmospheric gases. The last three factors were particularly interesting, because the author drew attention to recent research work which has been carried out on these problems. In connection with high definition radar, temperature gradients in the atmosphere are sufficient to bend radio waves to such an extent that the earth appears flat, and transmission over great distances occurs. Rain is a source of trouble because false echoes are recorded, but it is thought that the use of radar for storm detection, which has already been used, will be increased in the future. Troublesome absorptions are caused by the resonance of molecules of invisible water vapour and of oxygen at millimetre wavelengths. In the millimetre wave region the gap between the radio and infra-red spectrums will need to be explored with a view to finding if there is a bottom limit to useful radio applications.

Industrial Information

I.E.S. Technical Conference

The 1948 National I.E.S. Technical Conference will be held at the Hotel Statler in Boston, Massachusetts, from September 20 to 24.

Gauge and Tool Exhibition

Arrangements are proceeding apace for the Gauge and Tool Exhibition, which is to be held at the New Hall, Vincent Square, London, S.W.1, from Monday, January 26, to Friday, February 6, inclusive. Support is being received from the Board of Trade, Ministry of Supply, and the Foreign Office.

Midland Radio Industries' Club

The next lunch of the Radio Industries' Club of the Midlands will take place at the Queen's Hotel, Birmingham, on Wednesday, November 12, at 1.15 p.m., when the speaker will be Dr. W. Wilson, of the research department of the General Electric Co., Ltd., who will speak on "The Application of Radio Principles to Heavy Industry."

A "Workers' Playtime" Broadcast

On Thursday, October 23, the B.B.C. programme, "Workers' Playtime," was broadcast from the Ekco canteen, adjoining the E. K. Cole factory at Prittlewell, before a very large audience. The show, which is the second of its kind to be broadcast from the Ekco factory since the war ended, was compered by Bryan Sears, and the artists were George Middleton, James and Molloy, Helen Hill and Peter Cavanagh.

Trade with Austria

The Board of Trade announce that the general effect of Orders, made under the Trading with the Enemy Act, on October 14, is to allow the full resumption of trade between the United Kingdom and Austria. Money and property in the United Kingdom at the date of the Orders belonging to persons resident or carrying on business in Austria and income deriving therefrom, continue to remain under Board of Trade and Custodian of Enemy Property Control.

"Women in Industry" Exhibition

"There's a place for you at the G.E.C.," was the theme of the stand of the General Electric Co., Ltd., at an exhibition held at the Gaumont Cinema, Coventry, as a climax to the Ministry of Labour's campaign to bring more women into industry. Four girls from the telephone works, Stoke, Coventry, demonstrated switchboard wiring, condenser

wiring, drilling and press operating. A member of the company's employment department attended to answer questions. In addition to this display, samples of tele-



G.E.C. stand at "Women in Industry" Exhibition at Coventry

communication equipment and photographs of the recreational and welfare facilities offered to employees, were shown.

Change of Name

Hopkinson Motors and Electric Co., Ltd., announce that the name of the company has been changed to Hopkinson Electric Co., Ltd.

Electrical Apparatus in Mines

The Ministry of Fuel has issued a list of electrical apparatus for which certificates of flameproof enclosure have been granted during the three months ended September 30, 1947. At the request of the B.E.A.M.A., copies may be obtained (1s. 2½d., post free) from the Library, Ministry of Fuel and Power, Kings Buildings, Dean Stanley Street, S.W.1.

Certification of Meters

An Order in Council (S.R. and O., 1947, No. 2197) has been made revoking Defence Regulation 60CB (Suspension of Certification of Electricity Meters) with effect as from October 14. It is now, therefore, obligatory for all electricity meters installed on the premises of ordinary consumers (other than meters to which Section 3 of the Electricity Supply (Meters) Act, 1936, applies) to be certified unless otherwise agreed.

Fluorescent Lighting on "Caronia"

The British Thomson-Houston Co., Ltd., has been entrusted with the contract to supply Mazdalux fluorescent lighting fittings for equipping all public rooms and

spaces of the R.M.S. "Caronia," which was launched yesterday (Thursday) by Princess Elizabeth at Clydebank, Working in close collaboration with the decorative architect, B.T.H. lighting engineers have introduced many new features in the design of fittings. The Mazda 40 W 4 ft. "warm-white" fluorescent lamp will be employed in most of the basic lighting units, with specially tinted diffusing glass filters. These, together with a careful selection of pastel tints for the ceilings, will ensure pleasing colour rendering.

Electrical Drainage of Soils

The electrical drainage of fine-grained, water-logged soils for stabilising excavations and cuts is dealt with in "Building Research Technical Paper No. 30—The Application of Electro-Osmosis to Practical Problems in Foundations and Earthwork," published by the Stationery Office (price

include penstocks and elbows fabricated by the company for the Abitibi power scheme of the Ontario Hydro-Electric Power Commission. The second booklet deals with the Robb "Victory" straight tube boiler, which has a useful application in the medium power field. The company also manufactures bent tube steam generators, and a catalogue on this subject is in the course of preparation.

Anti-Friction Metal

A booklet has been published by Murex, Ltd., Rainham, Essex, giving particulars of the physical and mechanical properties of their "Eel" brand nickel-hardened anti-friction metal and its application to different types of bearings.

Fluorescent Lighting Afloat

What is claimed to be the first installation of fluorescent lighting throughout the public rooms of a British liner has been made in the T.S.S. "Orion," which recently returned to the England-Australian run after war-time duty as a troopship. In line with present trends, the lighting is treated as a functional part of the interior decorative scheme. The fittings were designed by the owners' consultant architect, Mr. Brian O'Rourke and the Metropolitan-Vickers Electrical Co., Ltd., were responsible for the mechanical and electrical details of manufacture. In the first class lounge on "B" deck, warm-white tubes are housed with the appropriate accessories in the architectural coves in the aisles and central area.

The central lighting feature in the new restaurant on "A" deck comprises six warm-white and six daylight lamps mounted alternatively behind etched glass laylights with switching arranged to provide three different colour effects. Flanking the laylights are two large pendant louvred units, each housing six warm-white lamps mounted in two rows of three. At either side of the restaurant, adjacent to the windows, four louvred units are recessed into the ceiling beam, each unit housing one warm-white and one daylight lamp. Similar louvred fittings are used on the new foyer lounge on "A" deck. Lighting of the main central area of the first-class dining saloon is by means of warm-white lamps housed in the cornices of the dome. The intensity of illumination of this area is approximately 8 lumens per sq. ft. In the dance



Fluorescent lighting behind etched laylights in the new restaurant on "A" deck on the T.S.S. "Orion"

9d.). This report has been prepared at the Building Research Station, D.S.I.R.

Emergency Lighting Equipment

"Keapalite" automatic emergency lighting equipment, manufactured by the Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester, has been ordered by the Throat, Nose and Ear Hospital, London, St. Bartholomew's Hospital, London, the Cottage Hospital, Wallasey, and Lanark District Asylum, Shotts.

Platework and Boilers

We have received from the Dominion Bridge Co., Ltd., Lachine, Montreal, Quebec, Canada, copies of two new catalogues. The first, entitled "Platework For Every Industry," describes briefly the facilities for this type of work which exist in the organisation, and the illustrations

space on "B" deck warm-white lamps mounted in the cornices provide general illumination, and above these a multi-coloured lighting effect is provided by groups of different coloured lamps, the colour combinations being controlled and continuously varied by an automatic motor-operated dimmer.

Battery Electric Clock

Anglo-Time Corporation, Ltd., which has taken over part of Brockhouse Mill, Blackburn, will produce a new type of electric clock which will run either from the mains or a battery. Now in production is a clock which, it is claimed, will run continuously for a year from a flash lamp battery fitted to the back. Nearly all the company's output is for export.

Reports from Germany and Japan

Hitherto enquiries about German and Japanese reports in the B.I.O.S. series have been directed to B.I.O.S. at 32/37, Bryanston Square, W.1, and applications to examine original German documents have been addressed to Documents Unit, German Division, Board of Trade, Lansdowne House, Berkeley Square, W.1. These two units are being integrated as from Monday, November 3, and will be known as Technical Information and Documents Unit, German Division, Board of Trade, 40, Cadogan Square, S.W.1.

Argonarc Welding

During 1943, the British Welding Research Association, at the request of the M.A.P., constituted a committee to investigate the Argonarc welding of magnesium-rich alloys. Four papers on the subject were subsequently presented by their authors to the B.W.R.A. Symposium on Light Alloy Welding in October, 1946, and now, in response to a widespread request from industry for data on the findings of the investigations, these have been collected together in a book published by the Association at 7s. 6d. The four papers are: "Argonarc Welding of Magnesium-Rich Alloys," by R. E. Doré, L. C. Percival and R. R. Silliphant; "Argonarc Welding of Magnesium Alloys at High Duty Alloys, Ltd.," by E. J. Grimwood; "Some Notes on an Investigation of the Hand Method of Argonarc Welding as Applied to Magnesium Base Alloys," by F. A. Fox; and "Argonarc Welding of Magnesium Alloys at the Metropolitan-Vickers Electrical Co., Ltd.," by I. H. Hogg. The publication also contains an appendix illustrating types of welded joint which it is now possible to make as a result of the introduction of the Argonarc technique. The three papers by Grimwood, Fox and Hogg summarise the results of early experimental work on the process, using equipment

which was initially designed for welding with a helium-shielded arc. The first paper, by Doré, Percival and Silliphant, describes a series of later investigations carried out during the last four years and gives detailed and factual data of the procedure, including the use of high-frequency current for stabilising the arc.

Trade Publications Received

A leaflet (No. 32), issued by Steatite and Porcelain Products, Ltd., Stourport-on-Severn, Worcestershire, giving particulars of Steatite insulating heads.

A booklet, published by Barries Electrical Agencies, Ltd., King Street, Brighton, Sussex, giving particulars of Barlecta p.v.c. cables and flexible wires.

A leaflet issued by the Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham, giving net prices for Simplex conduits and details of an advance in the prices of switchgear.

Leaflets issued by the Cressall Manufacturing Co., Ltd., Tower Street, Birmingham, 19, giving details and illustrations of their rotary rheostats and potentiometers and toroidally wound potentiometers.

An illustrated leaflet, entitled "Industrial Efficiency Through Good Lighting," published by the lighting department of the British Thomson-Houston Co., Ltd., Bride Path, Watford, Herts. It explains how good lighting, without glare or shadows, increases production.

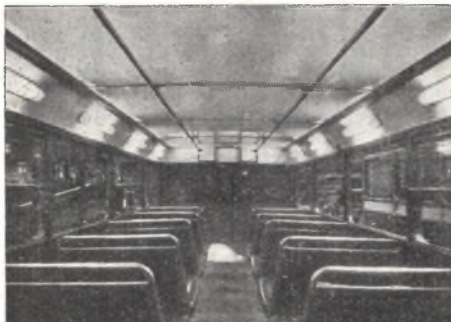
A catalogue in loose leaf form, issued by the Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17, describing the company's Fluorolier reflectors and fittings, wiring circuits and auxiliaries for fluorescent lamps. Some Benjamin installations are illustrated.

An illustrated booklet entitled "Power for Production," published by Associated British Oil Engines, Ltd., Duke's Court, 32, Duke Street, London, S.W.1, describing, with illustrations, the "Aboe 55" self-contained 55 kW Diesel-electric generating set for installation in factory or works.

The method by which electricity undertakings pay rates will be substantially modified when the Local Government Bill, presented to Parliament on Monday, becomes law. The Bill provides that as from April 1, 1948, in England and Wales, and May 16, 1948, in Scotland, the British Electricity Authority and the North of Scotland Hydro-Electric Board will no longer pay rates in the ordinary way in respect of their undertakings, but will instead make annual lump sum payments. These payments will be distributed to rating authorities in proportion to rateable value.

Fluorescent Lighting in a 'Bus

BELIEVED to be the first Diesel road vehicle to be equipped with fluorescent lighting in this country, a special "Golden



A view of the fluorescent lighting installation in the "Golden Jubilee" bus

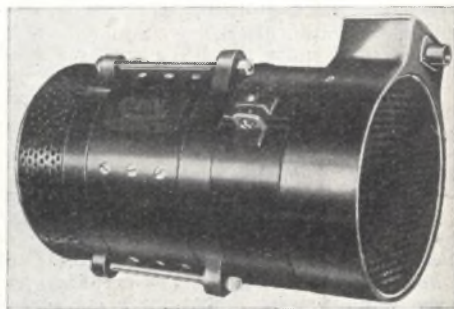
Jubilee" omnibus was put into service at Nottingham on October 13, in connection with the celebration of the 50th anniversary of the city transport department.

The current for the lighting is derived from a normal 24 V vehicle battery through a small C.A.V. rotary convertor which gives three-phase a.c. output at approximately 100 V, 400 cycles. Twenty-three specially designed G.E.C. lighting fittings are employed, each totally enclosed by a reeded Perspex diffusing cover with opal ends, and carrying a 15 W Osram "warm white" fluorescent lamp. The auxiliary gear has been made as small as possible and is fixed behind each fitting.

The circuit allows of virtually instant starting, and practically constant light output, in spite of the variations which inevitably occur in the supply frequency and voltage. The average illumination is over 12 lumens per sq. ft., which is between two and three times that normally obtained with tungsten filament lamps in a northern omnibus lighting installation.

The power supply unit and the switch-gear have been supplied by C.A.V., Ltd. The rotary convertor runs at 8 000 r.p.m. The unit is suspended in rubber in a sound proofing container.

The switchboard contains a solenoid-operated switch for connecting the motor to the battery and a thermal delay switch arranged to allow the machine to run up to its normal frequency before connecting the a.c. output to the lamp circuits.



C.A.V. rotary convertor, 9 in. long

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 Board of Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated:—

Manchester, November 10.—Supply and laying complete of 33 kV cable with auxiliary pilot and telephone cables between Benchill sub-station and Cheadle. Specification from Chief Engineer and Manager, Electricity Department, Town Hall, Manchester, 2; deposit, £1 ls.

Erith, November 10.—Supply and delivery of: (a) 50 cast-iron pattern street-lighting standards, complete with

ladder irons, swan-neck brackets, etc.; (b) 12 "Keep-Left" bollards (illuminated pattern). Specifications from Borough Engineer and Surveyor, Council Offices, Erith, Kent; deposit, £1 ls.

Salford, November 10.—Electric lighting installation at Marlborough Road Primary School. Specification from Acting City Electrical Engineer, Electricity Department, Frederick Road, Salford, 6, Lancs.

Blackpool, November 12.—Supply and delivery of transformers:—Five 400 kVA and one 300 kVA 6.6 kV/252 each phase to neutral, arranged to give a temporary supply at 210 V phase to neutral. Specification from Borough Electrical Engineer, Shannon Street, Blackpool.

Company News

AMERICAN TELEPHONE AND TELEGRAPH CO., LTD.—Net income in yr. ended Sept. 30, \$170 600 000, equal to \$8.20 per sh., compared with an income of \$184 374 000, equal to \$9.10, the yr. before.

BRITANNIA ELECTRIC LAMP WORKS, LTD.—Net prft. for yr. to Mar. 31, after taxn., £16 531 (£27 034), div. 12½% (div. 7% and bonus 3%), gen. res. £4 500 (£12 450), off goodwill and trade-marks nil (£4 999), fwd. £12 650 (same). Current assets £222 724 (£217 818), curr. liabs. £54 833 (£53 354).

FERRANTI, LTD.—Trdg., etc., prft. to June 30, after tax, £171 153 (£116,079). To depren. £38 000 (£35 000), dirs.' fees £3 555 (£4 072), defd. reprs. £24 305 (nil), lvg. net prft. £105 293 (£77 007). To gen. res. £60 000 (£40 000), Ord. div. 6%, tax free (same); fwd. £67 507 (£59 464). Cons. trdg., etc., prfts., after tax, were £214 321 (£147 493). Cons. blice. sheet shows curr. assets £2 724 973 (£2 421 365), curr. liabs. £1 566 289 (£1 542 876), res. and surplus £1 004 128 (£904 295).

ELECTRICAL COMPONENTS, LTD.—Prft. for yr. to June 30, £85 506 (£44 283). To tax prov. £55 835 (£35 655), off cost of cap. inc. and acquisitn. of subsid. cos. £3 567 (£772), res. £2 500 (£1 403), div. (already announced) 20% (nil) £16 500, fwd. £17 412 (£10 308). Rept. states share prem. acct. has increased from £2 000 to £35 000 by issue in Sept., 1946, of 120 000 shares fully pd. at 10s. 6d. in exch. for share cap. of F. D. Newcombe and Co., Cap. of Flinders (Wholesale) which carries on similar business acquired Mar. 8 last. As this co. was not controlled at date of mkg. up its last accts. (Mar. 31) it is not considered appropriate to include it in consolidated statements. Divs. declared by both subsid. cos. have been applied in reductn. of cost of share acquisition as neither was controlled throughout yr. in which prfts. were earned.

AERIALITE, LTD.—Speaking at the annual meeting, Mr. L. S. Hargreaves (chairman and managing director) said that after returning from a visit to Canada and the U.S.A., he looked forward to doing a substantial turnover in the Canadian market in the future. He felt sure there was considerable scope for British manufacturers to go into those markets and form their own distributing companies, which was the only way, he thought, of ensuring a share of the business, and he put that up as a suggestion for those who cared to take advantage of it. Mr. Hargreaves

then made reference to the fact that the company had been refused a licence for a plant extension which would have saved £27 000 in the first year and would also have enabled them to reduce some of their prices by as much as six per cent. on those lines required for export. In his view it was quite wrong that restrictive practices of that sort should be in force with the country in the economic position it was today. If they had been allowed to make that improvement they would have increased their export business, reduced their costs and would have been able to make considerable labour saving. On those lines, surely the so-called labour shortage would quickly disappear if mechanisation was carried out, but, with the restrictions, such a policy seemed impossible. It seemed essential, if the country were to recover, that mechanisation should be encouraged to the very highest degree. If all British manufacturers were able to carry out a mechanisation policy with a view to cutting labour costs, that labour would be available for further productive industry, and that in his view should be the first priority.

Metal Prices

	Monday, Price	October 27 Inc.	Dec.
Copper—			
Best Selected	per ton £130 10 0	—	—
Electro Wire bars	" £132 0 0	—	—
H.C. Wires, basis	" £149 10 0	—	—
Sheet	" £173 10 0	—	—
Bronze—Electrical quality			
1% Tin—			
Wire (Telephone), per ton	£172 5 0	—	—
Brass (80/40)—			
Rod basis	per lb. 1s. 1½d.	—	—
Wire	" 1s. 6½d.	—	—
Iron and Steel—			
Pig Iron (B. Coast Hematite No. 1)	per ton £9 10 0	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.	£35 15 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.	" £22 15 0	—	—
Lead Pig—			
English	" £91 10 0	—	—
Foreign or Colonial	" £90 0 0	—	—
Tin—			
Ingot (minimum of 99.9% purity)	" £442 10 0	—	—
Wire, basis	per lb. 5s. 6½d.	—	—
Aluminium Ingots	per ton £80 0 0	—	—
Spelter	" £70 0 0	—	—
Mercury (spot)	per bott. £16 0 0	—	—
(ex. warehouse)			

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

BRITISH ELECTRIC RESISTANCE CO., LTD., Ponders End.—Sept. 10, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. Jan. 14, 1947.

H. N. ELECTRICAL SUPPLIES, LTD., London, W.—Aug. 11, by order on terms, £8 000 (not ex.) Land Registry charge to Lloyds Bank, Ltd.; charged on 254b, Brixton Hill, S.W.2 *—September 20, 1946.

"GLOWGEM" ALL ELECTRICS, LTD., London, W.—Aug. 28, charge to W. Hodges, East Finchley, securing £1 000 and further

securing moneys secured by deb. dated Oct. 28, 1946; charged on 78, Westbourne Grove, Paddington.

Intended Dividends

ELECTRICAL UTILITIES, LTD.—Registered Office: Rosedale Works, Rosedale Road, Richmond, Surrey. Court: High Court of Justice. Last day for receiving proofs: November 5, 1947. Liquidator: C. L. Walker, 23A, St. James's Street, London, S.W.1.

Dividend

BOOT, Cyril Henry, 39, St. Cuthberts Street, Wells, Somerset, formerly residing and carrying on business at 29, Lyndon Road, Rubery, near Bromsgrove, Worcs., radio and electrical engineer. Court: Worcester. Amount per £: 1s. 1d. First and final. Payable November 17, 1947, at the Official Receiver's Office, Somerset House, 37, Temple Street, Birmingham 2.

Coming Events

Friday, October 31 (To-day)

INSTITUTION OF MECHANICAL ENGINEERS.—London. "Turbine Blades for the Whittle Engine," by T. A. Kestell. 5.30 p.m.

Saturday, November 1

I.E.E., LONDON STUDENTS' SECTION.—North Hall, Victoria Halls, Bloomsbury Square, W.C.1. Dance. 7.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS, N. WESTERN SECTION.—Manchester. 46, St. Mary's Parsonage. "Patents from the Layman's Point of View," by L. H. A. Carr. 2.30 p.m.

Monday, November 3

I.E.E., N. EASTERN CENTRE, RADIO AND MEASUREMENTS GROUP.—Newcastle-on-Tyne. "The Application of Electrical Technique to the Service of Some Other Industries," by H. Cobden Turner and G. M. Tomlin. 6.15 p.m.

I.E.E., MERSEY AND N. WALES CENTRE.—Liverpool. Royal Institution, Colquitt Street. "Elements of Position Control," by Prof. K. A. Hayes. 6.30 p.m.

I.E.E., S. MIDLAND CENTRE.—Birmingham. James Watt Institute, Great Charles Street. "Electric Traction on the Southern Railway," by C. M. Cock. 6 p.m.

Tuesday, November 4

I.E.E., LONDON STUDENTS' SECTION.—Problems Night. 7 p.m.

I.E.E., E. MIDLAND CENTRE.—Loughborough. "The Teachings of the Principles of Electrical Machine Design," by L. H. A. Carr. 6.30 p.m.

I.E.E., N. WESTERN CENTRE.—Manchester. "Neutral Earthing of Three-phase Systems With Particular Reference to Large Power Stations," by J. R. Mortlock and C. M. Dobson. 6 p.m.

INSTITUTION OF ENGINEERING INSPECTION.—Bristol. Grand Hotel. "Hardening and Tempering," by W. H. Dearden.

Wednesday, November 5

I.E.E., N. EASTERN CENTRE, TEES-SIDE SUB-CENTRE.—Middlesbrough. Cleveland Technical Institute, Corporation Road. "The Practical Training of Professional Electrical Engineers," by F. R. Livock. 6.30 p.m.

JUNIOR INSTITUTION OF ENGINEERS, MIDLAND SECTION.—Birmingham. James Watt Institute, Great Charles Street. Chairman's Address, by L. Hunt. 7 p.m.

I.E.E., LONDON STUDENTS' SECTION.—Visit to the British Thomson-Houston Co., Ltd., Willesden.

I.E.E., SOUTHERN CENTRE.—Southampton. University College. "The High-Pressure Mercury-Vapour Discharge and its Applications," by V. J. Francis and W. R. Stevens. 6.30 p.m.

I.E.E., RADIO SECTION.—London. "Tests for the Selection of Components for Broadcast Receivers," by G. D. Reynolds. 5.30 p.m.

Thursday, November 6

I.E.E., London. "Electric Traction on the Southern Railway," by C. M. Cock. 5.30 p.m.

LUTON ELECTRICAL SOCIETY.—Assembly Room, Town Hall. "Electricity and the Power Crisis," by C. T. Melling. 7.30 p.m.

Friday, November 7

I.E.E., S. MIDLAND CENTRE.—Hockley. J. Lucas, Ltd., Farm Street. Joint Meeting with the Illuminating Engineering Society. "High Voltage Fluorescent Lighting," by J. Bowtell and H. G. Jenkins. 6 p.m.

I.E.E., N. EASTERN STUDENTS' SECTION.—Newcastle-on-Tyne. Old Assembly Rooms. Annual Dance.

I.E.E., S. MIDLAND CENTRE.—Birmingham. Midland Institute. Joint Meeting with Institution of Civil Engineers and the Institution of Mechanical Engineers. "District Heating," by A. Margolis. 6.30 p.m.

I.E.E., MEASUREMENTS SECTION.—London. Discussion. "Telephone Cable Measurements," opened by S. Hanford. 5.30 p.m.

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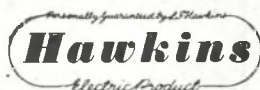
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Yours faithfully,

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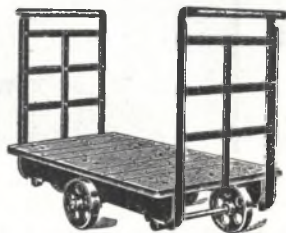
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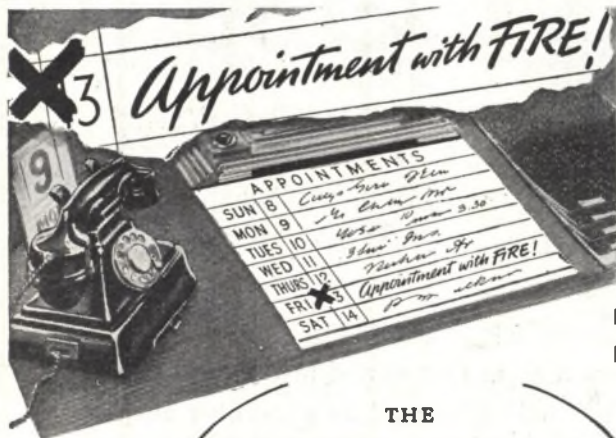
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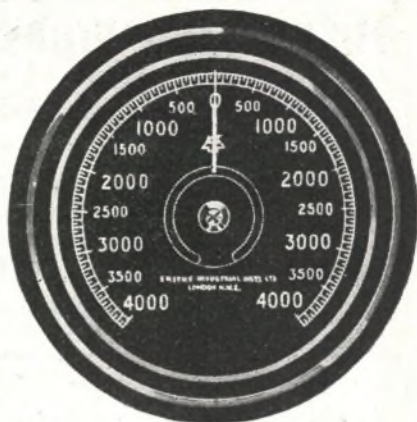
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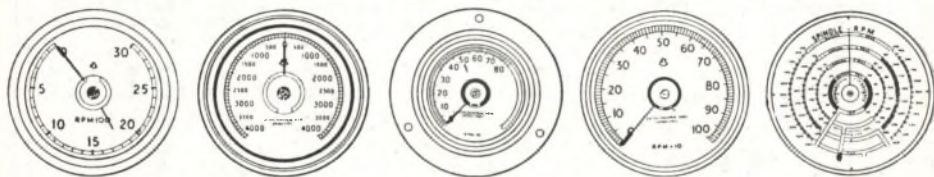
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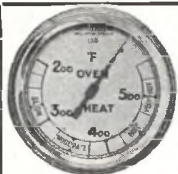
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THE AUTOMATIC TOASTER

is but one example from the DIAMIX range, which also includes the "Junior" and "Push button" Cookers, Thermostatic Irons, Fires and Boiling Rings. Please write or 'phone for New Season's Catalogues.

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Next week we shall illustrate our New Production
of
Seagull and Trough Fluorescent Fittings
fashioned in white glossy Perspex
in
MODERN STREAMLINE DESIGNS.

Available in various models from One to Five Foot Lengths..

Priced complete with Lamps and Gear.

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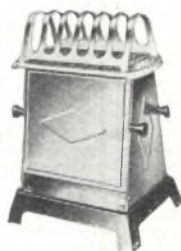
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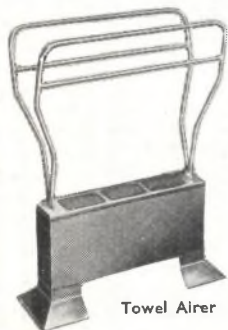
6 Slice Commercial Toaster



6 lb. Iron, voltages 200/220 or 230/250



Toaster with Rack



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Soundly constructed, well finished, fully guaranteed electrical appliances. Each article is packed in a separate carton. Photographs and details of these and other lines upon application to:—

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PRECISION ENGINEERS . . . TOOL MAKERS
METAL STAMPERS

TRADE ENQUIRIES INVITED.



Electric Fire with Independent Boiling Ring

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Famous throughout the World



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Scientific Glassware

Extra strength means additional safety.

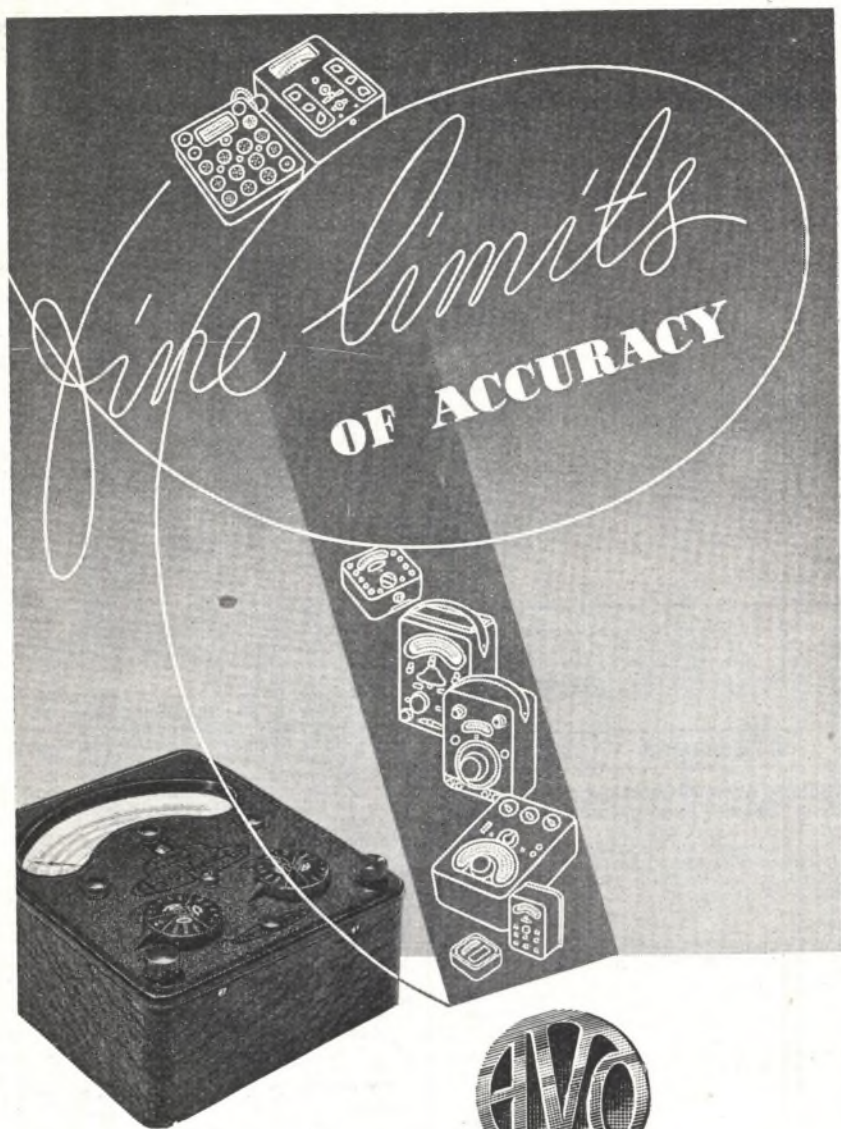
Far and wide, the many important qualities of PYREX Brand Glassware have proved of sterling value to the scientist, the research worker and the commercial manufacturing chemist alike.

Besides being highly resistant to all acids (other than hydrofluoric and glacial phosphoric) PYREX Brand Scientific Glassware with its low co-efficient of expansion of 3.2×10^{-6} per degree centigrade is immune to the effects of sudden thermal changes.

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JAMES A. JOBLING & CO. LTD.,
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The 50-range Model 7 Universal AvoMeter, the pioneer of the comprehensive range of "Avo" precision Instruments, is the world's most widely used combination electrical measuring instrument. Fully descriptive pamphlet available on application to the Sole Proprietors and Manufacturers :-



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CLASSIFIED ADVERTISEMENTS

TENDERS

CITY AND COUNTY BOROUGH OF BELFAST ELECTRICITY DEPARTMENT.

TENDERS are invited for the supply and delivery of :
Mains Cables and Joint Boxes.

Specification (No. G.91) and form of tender may be obtained from the City Electrical Engineer and General Manager, East Bridge Street, Belfast, on deposit of two guineas. (Cheque to be made payable to the Belfast Corporation Electricity Department.) This deposit will be refunded provided a *bona-fide* tender has been sent in and not withdrawn. Extra copies may be obtained at one guinea each, which sum will not be returnable.

Sealed tenders, endorsed with the name and address of the firm tendering, and marked "Tender for Mains Cables and Joint Boxes, Electricity Department," must be lodged with the undersigned not later than 4 p.m. on Friday, November 14th, 1947.

The lowest or any tender will not necessarily be accepted.

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

JOHN DUNLOP,
Town Clerk.

City Hall,
BELFAST.
October 23rd, 1947.

(303)

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

SITUATIONS VACANT

MANCHESTER MUNICIPAL COLLEGE OF TECHNOLOGY (Faculty of Technology in the University of Manchester).

APPOINTMENT OF ASSISTANT LECTURER IN ELECTRICAL ENGINEERING.

THE Governing Body invites applications from University Graduates in Engineering for an Assistant Lectureship in Electrical Engineering in the College of Technology, with the title and status of Assistant Lecturer in the University of Manchester.

Salary £420 per annum, rising by annual increments of £20 to £500 per annum. Commencing salary according to qualifications.

Conditions of appointment and form of application may be obtained from the Registrar, College of Technology, Manchester, 1. The last day for the receipt of applications is Thursday, November 6th, 1947.

Canvassing, either directly or indirectly, will disqualify a candidate for appointment.

J. E. MYERS,
Principal of the College.
(296)

ELECTRONIC Circuit and Electro-mechanical Engineers required for research and development work; good academic qualifications essential; apprenticeship or industrial or research experience desirable. Knowledge of any of the following subjects would be of assistance: Radar and television pulse techniques; centrimetric components; time-base generators; A.C. and D.C. amplifiers; feedback amplifiers; servos, especially low power electro-mechanical; stabilised power supply units; data transmission systems; gyroscopic applications; table form layouts. Some mathematical ability is desirable.—Write, with full details of qualifications, experience, age and salary required, to: The Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. (305)

SITUATIONS VACANT

CITY OF LIVERPOOL ELECTRIC SUPPLY DEPARTMENT.

OPERATING STAFF VACANCIES.

APPLICATIONS are invited for the following vacancies at the Department's CLARENCE DOCK and LISTER DRIVE GENERATING STATIONS.—

(a) SHIFT CHARGE ENGINEER, Class M, Grade 7 (£688-£719).

(b) ASSISTANT SHIFT CHARGE ENGINEER, Class M, Grade 8b (£558-£584).

(c) ASSISTANT SHIFT CHARGE ENGINEER, Class H, Grade 8b (£429-£447).

(d) SHIFT TURBINE ENGINEER, Class M, Grade 10 (£433-£454).

(e) ASSISTANT SHIFT TURBINE ENGINEER, Class M, Grade 10b (£381-£399).

All candidates must have served a recognised apprenticeship in mechanical engineering, and for vacancies (a), (b) and (c) they must have had a thorough practical engineering training and experience in the operation of large high pressure steam turbine and boiler units in a modern generating station, and should possess technical qualifications equal to Corporate Membership of the Institution of Electrical Engineers or the Institution of Mechanical Engineers.

Candidates for the vacancies (d) and (e) must have had experience in the operation of large turbine units, and possess a First Class Board of Trade Certificate in Marine Engineering, or an equivalent qualification.

The appointments will be subject to the Local Government Superannuation Act, 1937, and to the Standing Orders of the City Council.

Applications, on the appropriate form, which may be obtained from the City Electrical Engineer, 24, Hutton Garden, Liverpool, 3, must be accompanied by a covering letter in the candidate's own handwriting, together with a copy of three recent testimonials, and must be enclosed in a sealed envelope endorsed with the title of the appointment applied for and forwarded so as to reach the undersigned not later than first post on Wednesday, November 12th, 1947.

Candidates serving in H.M. Forces abroad need not complete the official form of application, but may submit direct applications within the date specified, giving particulars of age, education, qualifications and experience and three names as references; the number of applicant's release group and probable date of release should also be stated.

Canvassing of members of the City Council, either directly or indirectly, will be a disqualification.

THOMAS ALKER,
Municipal Buildings,
Liverpool, 2.
October, 1947. (297)

ACTIVE and experienced Representative required to develop the sale of all types of Rubber Insulated Cable in the North Eastern Area, location Newcastle.—Applications, detailing training and experience, should be sent to: The Employment and Welfare Officer, Johnson & Phillips Ltd., Victoria Works, Charlton, S.E.7. (284)

REQUIRED by firm of Scientific Instrument Makers in West London area Engineers with experience of precision mechanical design, good academic qualifications essential, and apprenticeship or industrial experience desirable. Knowledge of any of the following subjects would be of assistance: Mechanical systems of fire control computation; ballistics precision gearing; gyroscopic designs; hydraulics; data transmission systems; modern production methods of precision mechanical components. Some mathematical knowledge desirable.—Write, with full details of qualifications, experience, age and salary required, to: The Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. (304)

SITUATIONS WANTED

No. 1 ELECTRICIAN Officer, Merchant Navy, age 24, two years full charge of ship's electrical system (hospital ship), soon to be released, seeks post of responsibility with prospects, Assistant or Senior Maintenance Electrician. Experience general maintenance and engine room with turbo and Diesel engines.—Box L.H.M., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4. (298)

FOR SALE

A QUANTITY of Electric Bulbs, 12 v. and 24 v. S.B.C., for serial burning.—Suplex Lamps Ltd., Suplex House, 239, High Holborn, W.C.1. Phone: Holborn 0225. (279)

AMMETERS, Voltmeters and Wattmeters, switchboard/portable pattern, first grade accuracy. Sizes varying from 2 in. dial to 6 in. dial inclusive. Short delivery.—Write for price and literature to: Measuring Instruments (Pullin) Ltd., Electric Works, Winchester Street, Acton, London, W.3. (247)

AVOID power cuts. Install your own supply. 31.1 kVA Cummins mobile self-contained Alternator Sets can be supplied for 220 volts, single phase, 50 cycles, or altered to suit 400/230 volts, 3 phase, 50 cycles, 0.8 power factor, 1000 r.p.m., with G.E.C. or Westinghouse Alternator and Cummins vertical six cylinder Diesel engine, model A, radiator fan cooled, electric starting with 12 volt batteries. With control gear, including automatic voltage regulator. Each set is sheet metal enclosed on chassis with pneumatic tyred road wheels.—George Cohen Sons & Co., Ltd., Wood Lane, W.12, and Stanningley, near Leeds. (293)

BRITISH Electric Co. (Beco) Ltd. can supply most types of A.C. and D.C. Motors from stock.—British Electric Co. (Beco) Ltd., Electra House, 25-29, Lower Road, Rotherhithe, S.E.16. Bermondsey 3449. (20)

COMPREHENSIVE Stock List of Electrical, Radar and Radio Components, Equipment and Accessories. We invite inspection of a very large assortment of the following ranges available: Condensers of every description, fixed and variable; Transformers, Cables, Relays, Contactors Switchgear, Cords, Converters, Motors, Generators, Plastic Conduits, Junction Boxes, Connectors, Crommets, Meters, Power Units, Charging Boards, Charging Panels, Resistances, Potentiometers, Volume Controls of every description; Standard Electrical Fittings, Panels, Mountings, Insulating Materials, Paxelin, Fibre, Aircraft Electrical and Radio Fittings, Receivers, Rectifiers (Westinghouse and Cellendium), Yaxley Switches, all types with make-ups; Time Delay Switches, Fan Motor Controls and Small Radio Components.—Quantities and prices on enquiry to: M.M.C. Offices, 206-210, Bishopsgate, London, E.C.2 (Bis. 4707); Stores Depot, 205, Camberwell Road, London, S.E. (Rod. 3400). (292)

ELECTRIC HOIST BLOCKS, capacity 5 cwt. to 7 tons. Reasonable delivery.—A. Morgan and Co., 50, Wilkin Street, London, N.W.5. Telephone: GUL. 1147. (24)

ELECTRIC MOTORS, A.C. and D.C. We supply all types and sizes of Electrical Machinery: Slow Speed Reduction Gears can be supplied to customers' requirements with short deliveries.—Send your enquiries to The Electropower Co., Ltd., 3, Retreat Close, Kenton, Middlesex. Tel.: WORDSWORTH 4928. (14)

FIVE New A.C. Ball-bearing Motors, $\frac{3}{4}$ h.p., 230 v., single-phase, 2 800 r.p.m. Available from stock.—Box L.H.J., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4. (280)

FLUORESCENT Lighting. 4 ft. and 5 ft. single, double and triple lamp fittings manufactured by B.T.H., G.E.C., Siemens, Ediswan, Crompton, etc., complete with ring gear and lamps, supplied immediately from stock ready for installation, or can be installed by us (in London area only). All fittings and gear fully guaranteed. Full range demonstrated in our showrooms.—Apex Industries Limited, 27, North Audley Street, W.1 (near Selfridges), Mayfair 0618-8960. (89)

FOR SALE

FLUORESCENT LIGHTING UNITS, 5 ft. Reflector or Swallow, £5 18s.; 4 ft. Reflector, £4 18s. 6d.; 4 ft. Batten, £4 9s. 6d. All self-contained and complete with new tubes. Call or write for September lists. Also 80 watt silent tapped Chokes, 27s. 6d.; 40 watt ditto, 25s. Bi-pin Holders, P/F Condensers, 4 ft. Tubes.—MOSS BROS., 53, Goudge Street, W.1. Mus. 5385. (TC114)

FOR SALE. All sizes of Electric Motors, alternating and direct current, new and reconditioned.—Sales Dept., A & C Electric, 43 and 45, Hornchurch Road, Romford, Tel. Romford 835 and 4815. (300)

FOR SALE. Motors 440, 120, 50, 25, 15, 10, $\frac{7}{8}$, 5, 3, 2, $\frac{1}{4}$, h.p., 3-phase 50 cycle motors, starters and accessories: 10 000/3 300 volt and 10 000/440 volt transformers. All new 1942 and in excellent condition.—Write: Box 1574, Walter Skinner Ltd., 20, Copthall Avenue, London, E.C.2 (287)

FOR SALE. One secondhand Metro-Vickers Oil Immersed Transformer. B.S. rating 100 kVA transforming 7 000 HV, to 220 LV, 50 cycles, 2 phase. HV amps 7.14, LV amps 227 B.S. rating. Impedance 1.7%. The Transformer can be inspected any time at these works.—John Harper & Co., Ltd., Albion Works, Willenhall, Staffs. (294)

FOR sale from stock. New Lundberg SWITCHES, 2 in. \times $\frac{1}{4}$ in. \times 1 in. Adhesive Tapes, white, 1 in. and $\frac{1}{4}$ in.—For particulars and price apply: E. S. Mashal, 86, Alie Street, E.1. Phone: Royal 4405/6. (264)

HEAVY DUTY ARC WELDING PLANTS. 200 amps. Price £44 15s. complete. Also 250 amps. £59 10s. Spot Welders. £59.—JOHN E. STEEL, Bingley, Yorks. Phone 1066. (TC111)

JUNCTION Electric Irons, complete with Stand, Switch connector, and Flex, again available, very prompt deliveries (beautifully chromium plated. The finest of its kind in the world, A.C. D.C., in all voltages), with wide range of electrical accessories.—Distributors: Brooks and Bohm Ltd., 90, Victoria Street, London, S.W.1. (27)

LADDERS, Trestles, Steps, Handcarts, etc.—From Ramsay & Sons (Forfar) Ltd., Forfar. Phone 172. (10)

LAMP SHADE Manufacturer has large stock of Lampshades for sale. Selling below cost.—Apply to: British Bright Light Co., Ltd., 266-268, Battersea Park Road, Tel. Battersea 3757. (301)

LANGLEY LONDON LIMITED offer substantial and regular supply of Laminated Plastic S.R.V.P. Tubes in round and rectangular sections. Some additional capacity available for processed tubes, but principally for plain tubes in lengths up to 40 in. Enquiries are invited.—Langley London Limited, 161, Borough High Street, London, S.E.1. (307)

MOTORS. Batwin, $\frac{1}{4}$ h.p., 100 volts, 100 r.p.m. compound protected D.C. motor, £9 10s.

Siemens's, $\frac{3}{4}$ h.p., 230 volts, 850 r.p.m. shunt, D.C. motor, £6 10s.

Crompton Parkinson, $\frac{1}{4}$ h.p., 1 440 r.p.m., 230/1/50 R.L., £11 10s.

Crompton Parkinson, 2 h.p., 1 430 r.p.m., 400/3/50, £18 10s.

G.M.C., 2 h.p., 1 440 r.p.m., 400/3/50, motor only, £18 10s.

Cutting, 3 h.p., 950 r.p.m., 230 volts D.C. motor with starter, £25.

Hugh Scott, $\frac{1}{4}$ h.p., totally enclosed, double ended shaft, 400/3/50, 1 440 r.p.m., with P.B. starter, £20.

$\frac{1}{4}$ h.p., 2 800 r.p.m., 400/3/50, motor only, rewind, £15.

Harland, 52 h.p., 1 470 r.p.m., 400/3/50, screen protected, squirrel cage motor, O.J. star delta starter, £165.

Various $\frac{1}{4}$ and $\frac{1}{2}$ h.p. single and 3-phase motors, from £8.

Mayor Smith Limited, 73, Market Street, Birkenhead. Grams: Lecmos, Birkenhead. Telephone Birkenhead 1350. Terms: Cash on pro forma invoice. Carriage extra. (306)

FOR SALE

NEW Rotary Converter (filtered), 24 v. D.C. input, 230 v. A.C. output, 100-120 watts, £12 10s.—Universal Electrical, 221, City Road, London, E.C. (268)

ONE only, Westinghouse 20 h.p. Motor at 945 r.p.m., squirrel cage, drip-proof, with Ellison oil-immersed star/delta starter for 400/350, price £95; one only, Westinghouse 15 h.p., slipping, drip-proof Motor at 370 r.p.m. for 400/350 supply, price £120—Chas. Richardson and Sons, Electrical Engineers, Romiley, near Stockport. (302)

ONE Variable Speed Commutator Motor by Holmes of Newcastle, 100/25 h.p., 960/230 r.p.m., 500/400 volts, 3-phase supply. For operating this variable speed commutator motor, Brookhirst Switchgear and Control Panel, 100 h.p., rating complete with all equipment, is available. Full technical details on application. THE BRITISH ELECTRIC CO. (BECO LTD.), 25-29, Lower Road, Rotherhithe, S.E.16. (258)

PENCIL Elements for electric fires of very good quality, 9 in. to 12 in., 750 W to 1 000 W. wound to your requirements. Wholesalers and manufacturers. Deliver same week.—Charles, 48, Dorchester Way, Kenton, Harrow, Middlesex. (248)

PROMPT delivery from Czechoslovakia—45 3-phase Alternators with built-in exciter 2.4 KVA, 400/231 volt, 50 cycles, 1 500 r.p.m., 4 poles with pulley 160/100 mm. with shunt regulator. 49 pieces ditto, 4 KVA. 39 pieces ditto, 5 KVA.—Rustone Ltd., 13 Bateman Street, London, W.1. (290)

QUANTITY of 3-way S.P. and Neutral, 500 v., 15 amp., 1/C. Fuseboards. Also quantity of 5 ft. Fluorescent Tubes, D/B, used one month only for exhibition lighting, 20s. each.—MOSS BROS., 53, Goudge Street, W.1. Mus. 5385. (TC115)

S.H.E.F.I. MOVING COIL PICK-UP is now available for both Home Trade and Export. It combines for the first time High Fidelity with High Output Voltage, enabling it to directly replace normal Moving Iron Pick-ups without any extra amplification. It has an exceptionally clean response with no undesirable resonances, thereby reducing needle scratch. Retail price, including Transformer, £3 5s. 3d., plus 14s. 6d. Purchase Tax. Wholesale and Retail enquiries invited. Illustration sent on request.—Brooks & Bohm Ltd., 90, Victoria Street, S.W.1. (TC118)

STANDARD FUSES, 15 amp. vit. porcelain body, arranged for front wiring and back busbar connection, or completely assembled units as required for incorporation into fuse boards. Also Distribution Boards, 15 amp., 3-way double-pole clad type, in aluminium die-cast housing with 3 knock-out entries either side for $\frac{1}{2}$ conduit. Supplies from stock, or good deliveries for larger quantities.—For full details apply: Renas Eng. Co., Ltd., 107, Albert Road, S.E.25. Phone Addiscombe 6053-6-7. (256)

TINNED ARMATURE BINDING WIRE. All sizes from 16 s.w.g.—28 s.w.g. supplied from stock on 7lb., 14lb., or 28 lb. reels.—Frederick Smith and Co., Wire Manufacturers Ltd., Caledonian Works, Halifax. (46)

VACUUM Cleaner, Spares and Accessories. Belts, Brushes Bearings, Fans, Dustbags, etc. Largest stock of spares in the country. Repairs, rewinding, etc.—Reliance Vac Spares, Ltd., 152-154, Broadway, Bexley Heath, Kent. (TC116)

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15 x 3 SWITCHPLUGS, all sizes Switchplugs, Sockets, Plugtops, Multiplugs, Switches, Lampholders, Battenholder, Junction Boxes, Ceiling Roses, Adaptors, Connectors, Elements, &c. Immediate delivery.—Douglas Turner Ltd., 13a, Edge Street, London, W.8. (288)

THE ELECTRICIAN

FOR SALE

CIRCUIT BREAKERS: 15 amp. 250 v. Single Pole; complete with automatic overload cut-out; robust moulded construction. Accepted by most supply undertakings as efficient switch fuses if used in conjunction with our Distribution Boards.

DISTRIBUTION BOARDS: 5 and 15 amp.; 2, 3, 4 or 6 way; D.P. or S.P. and N.P.; wood cases; improved design and finish. Bus Bars and Terminals fitted complete at no extra charge.

EKCO and SMITHLITE FLUORESCENT FITTINGS: Complete; ex stock. Large quantities available; carriage paid.

INSULATORS: Suitable for overhead service cables. Bakelite, brass inserts; screwed P.O. thread for pin mounting; vertical type with drip groove, $\frac{5}{8}$ in. high, $3\frac{1}{2}$ in. dia. Large quantities available, sample 2s. per return; discount on quantities.

WOOD SWITCH BLOCKS: $3\frac{1}{2}$ in. round and square, 6 in. by 3 in. by $\frac{1}{2}$ in.; 9 in. by 3 in. by $\frac{1}{2}$ in., and 6 in. by 6 in. by 1 in. White Enamelled and Walnut Finish from 6s. 6d. to 6s. 3d. per dozen respectively. Large quantities available, sample 2s. per return. Discount for quantities and for natural finish.

CLOTHES HORSE RAILS designed for Electric Dryer; in light steel tubing. Stove enamelled any colour. Quantity deliveries four weeks.

METROPOLITAN DISTRIBUTION LTD.,
TRURO. (210)

FLUORESCENT LIGHTING. 1 000 Fittings complete with Tubes always in stock. Send for our 20-page List Price illustrated catalogue. Generous terms to Export, Wholesale and Trade.—Apply: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC101)

FLUORESCENT LIGHTING. Instantaneous starting control units for 5 ft. 80 watt lamps. The **CONSTEAD PLUS** and **THE SCENCO UNIT** dispenses with starter switch trouble. Guaranteed to strike tubes regardless of Supply Voltage reduction. Each unit guaranteed.—For full details apply: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC102)

FLUORESCENT LIGHTING. 4 ft. 40 watt and 5 ft. 80 watt Flush and Trough type fittings complete with tubes and Guaranteed control gear.—For details apply: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC103)

FLUORESCENT LIGHTING. Two Exceptional Value Lines. "The Scemco COMPENDIUM" Sets for 3 ft. 30 watt and 4 ft. 40 watt fluorescent lamps. Sets comprise: Fluorescent lamp, lamp holders, starter lamp and holder, choke, power factor and radio suppression condensers.—Write for full details: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC104)

FLUORESCENT LIGHTING. Speciality fittings designed to your own requirements and specifications. Estimates and sketches submitted **FREE** of charge of genuine enquiries.

Apply: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC105)

15 AMP. SWITCHED SOCKET for 3-pin plug top. Of robust design. Steel casing 5 in. by $3\frac{1}{2}$ in. by $2\frac{1}{2}$ in., finished Cream. With 5 knock-out entries for $\frac{1}{2}$ in. conduit.—Full details from: SCENCO LTD., Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC107)

FOR SALE

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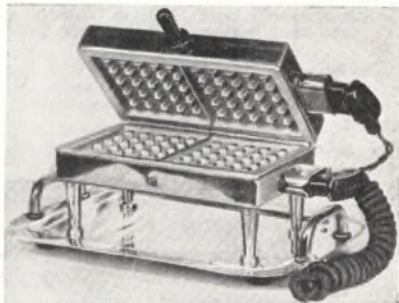
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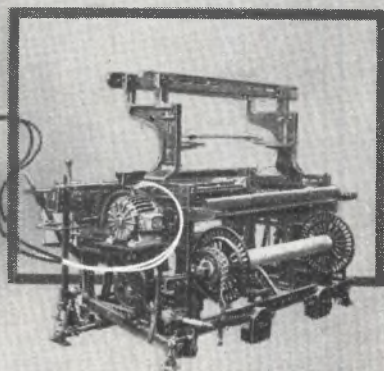
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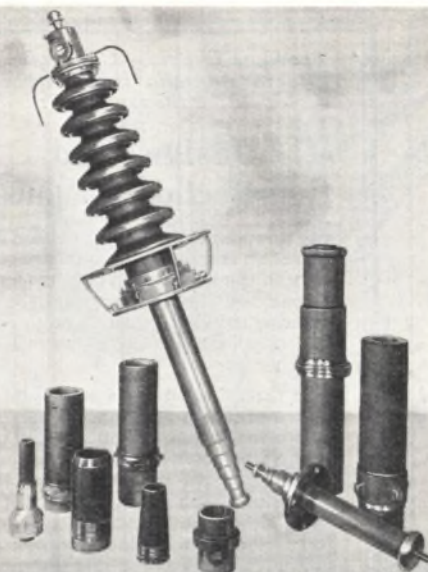
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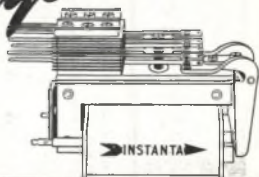


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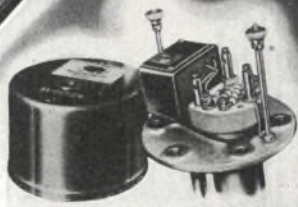
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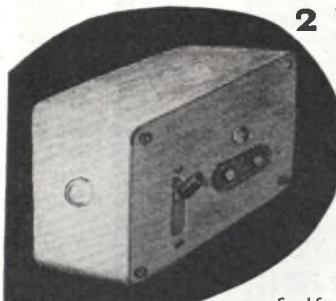
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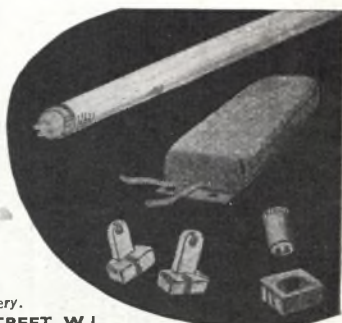


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