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THE TECHNICAL NEWSPAPER OF THE ELECTRICAL INDUSTRY

10 OCTOBER 1947
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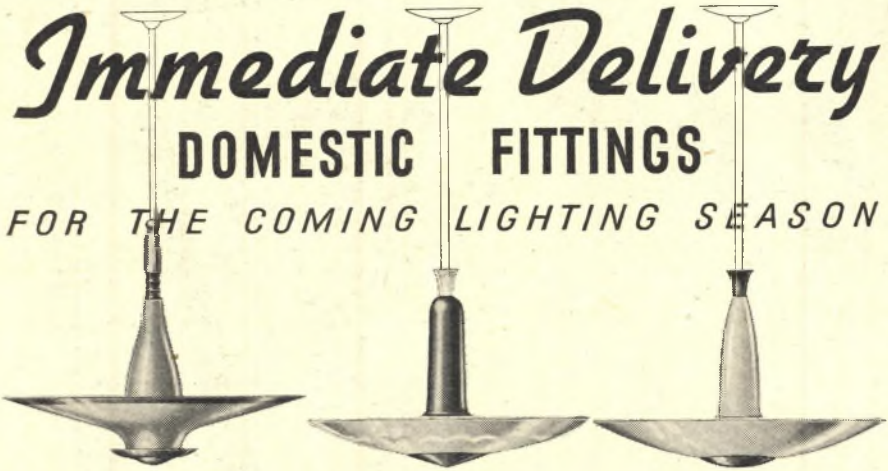

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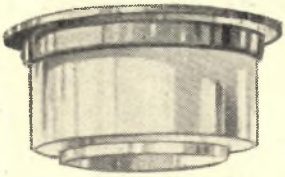

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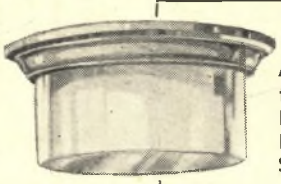

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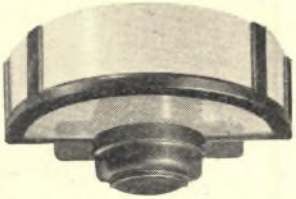

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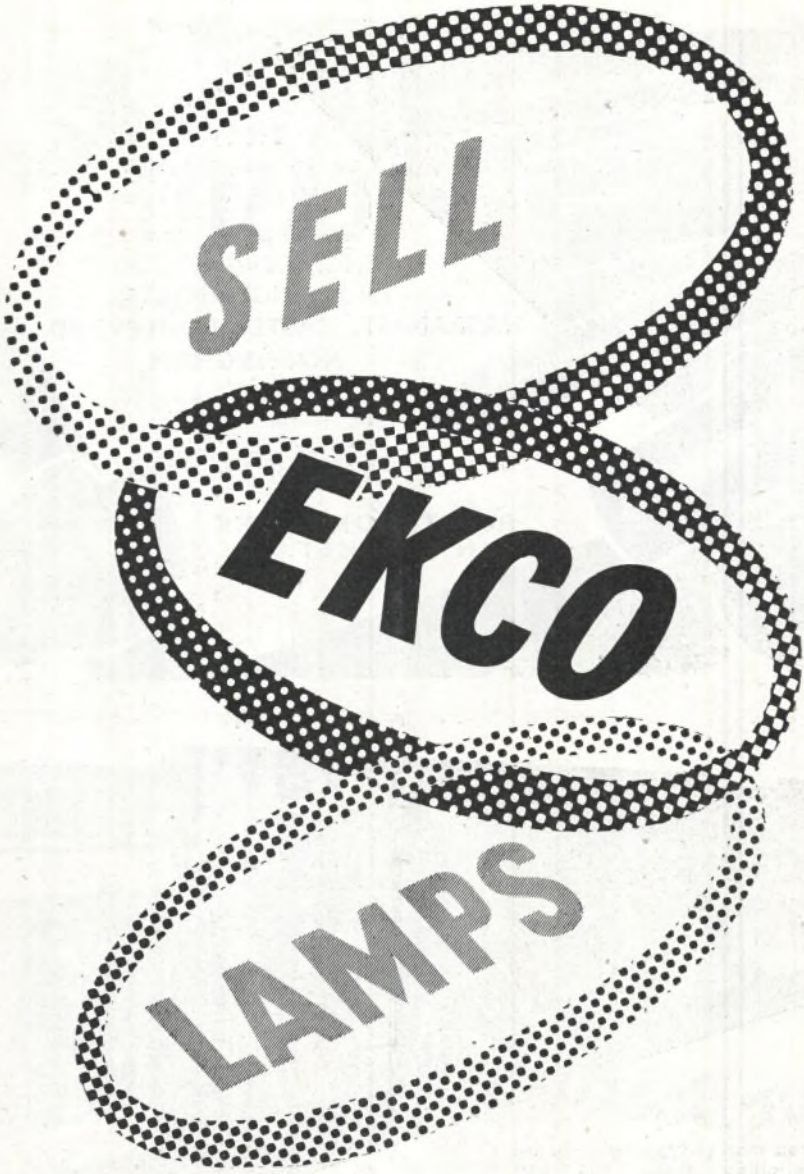

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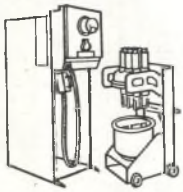

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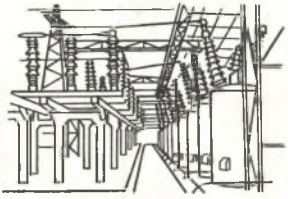

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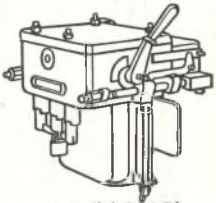

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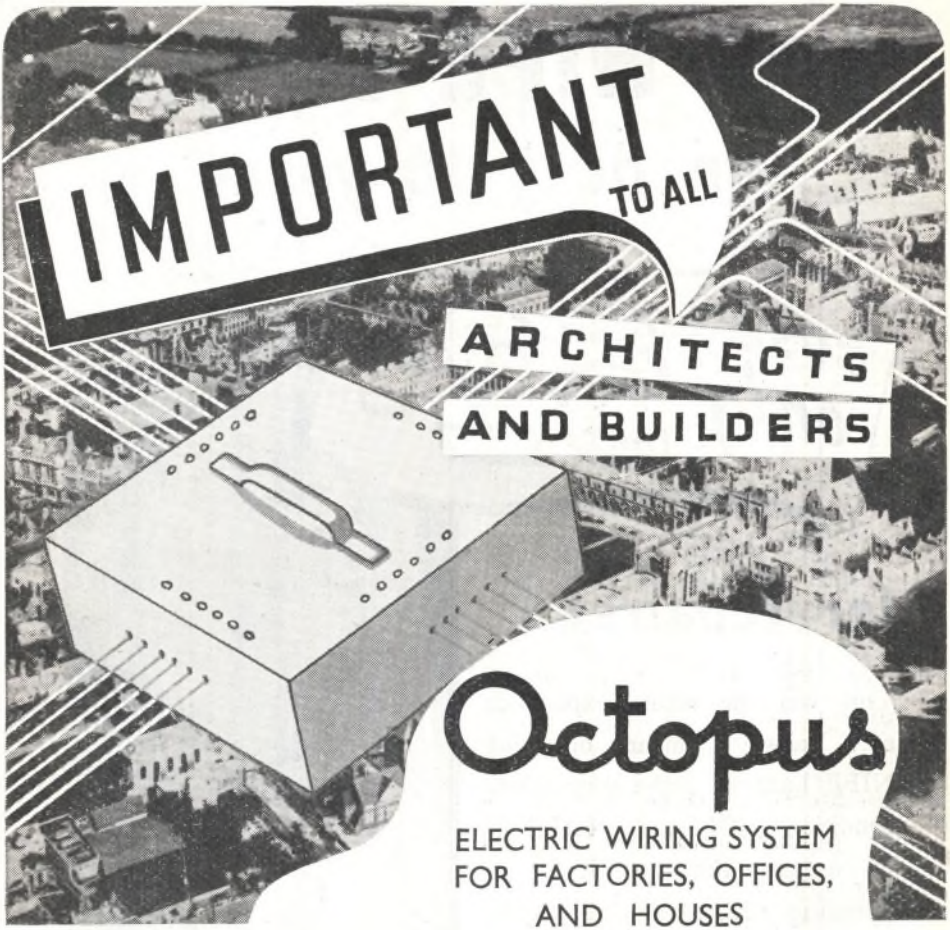

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Steel and Exports

THE statement made last week to the Engineering Advisory Council on the subject of materials in relation to the export drive, makes it clear that not only will the electrical industry be affected by the new licensing arrangements, but so also will be all those other industries looking for new electrical equipment to replace their war-worn plant.

The contribution which the engineering industries are expected to make to the export drive, is an increase from about £30 million a month in the last quarter of 1946 to £42 million a month by mid-1948, or 230 per cent. of the 1938 average—and it has to be made without any substantial assistance in the way of additional steel supplies.

The circumstances in which the engineering industry is required to improve still further its already exemplary export record, are therefore such, that iron and steel used for export purposes will have to be offset to a large extent by restriction in the manufacture of electrical machines for home industry—and therein lies a danger that the export targets of other industries may be affected. It is generally accepted that the manufacturing output of industry at large, depending upon the particular trade, is governed by the amount of electrification applied to its processes. Denying our manufacturing resources new electrical plant is therefore, a risk which cannot be overlooked.

The extent of the diversion of steel consumption from home to export will, of course, vary with different types of

machines, and in the case of heavy electrical plant, home requirements will continue to be a first charge. Outside this field, however, increased restriction in machinery supplies for the re-equipment of industry will be inevitable, in that though supplies of electric steel are being diverted from ordinary steel-sheet capacity, they will continue for some time to be a limiting factor in the production of electric motors, transformers, and other auxiliaries for large and small machine tools. As much existing industrial plant will thus have to remain in service longer than would in other times be the case, it is possible that the output rate of the machines, when compared with plant of modern design, is such as to offer for a given quantity production, a longer sustained load upon our generating capacity; and this possibility should be noted.

Sanction or Incentive?

IN order to ensure that the engineering industry is giving the export performance expected of it, the Ministry of Supply intends to apply an economic sanction or incentive, as the case may be, of relating allocations of steel and other materials to export and other essential production, based on statutory returns to be made by the industry. These conditions will mean that manufacturers will in many cases have to reorganise the whole of their sales policy, and particularly will this be so among the smaller firms. A number of these latter are engaged in the production of electrical machines for industry, and official notice should be taken of the desirability of encouraging these firms to assist their larger brothers in fostering export trade, rather than entering in the overseas trade market on their own account. Whatever else happens under the sanction-incentive licensing arrangements the continued existence of our small engineering manufacturing and repairing firms must be assured, for their manufacturing capacity, when taken in the aggregate, has a high potential output which should be geared to the efforts of our larger organisations. To force them out of business by sanctions or expect them to enter the export field at this stage, would result in a serious famine in machinery on the one hand and would deny to bigger engineering firms experienced in export trade, the invaluable support they give in sub-contracting and in other ways.

Steel for Transformers

THE electrical industry, fully alive to the urgency of the problem of economising in the use of sheet steel and at the same time of doing all in its power to meet the industrial electricity load has, as the result of discussions between the Commissioners and the B.E.A.M.A., reached the conclusion that a considerable saving could be made if supply authorities and others, when purchasing transformers specified the highest possible flux densities. This would not only reduce the weight of sheet steel required with a consequential saving of coal—approximately one ton of coal is required for the manufacture of every ton of sheet steel—but there would also be a saving in the amount of copper required for the transformers and steel for the tanks. Details of the recommendations will be found in this issue and support of them is given by the Central Board.

The Coal Position

ACCORDING to figures furnished by the Ministry of Fuel, the consumption of coal by electricity undertakings during the week ended September 27 was 490 000 tons, and the stock in hand amounted to 4 024 600 tons, or on average a little less than six winter weeks' supply at a consumption of 670 000 tons per week. In the immediate pre-crisis week of last winter the consumption of coal for generation purposes was 698 300 tons, and in the last week of January 720 000 tons. Since that time some 330 MW of additional plant has been put in commission and the total number of units generated up to August last was 4.6 per cent. greater than in the corresponding period of 1946.

Load Spreading Begins

OPINIONS on the first day's load spreading ranged from "a reasonable response," reported by several undertakings in the south, to what Mr. GEORGE GIBSON, chairman of the North-West Regional Board for Industry, termed "a disappointing result, showing that the area is not implementing the promises made to the Board." The Central Board are so far unable to express an opinion, and point out that it will be

several weeks before they are able to form a picture of the position. While it would be unjust to be too critical of the scheme at this early stage, it is significant that the Government itself is apparently resigned to a reduction of not more than 25 per cent., and the first reports give no indication that this view is over-pessimistic. The reasons for this must be closely examined, because the same problem will arise next winter, and it is on the experience of the next few months that a scheme for 1948 should be planned—a scheme that will not only ensure that the requisite load is shifted from the day-time hours but that it is done in a way which causes the minimum interference with production, which the widespread adoption of "powerless days" without a compensating increase in working hours will not.

Minister of Fuel

THE departure of Mr. SHINWELL from the Ministry of Fuel and Power, announced on Wednesday, brings to a close an era which few in the supply industry would regard as satisfactory. Mr. HUGH GAITSKELL, who is promoted from Joint Parliamentary Secretary to the position of Minister, showed himself, during the long debates on the Electricity Bill in Standing Committee early this year, to be willing to listen to reason and to concede points to his critics in a way that encourages the hope that some of the more obvious defects in the control of that Ministry may be absent in the future. The present Government is committed to planning to overcome our economic difficulties. On the wisdom of that policy there are two sharply opposed opinions. What is unquestioned is that if there is to be planning, it should be done well, and that the lamentable lack of co-ordination which has so far characterised many of the plans put forward should be ended.

Direction of Labour

IN carrying out the redisposition of labour under the Control of Engagement Order, which came into force on Monday, the preferential lists of industries which were used during the war have been revived. The Ministry recognise the importance of not disturbing the electrical industry by any transfer of workers, because, in the first place of the urgent need to maintain an adequate labour force for the manufacture, installation, repair and maintenance of generating plant required by electricity supply undertakings, and, in the second, because of the contribution it is making in electrical machinery, goods and apparatus to the export drive. It is claimed by the Ministry that at the moment there is no general shortage of manpower in the industry, and, consequently, electrical engineering is not listed to receive first preference in the filling of vacancies. Generating plant manufacture, however, is listed as "very important work," and while the making of electrical goods and apparatus is not mentioned, Sir HAROLD WILES, deputy secretary to the Ministry, assured a representative of THE ELECTRICIAN that such manufacture was considered to be essential and of particular importance in relation to exports.

Accident Prevention

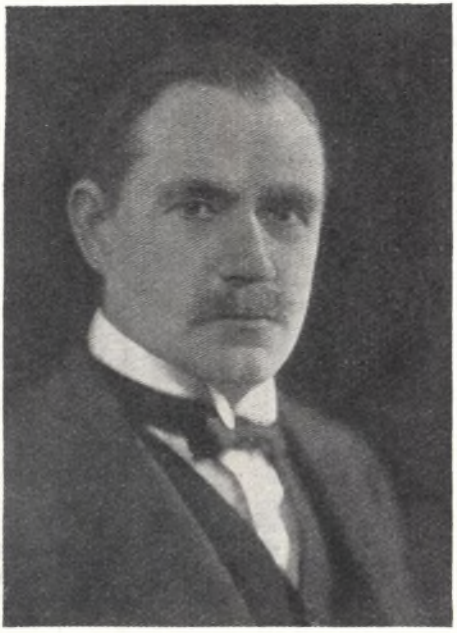
A VALUABLE contribution is made by the electrical industry to the success of the Silver Jubilee Congress of the Royal Society for the Prevention of Accidents, which is being held at Brighton this week. Special exhibitions are to be seen at the Corporation electricity showrooms and in the Dome, the E.D.A. demonstrate many safety-first features for the everyday use of domestic appliances; films of E.D.A. vintage are being shown in the Royal Pavilion. On Wednesday afternoon at a special electricity session, Mr. H. W. SWANN spoke on the use and abuse of electricity in the home, and a discussion based on his remarks was opened by Dame CAROLINE HASLETT. The subject was treated by both speakers in a way which must have left, even the least electrically-minded fully conscious of how electrical accidents can be prevented, and of how, although the electrical accident rate in the home and the fire causation possibilities are comparatively small, the electrical industry as a whole is anxious to prevent their growth. There was nothing in the subject matter of the addresses which the industry should not already know, but from the interesting statistics given by Mr. SWANN, we noted that out of the total fires attended by the N.F.S. in 1946, 9.7 per cent. were known to be electrical in origin.

Portrait—Dr. W. H. Eccles

IT is an honour not given to many to assist at the birth of a new technology, but this, in fact, is what Dr. W. H. Eccles, F.R.S., can justly claim to have done when, nearly 50 years ago, he joined the small group working under Marconi.

Since that time, he has made many significant contributions both to fundamental theory and to circuit design; many of the largest radio stations in the Commonwealth were designed by him, and all owe much to his work. In public life, he has advised Governments, played a large part on innumerable committees, and done a great deal, by his careful nurturing of the Radio Society of Great Britain, to demonstrate through the successful work of radio amateurs the feasibility of round-the-world broadcasting by short waves.

Suffering, in childhood, from a succession of minor ailments, he was educated largely at home, deriving from his engineer father an early knowledge of mechanical engineering. His main interest in those days was in metallurgy, to study which he entered the Royal College of Science in 1894. Fortunately for the world of radio, his affections were soon transferred to physics, in which he decided to specialise. Attending lecture courses at the City and Guilds Central College, he concentrated for two years on electrical engineering, and this led to his joining Marconi in 1899.



In 1904, as he puts it, "a missionary urge" took him into education, and for 20 years he taught, starting at the South Western Polytechnic in Chelsea and ending as successor to Silvanus P. Thomson as Professor of Applied Physics and Electrical Engineering at the City and Guilds College, Finsbury.

These 20 academic years were among the most fertile of his career. A full list of his inventions and discoveries during the period would range from motor starters to calculating machines. It is interesting to note that an early patent of his for a "trigger pair" of triodes—in which one valve, on application of an impulse, draws a maximum current while the other becomes virtually non-conducting—remains a key portion of many of the electronic calculators made to-day. He made an important series of discoveries in connection with tuning-fork controlled oscillators, was a pioneer in crystal control, and amongst many theoretical tasks, he gave an early explanation of the transmission of waves within the ionised reflecting layers.

"Of public works," he tells a questioner, "I have done a fair share." To demonstrate the understatement of this remark would demand more space than is here available. It must simply be said that, for at least 30 years, there were few important movements or committees in the British radio world with which he was not associated, usually in an important capacity. During the 1914 war, he did much for the fighting Services, helping to develop transmitters for the Army and submarine locators for the Navy. He was instrumental in establishing the Department of Scientific and Industrial Research.

Soon after that war, Eccles became vice-chairman of the Imperial Wireless Commission, and this contact with world wireless led, in turn, to the chairmanship of the design committee responsible for the G.P.O. station at Rugby. In 1926 he became consulting engineer for the Eastern Telegraph Co., and later for Cable and Wireless, and other companies.

Dr. Eccles has been President of the Institution of Electrical Engineers, the Physical Society, the Association of Scientific Workers and the Radio Society of Great Britain.

He lives now in Roehampton. He is a keen walker and swimmer from his youth.

CODES OF WIRING PRACTICE

by "SUPERVISOR"

THE British Standard Codes of Practice Nos. CP(B) 625/1946, Electrical Installations (General), and CP(B) 627/1946, Choice, Installation and Maintenance of Electric Wiring Systems (for Power, Lighting or Heating Circuits) in Buildings, are apparently now published and available to the public. Judging from the fact that the copies sent to the writer still bear at the top the words "Draft for Comment," and that the actual numeral spaces are left blank, three things may be deduced. One, the copies were sent in error; two, the rush of applications has been so great that recourse has had to be made to draft copies; and three, it does not matter anyway, as the published Codes are identical with the draft.

LITTLE TRADE INTEREST

It will be remembered that prior to February 24, 1947, the drafts were circulated for comment by interested bodies and others, but the writer can recall no case in which any public discussion was initiated on the drafts, nor has any comment, beyond his own puny efforts in these columns been made in the technical Press. This again argues two things—the Codes are perfect, and quite reasonably represent the accumulated wisdom of the ages in the field of electrical installation technique, alternatively, the technical bodies of the industry and individual members of it cannot be bothered to comment.

In the course of his daily occupation, the writer has to travel the country and talk with supply engineers, consumers' engineers, electrical contractors, architects and representatives of housing authorities. As a result of these conversations the writer is unfortunately compelled to accept the second of these alternatives, as practically nobody has even heard about the Codes, and could not care less about them and their contents. Only one consumers' engineer had copies of the Codes, and his comment was to the effect that they appeared to be identical with the I.E.E. Wiring Regulations, and were therefore unnecessary.

Comment upon the apathy shown in connection with local and Parliamentary elections by the man in the street, must surely be surpassed by the lack of interest exhibited by the average member of the installation industry in anything affecting the technical progress of his craft, and which may possibly take him away from the well-worn paths of age-old practice. Not thus was the electrical industry created and developed, and the present-day attitude has the effect of damping down the few enthusiasts that still remain.

This apathy on the part of installation engineers means that others, more progressively minded, can impose all kinds of things upon them. Supply engineers rule the roost in many areas as to what kind of installation shall be connected to their mains, and retain a power of veto that outshines that of our Russian friends as day does night. Manufacturers impose sockets and plugs that nobody seems to want but must accept, and now we have Codes of Practice that installation men will undoubtedly grumble at when they come to full comprehension, but which they could not be bothered to discuss when time offered an opportunity.

Amongst the twenty-five members of the Code Committee the writer can detect the names of some four, or at the most, five, eminent men truly representative of the installation side of the industry. Able men as they are, it is unreasonable to expect that with all the other interests represented they could secure a definite installation outlook on all the matters discussed in the preparation of the Codes, in fact, they must be congratulated on the fact that the Codes do, even in their inadequate way, meet modern needs at all. The blame must lie at the door of the trade itself, as the opportunity was there for discussion, and, possibly, for some amendment where necessary.

EARTHING PROBLEMS

The writer will repeat his two main criticisms of the Codes, and the first of these has to do with the section on earthing, in which the very existence of the voltage-operated earth-leakage circuit-breaker is ignored and, by implication, damned. Prior to the war, most progressive installation engineers had come to realise that danger from shock in installations was due to leakage potential, and that leakage current only came into the picture in so far as, by its passage over resistances in earth circuits, it gave rise to leakage potentials. It is, therefore, surprising to note that in para. 513, Prevention of Danger Arising from Current Leakage, three alternatives are given to ensure safety, and are: (a) Over-current operated devices (fuses, and what-not); (b) leakage-

current operated devices (over-current circuit-breakers); and (c) differential current devices. The insistence upon current operated apparatus will be noted and deplored, and whereas this might have been understandable prior to the year 1935 or so, it is incomprehensible to-day.

As in the I.E.E. Wiring Regulations, Section 10, the Code section on earthing points out that it is difficult to ensure that continuity of earth connections remains intact, and the general recommendation for the use of electrical apparatus of the all-insulated types is emphasised. From this, the Regulations go on to encourage the all-insulated type of circuit wiring as well, and is logical and in accordance again with the trends of modern thought, but not so the Codes. They are shot through with the rather extraordinary idea that in order to secure freedom from mains-borne radio interference, it is essential to employ some form of metallic enclosure for wiring, an idea that was surely exploded years ago.

From a careful reading of the Codes an architect would reach the conclusion that only metal-clad wiring can protect the occupiers of his houses from radio interference, and that all buildings that are wired, for instance, with tough rubber sheathed cables cannot be expected to be free from interference. There was never greater fallacy, as will be agreed by all installation engineers with experience, and in the writer's own flat, wired in the most complete of metal conduit systems, heavy gauge, locked into distribution boards in a most effective and permanent way—even the meters are earthed—mains-borne interference is such that indoor aerials cannot be used.

Every click of the water-heater thermostats, every ring of a bell, is faithfully reproduced in the loud-speaker, whilst the operation of lifts shuts out reception altogether. Several experts have looked over the installation, and the Post Office engineers are, it is understood, still experimenting. It is also understood that the temporary removal of the earth wires has resulted in a considerable mitigation of the trouble, but the galling part of the whole business is that a friend's house, only a short distance away, and which is wired with tough rubber sheathed cables in a very amateurish way, is completely free from similar interference.

Can we, therefore, as installation engineers, entirely approve the dogmatic statement, as found in the Codes—" A circuit is adequately screened for the purpose of preventing electrical interference if the conductors are enclosed in a continuous metallic sheath, effectively earthed? " Is it true?

Companies and Nationalisation

A TWO-DAY autumn meeting of the Incorporated Association of Electric Power Companies, held at Nottingham, terminated with a dinner, given by the Midland Counties E.S. Co., Ltd., at the Victoria Station Hotel on September 27, with Mr. W. S. Morrison, M.P., as chief guest.

Mr. Morrison, proposing the supply industry, spoke of the past, present and future. For the past, achievements spoke for themselves. Supplies had increased in 15 years up to 1945 from 9 000 000 000 units to 32 000 000 000, and the cost had steadily declined, especially to the domestic consumer.

" Whether it be due to the mysterious workings of the profit motive or not, electricity is practically the only commodity in general use of which that is true," he said. In spite of its suspension, the industry was even now making imaginative plans for the future.

Col. E. H. E. Woodward, director and general manager, North-Eastern E.S. Co., Ltd., and a member of the B.E.A., responded.

Mr. William Shearer, chairman of the Midland Counties Co., who presided, said that the occasion might be the last that the association would hold.

Mr. J. Eccles, president of the Incorporated Municipal Electrical Association, proposing " The Association," remarked that he was proposing the health of an organisation which, according to the best medical advice, had only a few months to live.

The British Electricity Authority would weld the whole of the electrical industry into one. " The new régime must keep both feet on solid earth and provide a service that is second to none, that is competitive with every other form of fuel and source of power—only thus will it continue to maintain the rate of progress that the electricity supply industry has shown over the past 25 years," he continued.

" Whatever we may think of the Government, it is only by our united and unselfish efforts that we shall see this old and lovely land safely through the next two decades."

Responding to the toast, Mr. James Paterson, president of the association, said they were assured the association was passing to its end, but its record would live long after.

Electricity, Coal and Economics

Chairman's Address to the I.E.E. North-Western Centre

IN his Chairman's Address to the I.E.E. North-Western Centre, on Tuesday, Mr. R. Alan S. Thwaites, chief engineer and manager, Manchester, spoke on electricity, coal and economic recovery.

After briefly outlining the constitution and functions of the British Electricity Authority, the Area Boards and the Consultative Councils, Mr. Thwaites expressed the view that the transition towards the final reorganisation would take place in progressive steps rather than in any sudden manner. He outlined some of the alterations involved in severing a municipal electricity department from its parent body, also some of the problems which will arise in the separation of generation and transmission. The question of the justifiable rate of rural development was explored, together with the pros and cons of uniform, as opposed to zoned, tariffs for urban and rural districts respectively, within an area.

Mr. Thwaites next dealt with the problem of coal in relation to the use of mining machinery driven by electric power. He reminded members that whereas in 1913 only 8 per cent. of the coal mined was power cut, the proportion had risen to 81 per cent. in 1945. Similarly, no less than 71 per cent. of the coal is now handled by mechanical conveyors as against 17 per cent. in 1930. The results of progressive mechanisation were shown to have been disappointing as regards output, and the scope of further mechanisation was reviewed.

QUALITY OF COAL

He referred to the deterioration by pre-war standards in the quality of coal supplied to power stations, and the wide variations in characteristics from day to day—sometimes even from hour to hour—which had resulted in loss of output from generating stations and a substantial drop in the efficiency of combustion.

Examples were given to demonstrate the benefits accruing to the supply industry as the result of the availability of new and greatly-improved alloys, particularly those which were resistant to "creep" and oxidation at high temperatures. Such alloys had rendered jet propulsion possible, and the experience gained in the development of such power units for aircraft had enabled preliminary designs to be prepared for gas turbine units of sufficiently large size to be used advantageously in generating stations, particularly for peak load purposes. Mr. Thwaites hoped it would be found possible to construct a prototype of perhaps 15 000 kW capacity.

The question of the shortage of generating plant was referred to both from the point of view of the circumstances which had brought it about, and the various methods of load spreading which were being adopted. Figures were quoted to demonstrate that the heavy winter loads were largely brought about by the shortage of solid fuel for heating purposes, both in the home and elsewhere. The opinion was given that, if this shortage could be overcome, then load spreading might be obviated for the winter of 1948-49 and onwards.

PLANT AND PROSPERITY

Consideration was given to the interrelation of electricity supply and the manufacture of electrical plant on the one hand, and national prosperity on the other. Extracts were submitted from statements made by a number of leading authorities on finance, industry and economics, with a plea that members should pass on to others in their respective organisations (whether by way of discussion groups or otherwise) the salient factors known to be essential to economic recovery.

Briefly, the sequence of events had been that since the war we had been indulging in far more capital and consumer goods than we had produced. This fact had been largely concealed by the American loan and by subsidies. With the expenditure of the loan, the country had to face realities and was now very much in the position of the "prodigal son." Part of the essential remedy was harder work by all, but that alone could not bridge the gap. Effort must be concentrated on (a) essential products for the home market, whether of a capital or consumer nature, and (b) goods for export together with capital products necessary to expand the export trade; other commodities, however desirable in themselves, must wait.

Certain aspects of management were referred to, including the distinguishing traits which made an able and efficient administrator. In this connection it was noted with satisfaction that, of the twelve members of the newly-constituted British Electricity Authority, six were within the membership of the Institution of Electrical Engineers and had already, in their respective spheres, given proof of outstanding administrative ability.

Power Station Design—1920-1946

CHAIRMAN'S ADDRESS TO I.E.E. EAST-MIDLAND CENTRE

A REVIEW of changes in power station practice since 1920 formed the subject of the chairman's address delivered by Mr. J. P. Tucker (engineer and manager, Loughborough electricity department) before the newly-formed East-Midland Centre of the I.E.E. on Tuesday.

STATION SITING

Dealing first with the siting of stations, Mr. Tucker said that perhaps the most fundamental consideration in the development of modern steam stations during the past 26 years was water for cooling, and for this reason the best sites were on large rivers or estuaries. Cooling tower stations were still necessities in some parts of the Midland counties, and maximum thermal efficiencies within 1 per cent. of those at the best riverside sites could be obtained. A 250 MW riverside station required up to 250 000 000 galls. of water per day, and even a cooling tower station of this size required approximately 4 000 000 galls. per day. These considerations, together with good rail facilities and accessibility to coal, made it increasingly difficult to obtain suitable sites, and of late the preservation of amenities had become another very serious factor. The economic balance between freightage of coal and transmission of electricity had continuously urged the consideration of pithead generation.

Boilers presented a striking example of increase of capacity in the period under review. In 1920, boilers with a m.c.r. of 75 000 lbs. per hr. were regarded as large, whereas to-day 300 000 lbs. per hr. was becoming a common size for new boilers in this country, and boilers of over 500 000 lbs. per hr. had been and were being installed. In the U.S.A. there were several units with an evaporative capacity in excess of 1 000 000 lbs. per hr.

British steam conditions in 1920 were generally of the order of 200 lbs. per sq. in., with temperatures of 600° to 700° F. To-day natural circulation boilers in this country were operating at over 1 400 lbs. per sq. in. with temperatures of 965° F., while in America, one boiler at least, was operating at 2400 lbs. per sq. in., and it was believed that temperatures exceeding 1 500° F. would soon be adopted there. On firing methods, Mr. Tucker remarked that chain grate stokers, which were general in 1920, were still preferred by many engineers, although the retort type stoker seemed to be going out of favour. Pulverised fuel firing had increased in popularity; between 1925-29, only 3½ per cent. of the coal used in generating stations was pulverised, but in relation to new construction work now in progress and projected for the immediate future, the figure was approaching 70 per cent. In 1920, the average fuel consumption was nearly 4 lbs. per unit generated; to-day, the average was about 1.5 lbs., with the best figure for this country of less than 1 lb.

After discussing problems of atmospheric pollution, the speaker came to generators, remarking that while 26 years ago a 10 000 kW turbo-generator was exceptional, to-day there was a tendency to standardise on sets varying between 30 000 kW and 60 000 kW. Nearly all British and Continental manufacturers were designing machines to operate at 33 kV, but the present tendency to carry out local distribution at 66 kV and even 132 kV might reduce the demand for generation at 33 kV.

Closed circuit hydrogen cooling was a recent development. The use of hydrogen resulted in an effective windage loss of only 10 per cent. that of air, and its thermal conductivity was seven times that of air, so that for large machines a gain of one per cent. in efficiency could be achieved and the better capacity for carrying heat away could increase the output of a generator by as much as 20 per cent.

RATING OF SWITCHGEAR

The increased short-circuit ratings required of switchgear had raised problems of testing. In the 1920's it was not uncommon to send new types to the U.S.A. for this purpose. A testing plant had been installed by Reyrolle's in 1930 with a capacity of 1 500 MVA, and recently 132 kV switchgear designed for 2 500 MVA had satisfactorily passed a series of specially designed proving tests. In Germany, breakers of 8 500 MVA capacity were being contemplated shortly before the capitulation.

After references to present-day tendencies in the design of cables and transmission lines, in the course of which he stated that a three-core 264 kV cable might now be a practical proposition, while the transmission of future loads on overhead lines of 1 000 MW at 400 kV or 800 kV would revive discussions of d.c. transmission, Mr. Tucker speculated on future developments.

• 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. R. W. TOWERS has been appointed a director of the Rheostatic Co., Ltd.

COUNC. W. R. BLACKBURN, electrical engineer, of Penhryn Road, Colwyn Bay, has accepted the invitation to become Mayor of that borough.

SIR DUNCAN WATSON has been appointed chairman of the Llanelly and District Electric Supply Co., Ltd., and the Gorseinon Electric Light Co., Ltd., in place of the late Mr. Morrice Alfred Edwards.

LORD CITRINE, chairman of the British Electricity Authority, is to address a Southern Regional conference in connection with the electricity economy campaign at Bournemouth Town Hall at 2 p.m., on Tuesday next, October 14.

MR. A. C. STOCKLEY, sub-station engineer of the electrical branch, Victoria Railways Department, has returned to Melbourne after a 12 months' visit to England, Switzerland and Sweden, where he studied electrical railway developments.

MR. T. B. NUTTER, who, as mentioned in our last issue, was the recipient of a writing bureau from the employees of the Burnley electricity department at a social gathering on the occasion of his retirement from the position of borough electrical engineer, has had a further presentation from the chief officials of the Corporation.

MR. F. W. BRECKNELL, borough electrical engineer, Birkenhead, has retired after 47 years' service with the undertaking. Mr. Brecknell switched on the current to drive the town's first tramcar in 1901, when he was a switchboard attendant at the Craven Street generating station. He became borough electrical engineer in 1941, on the retirement of the late Mr. F. E. Spencer. Chief officials of the Cor-

QUEEN MARY *at Radiolympia, with* MR. G. DARNLEY-SMITH, *chairman of the Radio Industry Council, acting as her guide.* MR. OLIVER LYTTELTON, *president of the Radio Industry Council and chairman of Associated Electrical Industries, Ltd., is on the left of the picture*

poration last week presented him with a silver plated tea service.

MR. T. V. LIRONI, deputy borough electrical engineer at Birkenhead, has been appointed acting electrical engineer.

MR. C. S. BUYERS, manager of Glasgow branch office of the plant division of Crompton Parkinson, Ltd., is retiring from that position this month, and Mr. Quin,

Part of the audience at the first post-war illumination design day course held by the E.L.M.A. Lighting Service Bureau in Birmingham. It was opened by the Lord Mayor at the electricity showrooms in Paradise Street

who has been Mr. Buyers' assistant for many years, has been appointed branch manager. Mr. Buyers has agreed to continue with the company, at their request, for a few more years in a consultative capacity in connection with switchgear and transformers for the North of England and Scotland.

MR. T. G. PROCTER has been appointed chief electrical engineer to the Auckland Harbour Board, New Zealand, in succession to Mr. S. Edwards, who has retired. Before joining the Harbour Board last year, Mr. Procter was with the British Thomson-Houston Co., Ltd., at Rugby.

In this picture MR. WILLIAM SHEARER *(centre) chairman of the Midland Counties Electric Supply Co., and* MR. W. S. MORRISON, M.P. *(right) are seen on the site of the new £10 000 000 power station at Staythorpe, Nottingham. The visit was in connection with the two-day meeting of the Incorporated Association of Electric Power Companies at Nottingham*

MR. T. R. SMITH has been elected president of the North Wales Society of Engineers, and in his Presidential Address he discussed hydro-electric power, with particular reference to North Wales. In north and central Wales, he said, only about 650 000 000 units could be made available from hydro resources.

MR. J. BATTEN, station superintendent of Bridport electricity undertaking, whose hobby is constructing model motor cars, has been breaking speed records at the British Model Club with his latest model. This is 18 in. long and weighs just over 8 lbs., and it has been averaging 24.6 m.p.h. over a distance of 10 miles on the club's circular track to establish new records for five and ten miles non-stop. It uses half a pint of lighter fuel.

SENOR MARIO MUCCINELI, assistant director of the planning and construction section of the National Telephone and Electricity Co. of Uruguay, has been to this country on a brief visit, under the auspices of the British Council, to see whether he could buy equipment from British manufacturers. Senor Muccineli left by air for Uruguay on Sunday, October 5.

MR. C. R. HOBSON, M.P. for North Wembley, who has been appointed Assistant Postmaster-General, was for 11 consecutive years, up to his election to Parliament in 1945, chairman of the Willesden Borough Council Electricity Committee, and for six years a representative of the Greater London area on the London and Home Counties Joint Electricity Authority. He was a maintenance fitter under the London Power Company, and previously he held a similar position under the London Transport Board at Neasden.

Obituary

PROF. MAX PLANCK, the German physicist, who won the Nobel Prize in 1918, at Gottingen, aged 89 years. His quantum theory, published in 1901, made him internationally famous. It revolutionised the world of science, and it is now generally ranked with relativity as the most far-reaching discovery in physics since Newton. In effect, Planck did for atomic processes what Einstein has done for large-scale phenomena. In 1929 he received the Copley Medal, highest award of the Royal Society.

The I.M.E.A.

IN view of the fact that the probable vesting day will be in April next and in order to decide the future of the association, the I.M.E.A. Council propose to convene an extraordinary general meeting, prior to which a memorandum will be circulated to members acquainting them of the position and the action which it will be necessary to take.

It will be remembered that Lord Citrine, chairman of the British Electricity Authority, while at Bournemouth during the week of this year's convention, expressed the opinion that the holding of similar functions should continue. Discussions have since taken place between representatives of the association and the Organising Committee, when it was agreed that the association should arrange a convention in 1948 on lines similar to previous years. Should the vesting date be prior to the holding of the convention, the British Electricity Authority will approve of and, if necessary, facilitate the holding of the function.

Domestic Heating Methods

Differing Viewpoints at Smoke Abatement Conference

ELECTRIC space heating and district heating from thermal-electric stations were among possible methods of abolishing domestic smoke to be discussed in three papers delivered at the annual conference of the National Smoke Abatement Society in Edinburgh on October 2.

DOMESTIC FUELS

Delivering the opening paper, which took the form of a number of questions for reply by subsequent speakers, Mr. Arnold Marsh, general secretary of the Society, said that although the problem, stated negatively, was to discontinue completely the use of raw bituminous coal for all domestic purposes, were the public yet prepared to accept the smokeless alternatives, and to what extent, and when, could they be made fully available for all requirements? There was still a very considerable attachment to the open fire, and a recent Gallup poll had revealed that 68 per cent. of the population still preferred it to other forms of heating. Further, there was no early likelihood on technical grounds of it being possible to do away with solid fuel in the home. The plan needed, therefore, must include the improved open fire and the closed or openable stove. These improved appliances could burn bituminous coal, and their rapid installation would materially help the drive for fuel economy, but they should be allowed to use such coal only until there was sufficient smokeless fuel available.

After a long failure to gain popularity, the idea of central heating for the small house was making headway. Was there a case, he asked, for advocating central heating installations in either new, or both new and existing houses, so that costs might be brought down to a level that, when balanced against the resultant fuel savings, would commend the method to all concerned in housing?

Turning to heating services provided centrally on a community basis, Mr. Marsh said that the evolution of domestic heating was likely to be towards the complete supply of energy from a central source of supply, where it could be produced under conditions of maximum efficiency. What could be done, he wondered, to make it economical for the ordinary householder to use gas and electricity in the place of coal; in other words, what were the possibilities of reducing the prices of these media to a level competitive with solid fuel for continuous use?

A recent report had given the impression that the electricity industry wished to take the whole of the domestic heating load, including open fires. If this was so, the problem was greatly simplified, but he would like to see the statistics of the case. The economics of electricity utilisation were greatly strengthened, it would be argued, if generation could be linked with district heating, or if electricity could be used in conjunction with a heat pump, but what were the views of the industry on such matters?

There was no doubt that district heating would be widely extended if the reports on the first installations were good. Theoretically, the thermal-electric system appeared to be preferable, but this could be economically applied only to new generating plant designed for the purpose. To what extent was this to be done with the new power stations which were promised, or were we to rely on the straight thermal system, in which district heat was the only product?

ON ELECTRIC HEATING

The point of view of the electricity supply industry to Mr. Marsh's questions was put by Mr. V. W. Dale (B.E.D.A.). Electric heating was, and might well be for a long time, he said, out of reach of many, but it was still an eminently desirable form of heating in every respect. If any lesson could be learned for the present situation it was not that electricity should not be used for heating at all, but that for the time being it should be used only where its many virtues made it particularly suitable and economical. Shortage of generating plant made it impossible at present for the supply industry to take the whole of the domestic heating load, but what would be possible to-morrow was a very different question. If all the houses in the country were constructed with a view to the conservation of heat, it would be possible for them to be heated electrically under present generating conditions without any increase in the amount of fuel used for domestic heating,

It was asked, Mr. Dale continued, what could be done to make electric heating economic for the householder? Why should electric heating always compete on fuel

cost with solid fuel? One did not expect the cost of whisky or beer to compare with that of water, and electricity and solid fuel were not precisely similar things.

With regard to the so-called sentimental attachment of the public to the open fire, he thought it likely that this was not really sentiment, but a desire for high temperature radiant heating. There was very general agreement to-day that maximum comfort was achieved with high temperature radiant heating, providing that the air temperature was not too low, and it was at least possible that a large section of the public was quite willing to exchange the open fire for an electric fire, although they were not willing to forego their open fire for central heating.

THE GAS TURBINE

So far as the combination of district heating with electricity generation was concerned, Mr. Dale went on, there was little doubt that the most efficient system would be found to be that in which electricity was the by-product and heating the main product. While it was unsafe to prophesy, if the gas turbine were adopted for generation on a large scale it would completely alter the prospects of supplying heating from waste heat, since this would be at a much higher temperature than the waste heat from steam plant.

Next, Mr. Donald V. H. Smith, in a paper on " Central and District Heating," answered point by point some of the questions raised by the first speaker. Capital costs, he said, should never be considered a barrier to improvement before calculating the resultant annual operating costs. In a new house, the capital cost of central heating was very little higher than the provision of a number of fireplaces and flues, and the extra cost might be as low as £20 or £30. On a district heating system, the extra cost might be from £80 to £120 per house in a new estate. The operating costs in each case, allowing for fuel, labour, maintenance and capital charges including repayment on any reasonable period, should in most cases show a reduction on yearly costs as compared with any other method.

In his opinion it was impossible to expect electricity to solve the problem by present methods; it was too costly a medium and too wasteful of coal. It used even more coal than a well-designed plain brick open fireplace. Electricity might be more economically and advantageously used in any district where combined thermal-electric schemes were installed, as at such stations it would be a cheap by-product of the main heat system, and it might be desirable at such stations to increase the electric load. At present, at condensing stations, it was unfortunately necessary to restrict the use of electricity, and it was no use shutting the factories in order to heat the home.

Even when the existing generating stations were extended, electricity from condensing stations was too costly a medium for space heating on any large scale. To suggest that it could take the whole of the domestic heating load was sheer nonsense, and would be very bad economics. For space and water heating alone, allowing a modest total of 300 therms per year per house, the 11 million existing houses would require nearly 100 000 million units, and the additional four million houses, which all agreed were needed, would require a further 35 000 million units. The present standards of heating were admittedly too low, and if the old houses were left on the lower scale and the new ones only raised to, say, 450 therms per year (an amount still low, according to some authorities), then the total electricity required would be over 150 000 million units per year. In addition, the lighting and industrial loads still had to be catered for, and when it was recalled that the total electricity production in one year was in the region of only 40 000 million units, surely further comment on the notion of all-electric houses was superfluous.

Electricity should be used for light and power, and its employment for space heating should be regarded as a luxury, or reserved for very occasional and intermittent emergencies, or for areas where other alternatives did not exist.

If electricity were generated as a by-product of district heat, then he agreed there was a case to be made for a somewhat wider use of it in topping-up, but it should be clearly understood that such projected stations, even if constructed and developed to their maximum possibility in Great Britain, could only be secondary stations, and the main supply of electricity must come from the existing plants and those condensing stations now under construction or projected.

ECONOMY OF DISTRICT HEATING

The economy of district heating, if well designed on suitable estates, was incontestable. It was cheaper in running cost and in the amount of coal used than any other method so far known. Thermal-electric stations would not necessarily provide cheaper heat; it was on electricity as a by-product that the main reduction in costs was secured, not on the heat side. Existing generating stations could not economically supply heat from so-called " waste heat."

Correspondence

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

Plugs and Sockets

[To the Editor]

Sir,—The article by "Supervisor" on "Plugs and Sockets" in The Electrician of September 26 was very interesting, but the only way to overcome the difficulty is to carry out the South African and American practice and make it a crime for anyone except a qualified and licensed man to do any work on an electrical installation.

The fact that a man is a member of the I.E.E. or the E.C.A. doesn't mean that he is skilled; a member of the E.T.U. is more likely to be qualified than a member of the other two organisations since he has to satisfy the other members that he is a time-served man. A 'bus or lorry driver has to pass an examination before being licensed and is held responsible to the authorities in the event of an accident or for speeding. A private motorist might be the best driver in the world, but he still has to pass an examination to qualify for his P.S.V. licence.

I have worked on both plant maintenance and contracting. While on the former I have had control of all gear run off sockets, but so far as contracting is concerned I have seen table standards run off 15 A plugs and 3 kW fires run off 5 A plugs, 15 A sockets tapped off lighting circuits and lighting tapped off power plug circuits, and all done by contractors. I have come across installations carried out by radio and motor mechanics and plumbers, and the only way to bring these installations up to I.E.E. standards is to do them again.

Let the E.T.U. and the E.C.A. members get together and work out a system of licences, let the licensees be held responsible for their work, fine anyone who interferes with electrical work, and the plug and socket question would be settled.

Yours faithfully,
John A. Ferguson.

Renfrewshire.

Sir,—In The Electrician of September 26 "Supervisor" asks for a fused plug and socket suitable for all domestic purposes and presumably up to the now accepted range of 3 kW, and which does not suffer from the disadvantages of the one specified in B.S.1363.

With due modesty, I would draw attention to the fact that the DS 3 kW fused plug has been in large scale use by hundreds of supply undertakings for some years. It is not only manufactured by our associated company, DS Plugs Ltd., but also by A. Reyrolle and Co., Ltd. To cope with the demand for it, two additional works are being built and equipped.

It does not suffer from the drawbacks mentioned by "Supervisor" and does not have to be taken to pieces to renew the fuse. Moreover, the fuse will break a prospective short-circuit of 40 000 A and probably much more.

Yours faithfully,
Dorman and Smith Ltd.,
R. Amberton, Director.

Power from Norway

[To the Editor]

Sir,—It is surprising that no use seems to be made of the phenomenon of superconductivity in the transmission of power by cable. It is known that the presence of a strong magnetic field spoils the effect, but a cable, constructed with a hollow conductor, might prove suitable. Liquid air could be introduced at one end into the conductor, and if this was of large diameter the field would be weak. Further, the "go" and "return" leads of a d.c. system could be laid some distance apart, which would roughly halve the field.

The saving in power loss would, no doubt, pay for the cost of the liquid air. Indeed, even if the cable could not be made cold enough to give the effect of zero resistance in the copper, and zero transmission loss, the degree of cold which could be obtained would, no doubt, so lower the resistance that an appreciable power saving would result.

If the low temperature for superconductivity could be reached, then little copper would need to be used; even a thin skin of copper on an iron tube would be good enough. The need for good thermal insulation might, however, be difficult to meet.

It is possible that a conductor with two gas holes in it might prove a suitable design, for then cold air could be put in at each end. The possibility of thus obtaining bulk power from Norway should surely be considered since it may be the solution to our coal and power problems, and help our export drive as nothing else could.

Yours faithfully,
Ormskirk, Lancs. T. H. Turney.

ELECTRICITY IN PERSIAN GULF

POWER PLANT FOR KUWAIT

FOR many years the sole source of electricity in Kuwait, the only town in the independent Arab state of that name, has been a 174 kW, 220 V, Crompton dynamo driven by a Ruston and Hornsby oil engine. This equipment was installed for supplying the Sheik's Palace and Government buildings, and a supply was not generally available for the town.

In view of the emphasis on export trade and the leading part being played by the electrical industry, the details herewith of a contract being carried out in the Kuwait State in the Persian Gulf are of interest.

As the result of a survey made by Mr. A. D. Foster, of the Kuwait Oil Co., early in 1946, however, the Shiek of Kuwait, Sir Ahmed-al-Jabir-as-Subah, decided to consider the installation of a new electrical power plant of sufficient capacity to supply the whole town.

As a result of a discussion on the prospects between Mr. C. S. Pass, overseas plant products sales manager of Crompton Parkinson, Ltd., Mr. G. Grieve, of Ruston and Hornsby, Ltd., Sir Ahmed and his official representative, Abdulla Mulla Saleh, together with representatives of the Kuwait Oil Co., a scheme was drawn up to provide a supply for the whole town, which stretches about three miles along the Persian Gulf, and extends inland for about one and a half miles. The population of the whole Kuwait State is probably about 90 000, of whom all but about 10 000 live in or around the town.

After estimating the probable demand for several years ahead, the scheme proposed was for three 175 kW (219 kVA), 380 V, three-phase, 50 cycle alternators, supplying directly a 4-wire network in the area of the station, and feeding a 380/2 200 V, 200 kVA step-up transformer for h.v. distribution to three 50 kVA transformer sub-stations. This scheme was adopted and a contract placed with Crompton Parkinson, Ltd., for the whole of the electrical equipment, including alternators, high and low voltage switchgear, transformers and cables. For driving the three alternators, the existing engine is being retained and two new Diesels are being supplied on a separate contract by Ruston and Hornsby, Ltd.

Apart from the prime movers and the alternators, the power station equipment will include three automatic voltage regulators, a five-unit oil circuit-breaker switchboard, a l.v. distribution board, and the 200 kVA transformer with a high voltage fuse-switch.

The voltage regulators are mounted in three separate exciter cubicles which form part of the main switchboard. This has three circuit-breakers for the alternators, one for the 380 V side of the transformer, and another for controlling the distribution board for local three-phase, four-wire supplies.

The 200 kVA step-up transformer has delta-star windings, with star point brought out on the 2 200 V side for solid connection to earth. For switching the output side a high-voltage, 100 A, three-phase, t.p. rotary oil fuse-switch is mounted on the transformer tank.

The transformer will feed a 0.04 sq. in. three-core cable running 1 000 yds. to one of the three transformer sub-stations, from which two 0.0225 sq. in. cables, each 1 500 yds. long, will feed the other two sub-stations. Equipment for the main sub-station consists of a four-unit switchboard with three oil-immersed t.p. non-automatic 300 A on-load ring main isolators, and a T.A.P. oil switch-fuse; and a 50 kVA 2 200/380 V transformer, and distribution switchboard, for supplying the local four-wire network. One of the ring main isolators will be in circuit with the incoming cable, and each of the other two in circuit with one of the outgoing cables.

The transformer unit will be isolated on the h.v. side by lowering the fuse-switch part of the T.A.P. unit. Each of the other two sub-stations will be equipped with a similar 50 kVA transformer. T.A.P. unit and l.v. distribution switch-board, but no isolating links are to be installed since safe isolation can be obtained by lowering the fuse-switch. All the cables will be laid direct, with the usual protection against mechanical damage, and as the soil contains gypsum, they are being protected against corrosion.

The equipment is now being installed and it is expected that it will be in operation early next year.

In the light of the export drive the above details are of special interest, for, apart from the capital equipment involved, it is reasonable to expect that orders for electrical gear of the consumer type will follow.

Answers to Technical Questions

We produce below the answers to a selection of questions which have been sent to us by readers. The co-operation of students and others in making this feature one of general interest is invited

What is the Jet Chain Rectifier ?

The jet-chain rectifier is a medium-power unit employing mercury jets to effect the necessary commutation; it has been developed by Prof. Hartmann of the Royal Technical College, Copenhagen, who is also well-known for his work on the jet-wave rectifier.

A bi-phase unit is illustrated diagrammatically in Fig. 1. Two jets of mercury are allowed to fall by gravity from upper tanks X and Y on to electrodes A and B, which are connected as shown to the transformer secondary terminals. A rotating knife C revolves synchronously with the a.c. supply and cuts the jets at intervals so that until the gap so formed has fallen to the electrode the jet can carry no current.

At the beginning of the half-cycle when electrode A is about to become positive the knife cuts jet B so that only A carries current. The length of the jet is adjusted

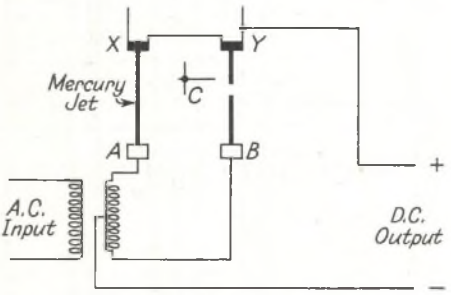


Fig. 1

so that the gap falls to the electrode in just half a cycle so that at the end of the first half cycle jet B becomes complete and the knife has revolved half a revolution and now cuts jet A. Jet B thus carries current during the next half cycle, when B is positive, so that a unidirectional output is obtained at the d.c. terminals.

The mercury which has fallen to the electrodes is collected and pumped back to the upper tank in which a constant head must be maintained. In order to prevent oxidation of the mercury and to minimise sparking the whole apparatus is operated in an atmosphere of hydrogen at slightly above atmospheric pressure.

By connecting three such units with their d.c. outputs in series or parallel and their transformers fed from a 3-phase supply, a 6-phase unit can be obtained.

Recently published efficiency figures (R.G.E. Feb., 1947) give, including transformer and auxiliary losses—

300 kW	600 V unit	94.2%
600 kW	1 200 V unit	96 %
300 kW	200 V unit	93.5%

It can be seen that the efficiency is comparable to that of a mercury arc rectifier at the higher voltages and better at the low voltage. E. O. T.

How much of the potential energy of the rainfall on the catchment area of a hydro-electric scheme can actually be converted to useful electrical output ?

The yearly potential energy of the rain falling on a given area is the weight of the yearly rainfall multiplied by the height of the area above sea level; summing this quantity over the whole catchment area gives the maximum potential energy available.

Of the total rainfall about 50 per cent. is lost by evaporation and due to absorption by plants; the remainder (the run-off) is collected in the upper reservoir of the scheme. This reservoir is, of course, at a lower level than the surrounding hillsides so that a further 20 to 50 per cent. of the initial energy of the water is lost in its running down into the reservoir. If, therefore, the reservoir is built at the highest practicable point in the catchment area, the potential energy of the water in it will generally be between 20 and 40 per cent. of that initially available in the rainfall.

An ideal scheme would make use of the whole of the head between the upper reservoir and sea level—in a few cases, where the land slopes very steeply to the sea, e.g. in Norway, this can actually be done. The loss of head in the pressure pipe due to friction will be between about 5 and 10 per cent., so that starting with an initial energy of 100 kWh and making suitable allowance for the losses already mentioned gives, as shown in Table I, 27.9 kWh available at the turbine stop valves. Modern water turbine efficiencies lie between 88 and 94 per cent. at full load, generator efficiencies between about 95 and 98 per cent. and the transmission system efficiency between about 90 and 97 per cent., depending on the distance of the hydro-electric station from the load centre. Applying these figures to the 27.9 kWh already mentioned gives the

remaining figures of Table I and shows that in this ideal case the available energy

TABLE I

		Available energy
Initial potential energy of the rainfall...		100 kWh
Loss due to evaporation ...	50%	
Loss of head before upper reservoir	20%	
Potential energy of water in reservoir...		30 kWh
Loss in pressure pipes ...	7%	
Energy available at stop valve		27.9 kWh
Loss in turbines	10%	
Turbine output		25.1 kWh
Loss in generators and auxiliaries	5%	
Generator output		23.8 kWh
Transmission loss	5%	
Useful energy at load centre		22.6 kWh

at the load centre is 22.9 kWh, i.e., the overall efficiency of the scheme is only 22.9 per cent.

The above case is ideal and in most circumstances, for the reasons mentioned below, the amount of energy available at the load centre may be less than half this value.

In most cases it is necessary to have a number of successive stations between the upper reaches of a watercourse and sea level—to avoid loss of head the tail race of one station should be in the reservoir of the next and the last should discharge at sea level. A good example of a scheme of this nature is that of the T.V.A. (Tennessee Valley Authority); there are 10 successive stations, the highest reservoir (Cherokee) being 1 073 ft. above sea level and the last station (Kentucky) discharges into the Ohio River at 300 ft. above sea level. The fall between the last station and sea level is so gradual as to make it impracticable to utilise it. Quite frequently it is also inevitable that some head is wasted in between successive stations.

It has been assumed above that the reservoirs are of sufficient capacity to store all the rainfall so that none has ever to be allowed to flow over the spillway—whether or not this can be achieved depends on the suitability of the sites and the expense which may be incurred on the construction of the dams.

Other causes of lost power are the compensation water which has sometimes to be allowed to run down the original watercourse or down fish ladders in order to avoid interfering with fishing interests. In some countries, e.g., Sweden, log shutes have to be provided to carry timber past the stations and these may require 3 or 4 per cent. of the flow to be diverted over them during the logging season (May-August). Irrigation and navigation have also sometimes to be considered.

It is thus seen that even with the best schemes only a few per cent. of the available energy can generally be utilised. To make the best use of the available energy it is obviously desirable to plan all the installations on a watercourse as a complete unit and, furthermore, to operate them as a complete unit. E. O. T.

Hydro-Electric Power for Italy

From Our Own Correspondent

HYDRO-ELECTRIC power supplies in Italy during this winter will be larger than forecast. The Società Idroelettrica Piemonte is to put into operation in the Piedmont district during 1947 and early in 1948 new hydro-electric power installations having an output capacity of 3 400 million kWh yearly, while the steam plants of Turbigo and Castellanza are to be enlarged, and a new generating plant of an initial capacity of 100 000 kW, in two sets of 50 000 kW each, is to be built in Turin. These will be duplicated as soon as raw materials are available for the construction of the necessary boilers and electric generators. Throughout Northern Italy, 220 kV high tension lines are to be built.

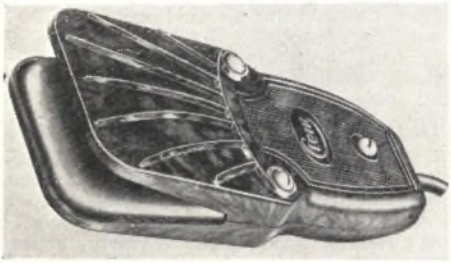
In the course of the next few months the construction is to be started of the four hydro-electric power plants in the Aosta Valley, projected by the Italo-American Electric Company. These are to have a total yearly output capacity of 450 million kWh. On the other hand, Swiss interests are co-operating with Milan Town Electric Corporation in the construction of a new hydro-electric power plant having an annual output capacity of 250 million kWh in the Livigno and in the Gallo valleys, in the province of Sondrio. The importance of this installation arises from the fact about three-fifths will be in Italian territory and two-fifths in Swiss territory, where there is to be erected a power station at Zerner through which the Italian electric system will be connected to the whole Swiss and Central European network, thus facilitating an exchange of power.

Finally, in regard to the latest electro-technical developments in Italy, Fiat is working upon a scheme for the construction of a 80 000 H.P. Diesel-electric centre in the proximity of the port of Genoa, comprising four 20 000 H.P. Diesel sets, each coupled to a 25 000 kW electric generator.

Equipment and Appliances

Portable Creasing Device

The manufacturers of the small " Clem " travelling iron, Clayton, Lewis and Miller, Ltd., of Manilla Road, Southend-on-Sea, have now added a portable electric trousers



The " Clem " portable electric trousers creaser

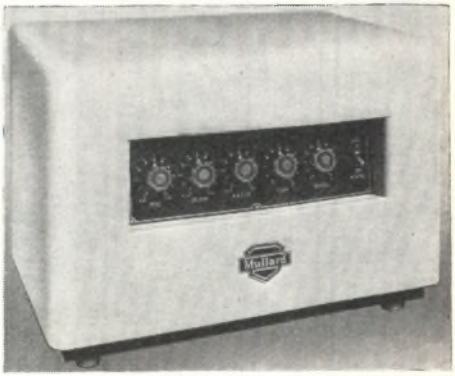
creaser to their range. The new appliance is said to put a good crease in a pair of trousers more quickly than by the normal ironing board and iron method, and it is supplied complete with 12 ft. of flex and a b.c. adaptor.

Synchronous Clock Control

Pointing out that mains frequency variations are likely to persist for some time, Jackson Automatic Electric Controls, Ltd., of Windsor House, Victoria Street, London, S.W.1, stress the advantages, where time-keeping of a high standard of accuracy is essential, of a new system of synchronous clock control which they have developed. The new control replaces grid frequency control by frequency control in the consumer's premises. The method has an electronic basis and consists of a frequency or time control unit and an amplifier at 50 cycles supplying the various clocks in the installation. An electric synchronous clock working from the output is supplied for checking against a suitable mechanical standard clock, and provision is made for correcting the time of the driven clock or clocks. The timing process is controlled by a 100 kc/s. crystal oscillator working through four stages of frequency division to give a reference output at 50 cycles at an accuracy, it is claimed, of better than one part in 100 000 —corresponding to a one second error in 27.8 hours. This 50 cycles signal is then amplified, the amplifying units available having a power output of 15 W, where the installation consists of 10 clocks only, or 30 W, where 20 clocks are employed. The accuracy of the mechanical clock is of the order of two seconds per week. Both this and the electric reference clock have central seconds pointers, for easy comparison, and are both mounted in one enclosure, with the amplifier in another. In that the system produces a clock motion which is uninterrupted and progressive, and can thus be used for driving synchronous recorders, the makers claim that it is superior to impulsing methods. It can be used, they state, for operating a series of timers which are now being developed and which will take the place of time switches for factory hooters, process timing, lighting and heating control, etc. Another possibility with the timers would be a form of programme control to include certain off-peak applications or to adjust the load of a consumer to suit local supply requirements. They can be used to operate contactors on heavy power installations, and can be arranged to open or close circuits with an accuracy extending to fractions of a second. Maintenance costs of the equipment, it is claimed, are nominal only.

Public Address Amplifier

The manufacture and marketing of amplifiers for public address work is a departure for the Mullard Wireless Service Co., Ltd., and a separate section of the company, to be known as the " Electro-Acoustic Division," has been formed to handle the new range of products. Working, for the present, for the export market



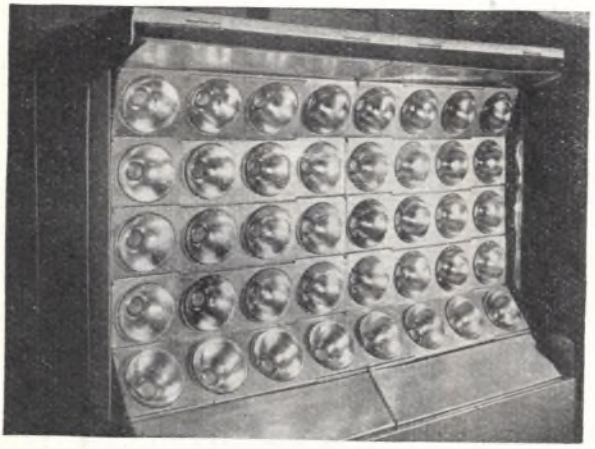
Front view of the Mullard " Ajax " 50 W amplifier (table model) showing control panel

only, the division has designed three high-quality amplifiers known as the " Leader " class. The largest of these, a 100 W model, will be ready early next year, but the other two, rated at 25 W and 50 W, are already available. All three amplifiers

are fitted with gramophone, microphone and radio input channels. The two smaller models employ resistance-capacity coupling, using eight valves in the 50 W and seven in the 25 W, with two EL. 37 valves in class AB1 as an output stage. Negative feedback is taken from the output transformer. In their specification, the makers state that the frequency characteristics of the series, with tone controls central, is within ± 1 dB over 40-20 000 cycles and that the total harmonic distortion does not exceed 3 per cent. Ninety per cent. of the full output can be obtained at 40 cycles and 20 000 cycles. A useful feature of the design is the provision of a separate output supply socket, giving 6.3 V, 3 A, a.c., and 400 V (50 W) or 350 V (25 W) at 10 mA, d.c. This may be used for the operation of external circuits such as pre-amplifiers or mixers, or for photo-cell pick-ups for sound film reproduction. Mains voltage adjustments between 110-245 V, 40-100 cycles, may be made.

New Infra-Red Lamp

The introduction of the Osram 250 W infra-red industrial lamp with internal reflector makes possible an extension of the technique of industrial radiant heating. One of the major improvements, it is stated, lies in the fact that whereas paint falling on a normal reflector cannot easily be removed without damage to the reflector surface, the internal reflector, consisting of silvering on the lower half of the inner surface of the bulb, is completely protected. Any paint which does fall on the glass surface of the bulb can be removed without difficulty. The reflector, which lasts the lifetime of the lamp, is always clean. The new lamps can be run in closer proximity to one another than when external reflectors have to be used, and thus a materially greater concentration of heat can be produced. Because of the high temperature to which it may be exposed, the Edison screw cap is fixed mechanically to the bulb instead of with cement. The new lamp weighs less than the combination of the clear 250 W lamp and external reflector. It is important that it should not be used on its own, but only in a properly designed plant incorporating secondary and end reflectors, as these contribute appreciably to the efficiency of the installation.



A bank of Osram infra-red industrial lamps with internal reflectors, showing the method of mounting in secondary reflector panels

High-Fidelity Radiogramophone

Recently announced by E. K. Cole and Co., Ltd., of Southend-on-Sea, is a new radio-gramophone designed with many technical refinements. Particular attention has been paid to high quality reproduction both from records and broadcast transmissions, and push-pull output stages give 8 W for less than 10 per cent. harmonic distortion. The pick-up is a high-fidelity lightweight model employing a sapphire stylus. The radio circuit, a six valve superheterodyne, works over seven short-wavebands, all of which employ electrically-controlled bandspreading for ease of tuning, the television sound band, and on medium- and long-wavelengths. The output stage consists of two pentodes in push-pull with negative feedback. Three medium-wave and two long-wave stations can be selected by means of the five pre-set selector buttons, and the other controls include a variable-selectivity switch, slow-motion drive tuning control and a four-position tone control. A 12 in. p.m. speaker is employed. With a Garrard eight-record autogram unit, the instrument is housed in a flat-topped cabinet of walnut veneers, with an anodised aluminium speaker grille. The power consumption is 73 W (including motor consumption), or 67 W, for radio only. A feature of the construction intended to facilitate the work of the service engineer is the arrangement of the components in two detachable assemblies—coil box and wavechange switchgear in one, and the drive, scale, gang-condenser and bandspread mechanism in another. The complete press-button switch and coil system is also on a separate and detachable unit.

Book Reviews

The Metre-Kilogram-Second System of Electrical Units. By R. K. Sas and F. B. Pidduck. (London: Methuen & Co., Ltd.) Pp. 60. Price, 4s. net.

Although the advantages of the MKS system of electrical units are now widely recognised, some considerable time must necessarily elapse before it is generally adopted. So many writers have been brought up on the older systems that it requires a considerable effort to depart from the more complicated, but more familiar, and adopt the simpler unit system. Consequently, the c.g.s. electrostatic and electromagnetic units will continue to be largely used, even by authors who admit the value of the later MKS system. It must be remembered, too, that the reader must receive due consideration.

This monograph, one of Methuen's useful series, will be of great value in presenting, in a concise and readable form, the main points in favour of the general adoption of the MKS system. The abolition of two systems—electrostatic and electromagnetic—in favour of one, which also does away with the necessity of distinguishing between practical and so-called "absolute" units, must make a forcible appeal to the majority of electrical engineers.

The first 22 pages are devoted to argument in favour of the MKS in comparison with earlier systems, while most of the remainder of the book deals with the explanation of formulæ and worked examples. The last section of four pages comprises a list of formulæ. It is felt that a little more time spent in preparation might have made certain parts of the book more readily understood, and there are some misprints or clerical errors which, in so small a book, cannot readily be excused. Most of the errors will, however, be obvious to the reader and the book is well worth a perusal by technical writers not well acquainted with the MKS system.

A useful addition to the contents would have been a short bibliography of selected references.—T.A.L.

Robert Holland Martin—A Business Biography. (London: Frederick Muller.) Price, 17s. 6d. net.

Business men, in particular, will derive pleasure and satisfaction from this memoir in that it tells the story of a man who was well known as chairman of Martin's Bank and of the Southern Railway, but whose interests and activities were far from being confined to finance and industry.

Bagehot's classic description of the private banker of tradition was peculiarly applicable to "Rob," as he was called by his many friends. "A man of known wealth, known integrity and known ability is largely entrusted with the money of his neighbours. . . They see daily his manner of life and judge from it that their confidence is deserved. . . A certain part of his time, and a considerable part of his thoughts, he can readily devote to other pursuits." Holland Martin took great pride in his home and family, and was like an elder brother to his five sons. He was deeply interested in the staff association of his bank, which retained the individuality of a family concern; and he brought the same human sympathy to bear in his relations with the railwaymen.

Passionately fond of architecture and archæology, he entrusted the rebuilding of the head office of Martin's Bank to Sir Herbert Baker, who contributes an appreciative chapter. Martin put up the ancient sign of his bank, a grasshopper, outside the new building in Lombard Street, and persuaded other great banks to do the same with their emblems. Soon afterwards he was amused to overhear two draymen discussing the great gilt insect. "What is it for?" asked one. "It's their trade mark," said the other, "a blood-sucker!"

It would be hard to imagine anyone to whom this comment was less applicable, as the reader will gather from the eleven chapters that make up this lively portrait of a lovable and remarkable man. —J.A.B.

Textbook of Illuminating Engineering, by Dr. J. W. T. Walsh (London: Pitmans). Pp. 191. Price 17s. 6d. net.

Some 10 years have passed since a certain technical institute first initiated a specialised course in illuminating engineering, to be followed one year later by the holding of an examination on the subject arranged by the City and Guilds of London Institute. Although textbooks (mainly American) dealing with various fundamental and advanced aspects of illumination, were available to teachers and students, unlike other established subjects, there was no published standard British work dealing fully with the examination syllabus. Examinations cannot be passed solely by the cramming of textbooks, but Dr. Walsh's latest work, in conjunction with attendance at one of the many technical institute courses available in illuminating engineering, will enable any average student to pass the

City and Guilds Intermediate Examination in that subject. The book is based, and adheres very closely to, the syllabus of the examination, and the text is written in a clear and comprehensive manner and is illustrated by means of well executed diagrams.

Although the author has succeeded in his aim of keeping the book as small as possible, it is considered that some reference should have been made in Chapter VIII, to cold-cathode discharge lamps such as high voltage fluorescent tubes, and " neon " signs, and also carbon dioxide tubing. Similarly more detailed treatment might have been given in respect of the use of mains-operated fluorescent lamps on d.c. supplies and voltage characteristics of mercury vapour and sodium vapour lamps. Many sections of the book will, as should always be the case, need amplification by the lecturer, who will be aided in his resort to specialised treatises, etc., by the many footnote references.

It is very useful to be able to refer readily to comprehensive authoritative data and it is suggested, therefore, that the appendices might well be augmented, for example by the addition of Tables of Reflection Factors, Transmission Factors, etc. Although plastic materials play a great part in the design of modern fittings, no mention is made of these or of the many various glasses (other than opal) used in current lighting practice.

That modern illumination schemes should be the subject of careful and deliberate planning instead of depending on results of trial and error and out of date " rule of thumb " methods, is excellently dealt with in Chapters X and XI with respect to lighting design. Whereas a few years ago the standard I.E.S. publication consisted of a list of interiors with approximate illumination values, now the recommendations consist of a " Code of Practice for Good Lighting of Building Interiors " and detailed reference is made to this particular publication.

Dr. Walsh (not forgetting the I.E.S. at whose request the book was written) is to be congratulated on writing a concise and up-to-date textbook which will be welcomed by teachers and students alike. It is to be hoped that he will complete his good work by writing a companion volume covering the syllabus of the Final Grade Examination.

J. B. H.

Electrical Statistics

THE weekly average consumption of coal by authorised electricity undertakings during August amounted to 409 000 tons—5 000 tons more than in July and 13 000 tons more than in August last year. Distributed stocks of coal held by undertakings increased from 3 531 000 tons in July to 3 739 000 tons at the end of August. For the same month last year distributed stocks were down to 1 797 000 tons. Electricity generated decreased from 2 866 000 000 kWh in July to 2 767 000 000 kWh in August. This was less than the total for August, 1946, which was 2 847 000 000 kWh.

Deliveries of British-built arc-welding sets during the second quarter of the year showed a monthly average of 826, value £133 000, and resistance welding sets, a monthly average of 231, value £60 000. The monthly averages in the first quarter were: Arc-welding sets 593, value £74 000; resistance welding sets 222, value £49 000.

The latest issue of the Monthly Digest of Statistics also shows that in June the deliveries of steam turbo-alternators of 10 000 kW and over had a total rating of 167.5 thousand kW, of which 32.5 thousand kW was for export. In May deliveries amounted to 52.5 thousand kW, of which 40 thousand kW were for export; and in April 40 thousand kW, all of which were for export. In the first quarter of the year the deliveries were as follows:—January, 60.0 thousand kW (30.0 thousand kW for export); February, 55.0 thousand kW (25.0 thousand kW for export); March, 146.5 thousand kW (74.0 thousand kW for export).

Details given of the production of electrical appliances and supplies for the home civilian market are as follows:—January to March: Electric fires, 183.0 thousands (151.3 thousands for home market); irons, 222.0 thousands (160.7 thousands); vacuum cleaners, 70.0 thousands (49.0 thousands); kettles, 70.2 thousands (58.9 thousands). April to May: Fires, 82.3 thousands (58.9 thousands); irons, 166.4 thousands (90.5 thousands); vacuum cleaners, 74.7 thousands (41.3 thousands); kettles, 57.3 thousands (40.7 thousands).

For housing purposes the production of electric cookers increased from 17.3 thousand in June to 22.1 thousand in July; the output of electric wash-boilers decreased from 14.8 thousand to 13.8 thousand, and immersion water heaters from 38.4 thousand to 30.4 thousand, while the production of electricity meters increased from 121.5 in June to 136.6 thousand in July.

Electricity Supply

Oldham.—A 60 000 kW extension to the Slacks Valley station at Chadderton, consisting of one set and two 360 000 lbs. per hr. boilers, is scheduled for completion by July, 1952. The extension is estimated to cost between £3 000 000 and £3 500 000, and the Chief Engineer is shortly to open negotiations with plant manufacturers.

Leeds.—A contract for the steel-framed buildings at the Skelton Grange power station, worth £463 575, has been placed with Dorman, Long and Co., Ltd. The first stage of the station will comprise three 60 000 kW sets and six 360 000 lbs. per hr. boilers. To this will be added, as part of the 1951-52 programme, a further 60 000 kW set and one 550 000 lbs. per hr. boiler.

Blackpool.—Formal notice will shortly be forthcoming from the C.E.B., the Electricity Committee have been informed, to erect a new generating station in the district. Boring operations, which will include 12 holes 30 ft. deep and two holes 100 ft. deep, are to be undertaken in order to determine a suitable site. These investigations will be carried out by Prof. E. Molton and will cost £1 000.

Edinburgh.—A single 540 000 lbs. per hr. pulverised fuel-fired boiler is now being installed at the Portobello station, in conjunction with one 60 000 kW cross-compound turbo-alternator. The plant is scheduled for commercial operation by September, 1949. Authority has also been given for the installation of a duplicate set for operation not later than July, 1952. Ultimately the station will house some six units, the later four to be of a larger type than those now installed.

Luton.—Under the title "Spreading the Industrial Load," Mr. C. T. Melling, borough electrical engineer, has compiled a booklet explaining the purposes of load-staggering, for circulation to industrial consumers in the area of supply. It outlines the functions of the Regional Boards for Industry and gives many hints on possible methods of reducing individual demand without interference to production. The undertaking has appointed an industrial power engineer (Mr. V. Southon) whom consumers are invited to consult on their load-spreading problems.

Menai Straits.—The Ministry of Fuel and Power has informed Anglesey County Council that the views of the Council and those of Beaumaris Corporation and Menai Bridge Urban Council will be "carefully borne in mind" when further consideration of the hydro-electric development scheme is practicable. Estimated to cost £4 000 000, the scheme plans to use the tidal waters of the 12 miles long straits for the generation of electricity by the construction of three dams, the centre dam carrying the turbine plant. This, it is stated, would save 60 000 tons of coal annually. The Beaumaris and Menai Bridge authorities have protested against the scheme on the grounds that it would hinder navigation.

West Hartlepool.—The annual report of the Borough Electrical Engineer (Mr. S. Tillotson) states that there was a deficit of £3 291 for the year ended March 31 last, compared with a surplus of £627 the previous year. Revenue from sales of electricity increased by £12 780. The report commented that it was satisfactory that it had been possible in 1947, despite adverse factors, to maintain a progressive policy, to sell units at a lower average than in 1946, and to produce a revenue account with a deficit relatively so small as might justify the year's trading being regarded as balanced. Despite the deficit, it is not intended by the Corporation to increase charges.

Islington.—Among measures recently approved at a Council meeting was a proposal to transfer the 12 500 kW set from the C.E.B. switchgear to that of the undertaking. The work, which is being undertaken as an emergency measure pending the rearrangement of bulk supplies, will cost £2 000. Approval was also given to the application to the Electricity Commissioners for loan sanction for £100 000, to cover capital expenditure on unspecified works, and to the purchase of cooking and heating apparatus for two Council housing estates. Roof repairs are to be carried out at the central depôt, at a cost of £2 000, and maintenance is to be started on the power station chimney stacks. The staff of the undertaking is to be increased by the appointment of a commercial assistant and inquiry bureau supervisor and additional shift charge and junior charge engineers.

Banbury.—The town may be substantially without street lighting this winter, as a result of a misunderstanding on the part of the local Council. A contract was recently signed with the S.W. and S. E.P. Co. for the installation of electric street-lighting, and the existing contract with the local gas company was

cancelled at the same time. It has since been discovered that approval should first have been sought from the Ministry of Transport, and this has so far been refused. The gas company has now informed the Council that, having cancelled its own contracts with suppliers of maintenance materials for the gas system, it will be unable to help, and the S.W. and S. Co. has pointed out that, even if permission from the Ministry is immediately forthcoming, it would be some months before the scheme for electric street lighting could be put into operation. A deputation may visit the Ministry to seek advice on the situation.

Glasgow.—During the financial year ended May 31, 1947, the Electricity Department generated 719 961 900 units, compared with 665 860 600 units in the previous year. Units delivered amounted to 679 924 400 (628 349 900). Imports from the Central Electricity Board rose from 81 675 977 in 1946 to 109 015 361 units. Adding units purchased, at 2 692 738 (4 311 039), the total units to the system were 791 632 499, compared with 714 336 916. During the year the total connections on the system rose from 612 251 kW to 645 011 kW, and the number of meters, similarly, increased from 252 239 to 261 898. Units sold totalled 736 092 275 (658 419 329), of which 6 650 501 units were for public lighting. The percentage expended in distribution and unaccounted for fell during the year from 7.83 per cent. to 7.02 per cent. The gross revenue of the undertaking during the year was £2 480 905, compared with £2 171 104, and total expenditure was £2 454 845, compared with £2 270 028, giving a surplus for the year of £26 060, which compares with a deficit of £98 924 in the previous year. The balance carried forward on surplus revenue account was £160 949.

Hydro-Electricity in Sweden

THE development of water-power resources in Sweden has been intensified as a result of the shortage of coal caused by the war, and several new plants have been put into operation in recent years, with the result that since 1939 the water-power output has increased by about 5 000 000 000 kWh to over 13 000 000 000 kWh in 1946. It is estimated that about one-third of the total utilisable water-power has so far been harnessed.

A new station, comprising two turbine-generators with a combined capacity of 46 000 kW, was opened last month at Näm Rapids, on the Angerman River in Northern Sweden. The plant, which cost £1 414 000, was erected by the Swedish Hydro-Electric Power Board, after a protracted struggle with local historians, who complained that its suggested location would involve the destruction of ancient rock carvings. As a result, the station was eventually situated further upstream, although this involved considerably higher building costs.

On the same river or its tributaries three other major plants are being built or planned. One of them, on the Forsmo Rapids, is expected to start operating in the spring and will have a capacity of 75 000 kW when a second generator is installed. Next year, the Power Board will begin work on a still larger plant, with a capacity of 180 000 kW, at the Kil Rapids. It will involve the quarrying of a discharge tunnel about five miles long, the longest of its kind so far in the country. A private company is building a 165 000 kW plant on the Faxälven River, where the first of three 55 000 kW sets, which will be situated in a machine hall nearly 270 ft. underground, is expected to be ready for use in May, 1949. The discharge tunnel will have a length of 4¼ miles. North of the Arctic Circle a 260 000 kW station is under construction at the Harspranget waterfall.

The International Commission on Large Dams will hold a Congress in Stockholm from June 10-17 next year. The Swedish Committee of the Organisation has recently issued an invitation to the 20 countries which are members of the organisation.

The four main questions to be dealt with at the Congress are: Measurement of uplift pressures and the stresses arising therefrom; research methods and instruments for measuring stresses and deformation in earth and concrete dams; recent precautions to avoid formation of pipings; experiences arising from the testing and use of special cements for large dams. The programme includes study tours to a number of Swedish dams and hydro-electric plants, among them a visit to the 260 000 kW station at Harspranget. The tours will conclude with meetings in the industrial town of Trollhättan, where one of Sweden's best-known hydro stations is situated.

The International Commission was formed in 1928 with the object of promoting research on various matters connected with construction and maintenance. The first Congress was held in Stockholm in 1933 and the second in Washington in 1936.

Industrial Information

Works' Outing

Victor H. Iddon, Ltd., Wythenshawe, Manchester, held their annual works' outing recently, when about 150 employees and friends went by steamer to Llandudno. The weather was excellent and the party spent a thoroughly enjoyable day.

Modern Mining Machinery

Under this title a condensed textbook for the student of mining machinery has been produced by the Ministry of Fuel and Power and the National Coal Board. It describes the modern machines at present in use in the British mining industry and others that will be employed in considerable quantities when available.

Appointment of Agents

Barries Electrical Agencies, Ltd., of King Street, Brighton, have been appointed sole agents for Alneco, Ltd., of Sandpitts, Birmingham, manufacturers of electric fires, kettles, irons, etc., also industrial fittings, for the London Home Counties, Eastern Counties, South Coast, West of England, Oxfordshire, Hertfordshire, Buckinghamshire and Berkshire.

E.A.W. Activities

The 18th Certificate Examination in Electrical Housecraft for Teachers, of the Electrical Association for Women was held on June 21, when 70 candidates qualified for the certificate. The total number of certificate holders is now 1 271. At the 21st E.A.W. Certificate Examination in Electrical Housecraft for Demonstrators and Saleswomen, held on June 12, 117 candidates qualified for the certificate, bringing the total number of certificate holders to 1 181. The association has made two more revisions in its series of educational charts. "Electricity—the Circuit in the Home" is the title of one new chart. Each room in the house is depicted, showing the socket outlets connected to the various circuits. "The Electric Cooker" chart has been revised to include variable boiling-plate control, and thermostatic control of the oven. Twenty-seven girls from the Burlington School, Wood Lane, visited the E.A.W. headquarters for home laundry and cookery demonstrations.

New 16 mm. Projector

New 16 mm. projectors, type 301, made by the British Thomson-Houston Co., Ltd., have been shipped to Argentina, Australia, Africa, Belgium, India, New Zealand, Norway, Palestine, Sweden, Spain and Turkey where they have created widespread interest. Countries to which demonstration models have been, or will be, sent include Borneo, China, Cyprus, Denmark, Finland and Iceland. Not only from overseas, but from users at home numerous orders and inquiries are being received for entertainment, educational and industrial purposes.

Protective Filters for Welding

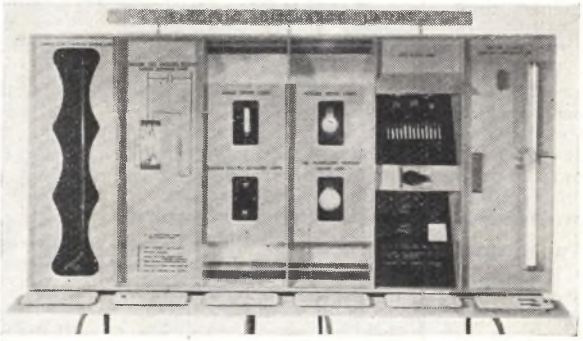
Published evidence on the effects of ultra-violet and infra-red radiation on human eyes, and on methods of protection from harmful effects, is surveyed at intervals by the B.S.I. Committees responsible for the preparation of B.S. 679, Protective Filters for Welding, in order to ensure that this standard specifies not only requirements that will give adequate protection to wearers, but also permits the most economical production methods compatible with this protection. B.S. 679 has been revised upon the basis of

On the left is a general view of the stand of the Marconi's Wireless Telegraph Co., Ltd., at Radiolympia, showing their twin-channel h.f. direction finder, new v.h.f. mobile communication equipment and marine equipment. On the right is one end of the radio and television stand of the General Electric Co., Ltd., at Radiolympia, devoted entirely to models for export

such a survey. Protection is specified for filters intended for electric welding. Copies of this B.S. can be obtained from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 2s., post free.

Electronic Lighting Exhibit

Reproduced on this page is a photograph of the stand contributed by the E.L.M.A. Lighting Service Bureau to the Electron Jubilee Exhibition at the Science Museum, South Kensington. On it are displayed the Cooper-Hewitt mercury vapour lamp; an enlarged projected image of a working discharge tube from a high-pressure mercury vapour lamp; a sodium vapour lamp and various types of neon glow-lamps; high-pressure mercury vapour lamps, both fluorescent and non-fluorescent; fluorescent powder and materials under "black" light; and a half-coated 4 ft. fluorescent lamp with control equipment.



The stand of the E.L.M.A. Lighting Service Bureau at the Electron Jubilee Exhibition, Science Museum, South Kensington, London. It illustrates electronic influence on modern lighting

To Help in Export Drive

An effective display of automatic radio valve testing was staged by Philips Electrical, Ltd., at the Blackburn electricity showrooms as part of a recruiting drive for girl assistants to help in export trade.

Price Increase

We are advised by Bylock Electric, Ltd., South Street, Ponders End, Middlesex, that as from October 1 all machines delivered from their factory will be for retail pricing of £13 13s., plus purchase tax. The reason for this increase is partially that the company have now included a swivel carpet tool attachment, and are unable to hold the price with this new component. The container at the new price will be price-labelled on the exterior.

Statement of Published Tariffs

The London and Home Counties J.E.A. has issued in booklet form a statement (No. 15) of published tariffs for the supply of electricity, hire of meters and so on, in force in the London and Home Counties electricity district on July 1, 1947. Undertakings are arranged in alphabetical order in their respective groups, namely, local authorities, companies and the J.E.A. The charge is 5s. and copies may be obtained at the Clerk's Office, 5-6, Lancaster Place, Strand, W.C.2.

Radio Research for Industry

The Department of Scientific and Industrial Research is to take over the fundamental radio side of the Telecommunications Research Establishment, the Services' biggest war-time radio station at Malvern, to develop and use techniques for industry. Sir Edward Appleton, the secretary of the Department, told the Select Committee on Estimates, whose minutes of evidence were published on Monday, that the Establishment was too large for peace-time. When it became clear that the Services could not carry on such a big organisation, the Department had suggested taking over the more fundamental radio side. The Department had proposed assuming responsibility for those working on fundamental research at a cost of £80 000 a year, and of another group working on electronics at a cost of about £60 000 a year.

Illuminating Engineers

MEMBERS of the Birmingham Centre of the Illuminating Engineering Society commenced their sessional meetings on September 27 as guests of the British Thomson-Houston Co., Ltd., at the Rugby works where, after being welcomed by the directors, the visitors were taken on an instructive tour of the various departments. It was in the lamp works, however, that most interest was shown, for here the visitors saw the production of lamps, and the continuous struggle towards perfection.

After tea, the lecture hall at the works was placed at the disposal of the society, and formal business being concluded, Mr. H. R. Ruff gave a paper "New Lamps—New Uses—And New Techniques," which he illustrated with cine films and demonstrations.

To round off the day, members then inspected the fluorescent street lighting of Rugby.

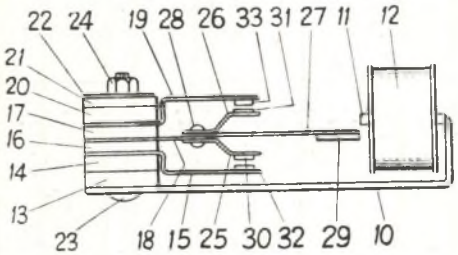
Electrical Inventions

The abstracts below, which are prepared with the permission of the Controller of H.M. Stationery Office, are written from the viewpoint of general interest and do not attempt to define the scope of the inventions, nor indicate in which features novelty lies. Specifications may be obtained from the Patent Office, price 1s. each, or 1s. 1d. abroad.

High Frequency Vibrator

The patentees describe a method of high frequency vibrator construction which, it is claimed, permits relatively high operating frequencies without any manufacturing difficulties, efficiently transforms the available coil energy into mechanical energy to operate the contacts, produces high contact pressure and tends to eliminate spurious oscillations of the contact members.

The ferromagnetic frame member 10 has the end of its hook portion narrowed down to a pole piece 11 around which is mounted the driver coil 12. On the other end of the frame is mounted a stack



comprising insulated spacers 13 and 14, a pair of side springs 15, a pair of insulated spacers 16 and 17, between which is clamped one end of a hinge plate 18, a second pair of side springs 19, insulated spacers 20 and 21 and a metal plate 22.

The characteristic feature of the invention lies in the construction of the vibratory member and the side springs. The hinge section 18 is made of a flexible spring material secured to which are a pair of rigid side arms 25 and 26 and also one end of an elongated rigid lever arm 27. On the free end of this lever is an armature or weight 29. Side arms 25 and 26 carry the vibratory contacts 30 and 31, which co-operate with the relatively fixed contacts 32 and 33 carried by the side springs 15 and 19.

From the point of attachment of the side arms 25 and 26 to the armature 29, the reed section is made of material of such thickness that practically no bending takes place in normal operation. On the other hand, the lower or hinge section of the reed is made from flexible material so that normal starting conditions are obtained. Similarly, the side springs are made with an elongated flexible material, and most of the compliance of the system therefore lies in them.

In operation, the stiff section of the vibratory system, arm 27, acts as a lever operating about a pivot at some point in the reed hinge section 18. The length of this lever, the mass of the armature 29 at its end, the contact spacing distance and the compliance of the side springs then determine the operating frequency at any given coil energy.

The Plessey Co., Ltd Convention date (U.S.A.), April 14, 1944. Complete accepted, June 20, 1947. No. 589 455.

Steel for Transformers

THE Ministry of Supply have drawn the attention of the Commissioners to the shortage of sheet steel for transformers and have asked that steps be taken to ensure that the requirements of the supply industry be reduced to a minimum. The matter has been discussed by the Commissioners and the B.E.A.M.A. and it is apparent that considerable economies would be effected if undertakers when purchasing transformers specified the highest possible flux densities. In the circumstances undertakers are invited to co-operate and are requested to specify in all further orders a minimum flux density in the core of any oil-immersed transformer in accordance with the table below, these figures having been agreed with the B.E.A.M.A. and the Central Board :—

Three-phase		Single-phase		Flux density in lines per sq. cm.
Above	Up to and including	Above	Up to and including	
—	25 kVA	—	8½ kVA	12 500
25 kVA	100 kVA	8½ kVA	33⅓ kVA	13 000
100 kVA	Any output	33⅓ kVA	Any output	13 500

As regards orders already placed, undertakers are asked to contact manufacturers with a view to arranging that unless construction has already commenced, the flux density should conform to the table if it does not already do so.

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:—

Scotland.—Supply, delivery and erection of approximately ten miles of 132 kV steel tower transmission lines. Tender documents from Messrs. Merz and McLellan, 39, Northumberland Street, Edinburgh, 3; deposit, £2 2s.

Cambridge, October 11.—Electrical installation in the Trumpington New Junior and Infants' School, comprising classrooms, offices, drying rooms, cloakrooms, assembly halls, dining rooms, kitchen, etc. Specification from Borough Surveyor, Guildhall, Cambridge; deposit, £5 5s.

Plympton St. Mary, October 17.—Supply and delivery of domestic apparatus: (a) electric cookers; (b) immersion type water heaters; (c) electric wash boilers; (d) electric kettles. Specification from Clerk to the Council, Council Offices, Plympton.

Stoke-on-Trent, October 17.—Tenders invited for purchase of used electric plant, comprising one oil engine direct-coupled to d.c. generator, 15 kW, 200 V, with switchgear, and one d.c. 12 H.P. motor-driven booster set. Specification from General Manager, Electricity Department, 31, Kingsway, Stoke-on-Trent.

Luton, October 18.—Installation of electric light in third section of Luton Technical College. Specification from County Architect, Shire Hall, Bedford; deposit, £2 2s.

Birmingham, October 20.—Supply, for twelve months, of electric kettles, cookers, wash-boilers, circulator water heaters, cooker control units, circulator water heater control panels. Specifications from Chief Engineer and Manager, City of Birmingham Electric Supply Department, 14, Dale End, Birmingham, 4.

Birmingham, October 20.—Supply, delivery and erection of electric lighting equipment, comprising floodlights, fittings, lanterns, concrete columns and associated apparatus for the railway sidings and roadways at Hams Hall "B" power station. Specification from Chief Engineer and Manager, City of Birmingham Electric Supply Department, 14, Dale End, Birmingham, 4; deposit, £2.

Rochdale, November 3. — Supply, delivery, laying, jointing and commissioning of 0.2 sq. in., 33 kV underground cable, together with associated pilot cable. Specification from Engineer and Manager, Electric House, Smith Street, Rochdale.

Pretoria, November 11.—Supply, delivery and erection of: (a) piping equipment and (b) circulating water pumps and equipment, for first stage of "B" power station. Specifications from City Electrical Engineer in Pretoria or from the consulting electrical engineers, Messrs. Merz and McLellan, Carliol House, Newcastle-on-Tyne, 1; deposit, £2 2s.

Stoke-on-Trent, November 12.—Manufacture, supply, delivery and erection of two 1 000 MVA outdoor oil circuit-breakers, switchgear structures, and two indoor control panels, as an extension of existing 33 kV equipment. Specification from General Manager, Electricity Department, 31, Kingsway, Stoke-on-Trent; deposit, £2.

Women's Engineering Society

THE annual conference of the Women's Engineering Society took place in London from September 26 to 28. Delegates were welcomed by Dr. E. M. Collin, chairman of the London branch. On September 27 members paid a visit to Northolt Aerodrome, where they were shown the new control tower. A paper on "Gas Turbines and Jet Propulsion" was delivered by Mr. F. C. Sheffield. At the annual dinner of the society in the evening, the speakers were Mr. P. J. Noel Baker, Secretary of State for Air, and Sir Frederick Handley Page. Mr. Noel Baker paid tribute to the work of women in industry and the Services during the war, and said that legislation to make the women's services part of the Armed Forces of the Crown would be soon introduced. The W.E.S. had played a great part in bringing the brains and character of women into industry. On September 28 Miss Winifred Hackett gave her Presidential Address as outgoing president, her subject being "Some Modern Trends in Telecommunication." Miss Hackett reviewed the development of telephony and telegraphy and described some of the experiments that were being made in the post-war development of radio links. In this country and in America a number of ultra-high frequency telecommunication links using the principle of continuous-wave frequency-modulation were in operation for experimental purposes. Mrs. F. D. Heywood was elected president of the society for the year 1947-48.

Company News

MIDLAND COUNTIES ELECTRIC SUPPLY CO., LTD.—Interim div. of 4%, less tax, on ord., for current yr., payable October 17, 1947.

CHRISTY BROS. AND CO., LTD.—The company has called an extraordinary meeting for to-day to consider a resolution authorising the directors to serve notice on the Minister of Fuel and Power in accordance with the proviso to Section (13) (1) (c) of the Electricity Act, 1947, stating that the company wishes to be treated as an electricity holding company.

MADRAS ELECTRIC SUPPLY CORPORATION, LTD.—The company is reducing its dividend on the £598 200 ordinary capital from 8 per cent. for 1945 to 5 per cent. for 1946. Net profit is stated at £74 976, against £74 799 for the previous year. As previously announced, the Government of Madras has given notice of its intention to acquire the undertaking. Negotiations between the parties are in progress.

BERRY'S ELECTRIC, LTD.—Prft. to Mar. 31, £88 082 (£75 277), plus int. £2 220 (£1 645), and prft. on sale of leasehold prop. £1 175 (nil), mkg. £91 477 (£76 922). Deduct depreen., fees, note int., etc., £15 113 (£16 097), lvg. net prft. £76 364 (£60 825). To res. for reprs. £7 500 (nil), inc.-tax £31 409 (£26 767), res. for N.D.C. £4 136 (£3 167), gen. res. £22 500 (£20 000), ord. div. 12½% (same); fwd., £9 724 (£8 599).

ELECTRICAL COMPONENTS, LTD.—Prft. for yr. to June 30, exclds. subsids., £85 506 (£41 223). Fin. div., payable Oct. 27, 12½%, mkg., with int. already paid, 20%, less tax (nil). Prelim. statemt. shows E.P.T. and N.D.C. £27 500 (£26 500), income-tax £28 335 (£9 155), off capital costs £3 567 (£772), gen. res. £2 500 (£7 500), divs. £16 500 (nil), lvg. carry-fwd. £17 412 (£10 308).

LONDON ELECTRICAL AND GENERAL TRUST, LTD.—Rept. for yr. ended June 30 shows divs. and int. £62 943 (£58 664); plus arrears of income recvd. in excess of one yr.'s income £1 776 (£2 445), plus transfer fees, mkg. £64 724 (£61 117); less deb. int. £16 000 (same), tax £4 900 (£2 439), gen. exes. £3 279 (£2 992), bank int. £16 (nil), dirs.' fees £1 800 (same), lvg. £38 729 (£37 886); to gen. res. £5 000 (£4 541), fin. 4%, mkg. 6% (same), fwd. £16 830 (£16 401).

HACKBRIDGE AND HEWITTIC ELECTRIC CO., LTD.—The company, which recently acquired the business of the Hackbridge Electric Construction Co. and the New Switchgear Construction Co., is paying a div. of 6%, less tax on the ord. for yr. ended Mar. 31 last. Accts. show trdg. prft. for yr. £94 010, incldg. prft. from Apl. 1, 1946, of two businesses acquired. Depreen. prov. £13 637, dirs.' fees £3 250, lvg. £77 123. Taxn. absorbed £38 200, (net) paid by vendor co. prior to Mar. 20, 1947, £11 117, and div. and provn. for premiums on redeemable pref. shares £1 711. Gen. res. £10 000, and 4% pref. div. for 11 days to Mar. 31, £232, 6% ord. div. £13 200, lvg. carry-fwd. £2 363 higher at £24 453. Balce.-sheet at Mar. 31 shows curr. assets aggregatg. £817 874 incldg. stks. and wk. in progress £373 416, and debtors £296 273. Current liabs. total £199 913, and res. and surplus £118 547. Future taxn. provn. amts. to £30 700. It is proposed to convert the ord. shares into 5s. stock units. Formerly known as the Hewittic Electric Co., the company changed to its present title on Mar. 20 last when authorised capital was increased to its present amount of £750 000, all issued, in 350 000 4% cumulative pref. of £1 and 1 600 000 ord. shares of 5s. A div. of 40% was paid on the existing 40 000 ord. shares of £1 for the year ending Mar. 31, 1946.

Metal Prices

		Monday, Price	Inc.	October 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 (60/40)—				
Rod basis	per lb.	1s. 1¾d.	—	—
Wire	„	1s. 6⅛d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)	per ton	£9 10 0	11s.	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.		£35 15 0	£1 10	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.	„	£22 15 0	£1	—
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. 6¾d.	—	—
Aluminium Ingots	per ton	£80 0 0	—	—
Spelter		£70 0 0	—	—
Mercury (spot) (*ex. warehouse*)	per bott.	£16 0 0	—	—

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.*

ELECTRIC BOILING PLATES, LTD., London, S.E.—Aug. 14, £2 500 deb., to W. T. Knorr, Halstead (Kent); general charge.

LANGLEY ELECTRICAL REPAIRS, LTD., London, S.W.—Aug. 15, mort., to Westminster Bank, Ltd., securing all moneys due or to become due to the bank; charged on 158, Stonhouse Street, S.W.4. *Nil. Apr. 8, 1941.

WESTINGHOUSE BRAKE AND SIGNAL CO., LTD. (formerly WESTINGHOUSE BRAKE AND SAXBY SIGNAL CO., LTD., AND WESTINGHOUSE BRAKE CO., LTD.), London, N.—Aug. 26, deed of variation and further charge by way of additional and collateral security to deb. dated Oct. 31, 1927, to Lloyds Bank, Ltd.; charged on certain ppties. at Chippenham, etc. *Nil. Mar. 25, 1947.

Receiving Order

WOOD, Raymond, 1244, Bristol Road South, Northfield, Birmingham, lately radio dealer, now commercial traveller. Court: Birmingham. Date of Filing Petition—August 1, 1947. Date of Receiving Order—September 15, 1947. Creditor's Petition. Act of Bankruptcy proved in Creditor's Petition—Section 1-1 (G.), Bankruptcy Act, 1914.

Coming Events

Saturday, October 11

I.E.E., N. WESTERN STUDENTS' SECTION.—Manchester. Annual Luncheon. *1.30 p.m.* Chairman's Address: "Modern Electric Winding Engines," by J. E. P. Mills. *2.30 p.m.*

Monday, October 13

I.E.E., WESTERN CENTRE.—Cardiff. At the S. Wales Institute of Engineers, Park Place. Chairman's Address, by G. Lewis. *5 p.m.*

JUNIOR INSTITUTION OF ENGINEERS, N. WESTERN SECTION.—Manchester. At 16, St. Mary's Parsonage. Presidential Address: "Steam Economy in the Process Industries," by G. A. J. Begg. *7 p.m.*

E.L.M.A. LIGHTING SERVICE BUREAU.—London. At 2, Savoy Hill, W.C.2. Illumination Design Course. *Until November 17.*

I.E.E., N. EASTERN CENTRE.—Newcastle-on-Tyne. Chairman's Address, by G. G. Mallinson. *6.15 p.m.*

I.E.E., S. MIDLAND CENTRE.—Birmingham. At the Grand Hotel. Chairman's Address, by W. S. Burge. *6 p.m.*

INSTITUTION OF ELECTRONICS.—London. At the Royal Society of Arts, Adelphi, W.C.2. "Luminescent Materials and Infra-Red Radiations," by G. F. J. Garlick. *6.30 p.m.*

E.L.M.A. LIGHTING SERVICE BUREAU.—Stoke-on-Trent. At the Corporation Electricity Department. Illumination Design Course. *Until November 17.*

Tuesday, October 14

ILLUMINATING ENGINEERING SOCIETY.—London. At the School of Hygiene and Tropical Medicine, Gower Street, W.C.1. Presidential Address, by Dr. J. W. T. Walsh. *6 p.m.*

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.—London. At the Lighting Service Bureau, 2, Savoy Hill, W.C.2. Film, "Can We Be Rich," followed by Presidential Address, by H. Nimmo. *5.45 p.m.*

E.L.M.A. LIGHTING SERVICE BUREAU.—Birmingham. At the Electricity Supply Showrooms. Illumination Design Course. *Until November 18.*

I.E.E., N. WESTERN CENTRE.—Manchester. "Protective Finishing of Electrical Equipment," by F. Widnall and R. Newbound. *6 p.m.*

I.E.E., SCOTTISH CENTRE.—Glasgow. At the Royal Technical College, George Street, C.1. Chairman's Address, by H. M. Speirs, followed by a talk, "The Chesters," by E. Leete. *6.30 p.m.*

I.E.E., N. IRELAND CENTRE.—Belfast. Chairman's Address, by J. McCandless. *6.45 p.m.*

Wednesday, October 15

I.E.E., SCOTTISH CENTRE.—Edinburgh. Chairman's Address, by H. M. Speirs, followed by a talk, "The Chesters," by E. Leete. *6 p.m.*

I.E.E., LONDON STUDENTS' SECTION.—Visit to Sangamo Weston, Ltd., Enfield.

I.E.E., W. WALES SUB-CENTRE.—Swansea. Chairman's Address, by A. S. Phillips.

I.E.E., RADIO SECTION.—London. Inaugural Address by the Chairman, C. E. Strong. *5.30 p.m.*

I.E.E., N. MIDLAND CENTRE, SHEFFIELD SUB-CENTRE.—Chairman's Address, by J. A. Walker. *6.15 p.m.*

Thursday, October 16

ELECTRICAL POWER ENGINEERS' ASSOCIATION, Midland Technical Group.—Worcester. At the City Electricity Works. "Gas Turbines," by R. G. Voysey. *7 p.m.*

I.E.E., INSTALLATIONS SECTION.—London. Inaugural Address by the Chairman, R. H. Rawll. *5.30 p.m.*

I.E.E., S. WESTERN SUB-CENTRE.—Plymouth. Chairman's Address, by J. Rodgers. *3.15 p.m.*

I.E.E., IRISH BRANCH.—Dublin. Chairman's Address. *6 p.m.*

Friday, October 17

ILLUMINATING ENGINEERING SOCIETY, BIRMINGHAM CENTRE.—Chairman's Address, by C. J. Allderidge. *6 p.m.*

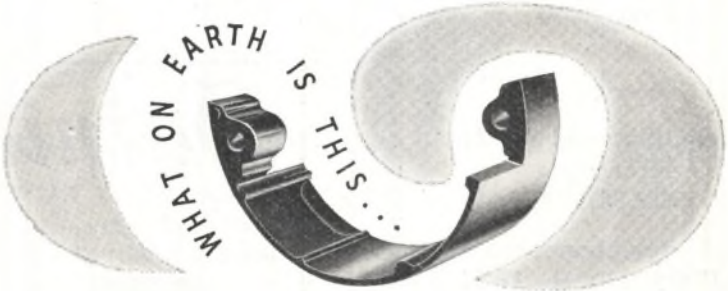
SCOTTISH ENGINEERING STUDENTS' ASSOCIATION.—Edinburgh. At the Royal British Hotel. "The Electrical Resistance Wire Strain Gauge," by A. G. Hadjiopyrou. *7.30 p.m.*

I.E.E., MEASUREMENTS SECTION.—London. Chairman's Address, by D. C. Gall. *5.30 p.m.*

For sixty years we have maintained our reputation for accuracy and efficiency, and in this, our Diamond Jubilee Year, we are proud to offer to the trade refractories, of the highest quality at strictly competitive prices.
If you require insulators of guaranteed reliability and efficiency, let us quote you.

WILLIAM KENT (PORCELAINS) LTD.

Wellington Street, Burslem, Stoke-on-Trent
Telephone Stoke-on-Trent 84237/8



The rather rummy looking object above is one section of the new DS skirt for surface mounting the DS conduit box type socket. The other section is an absolute twin, and they get together as shown below.

This enables the skirt to be fixed after the wiring has been completed and means greater ease for the wireman.
Just another ingenious addition to the DS Fused Plug and Socket range.

DS FUSED PLUG AND SOCKET

Announcement of DS Plugs Ltd., Manchester - London - Glasgow. EIM47

INDEX TO ADVERTISERS IN THIS ISSUE

CLASSIFIED ADVERTISEMENTS

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

BRITISH ELECTRICITY AUTHORITY.

WELFARE OFFICER.

APPLICATIONS are invited for the post of WELFARE OFFICER in the Labour Relations Department at a salary of £1,500, rising by annual increments of £50 to £2,000 per annum. Salary will be subject to deductions for superannuation.

Candidates must possess wide experience in the organisation of welfare work in an industrial undertaking and the drawing up of schemes of welfare development. They should state age, qualifications, experience, present salary and personal references. Applications, which will be acknowledged and treated as confidential, should be sent within 14 days to the Acting Establishment Officer, British Electricity Authority, Portland Court, 170a, Great Portland Street, W.1. (246)

CITY OF LEEDS ELECTRICITY DEPARTMENT.

SENIOR DEMONSTRATOR.

APPLICATIONS are invited for the post of Senior Demonstrator.

Candidates should preferably possess a recognised Diploma in Domestic Science and the E.A.W. Certificate in Electrical Housecraft, be competent to organise and conduct lecture demonstrations and to advise on the selection and use of all domestic apparatus.

Salary in accordance with the Higher Clerical Division of the National Scheme of Conditions of Service for Local Authorities, Administrative, Professional, Technical and Clerical Services, £304 to £340 per annum, plus war bonus at present £48 2s. per annum.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and the selected candidate will be required to pass a medical examination.

Applications, stating age and giving full particulars of training and experience, to be received by November 1st, 1947.

Canvassing in any form either directly or indirectly will be a disqualification.

F. NICHOLLS,
General Manager and City Electrical Engineer.

1, Whitehall Road,
LEEDS, 1.
September 29th, 1947. (237)

HUDDERSFIELD CORPORATION ELECTRICITY DEPARTMENT.

APPOINTMENT OF CONTROL ENGINEER.

APPLICATIONS are invited for the position of Control Engineer at the St. Andrew's Road Generating Station of the Huddersfield Corporation, at a salary in accordance with the National Joint Board Scale, Class "H," Grade 9, £402-£417 per annum.

Applicants should have had practical experience in the operation of a modern Selected Power Station, and Central Electricity Board grid supplies.

Applications, stating age, qualifications, practical and technical experience and accompanied by at least two copies of recent testimonials, should be submitted to the undersigned not later than Thursday, October 16th, 1947, and enclosed in a sealed envelope, endorsed "Control Engineer."

The appointment will be subject to the Corporation's Conditions of Service and to the Local Government Superannuation Act, 1937. The successful candidate will be required to pass a medical examination.

F. A. ELLIS, M.I.Mech.E., M.I.E.E.,
Engineer and Manager.

Market Street,
HUDDERSFIELD.
October 2nd, 1947. (250)

SITUATIONS VACANT

COUNTY BOROUGH OF EAST HAM.

APPOINTMENT OF ASSISTANT TO INSTALLATIONS ENGINEER.

ELECTRICITY DEPARTMENT

APPLICATIONS are invited for the above appointment from persons with sound technical training and who have had considerable experience in the preparation of estimates and specifications for all classes of installation work for new public buildings, schools, canteens and housing programmes. The successful applicant will be required to work under the direction of, and assist, the Installations Engineer. Candidates should possess the Higher National Certificate in electrical engineering, or equivalent qualification.

The salary will be in accordance with Class F, Grade 8b, of the National Joint Board Schedule, at present £405 6s. per annum, rising to £421 1s. per annum.

The successful candidate will be required to pass a medical examination and the appointment will be subject to the Local Government Superannuation Act, 1937.

Applications, on forms to be obtained from the undersigned, accompanied by copies of not more than three recent testimonials, must reach me not later than October 25th, 1947.

Canvassing in any form will be a disqualification.

H. A. EDWARDS,
Town Clerk.

Town Hall,
EAST HAM, E.6.
September, 1947. (213)

IMPERIAL CHEMICAL INDUSTRIES, LTD., WILTON WORKS.

ADVERTISEMENT REFERENCE No. ICI/X/33.

CONSTRUCTION ENGINEERS. IMPERIAL CHEMICAL INDUSTRIES LTD., WILTON WORKS, invite applications for the following appointments :—

(1) **SENIOR MECHANICAL CONSTRUCTION ENGINEER** to supervise the installation of mechanical equipment in connection with large scale chemical plants. Applicants should be fully conversant with modern construction equipment and methods and should have experience in the installation of general plant equipment and pipework. Experience essential in the control of site workers of the various trades.

(2) **BOILERS CONSTRUCTION ENGINEER** to supervise the erection by contractors of water tube boilers and auxiliary equipment. Experience essential in the erection of H.P. boiler plant. Preference will be given to applicants with some experience with pulverised fuel and oil firing equipment.

(3) **ELECTRICAL (PLANT) CONSTRUCTION ENGINEER** for the erection of plant electrical installations including motors, starters, distribution boards, cables and lighting. Experience essential in erection and installation of above equipment in large chemical or engineering works.

The successful candidates will be appointed to the established staff. They will be responsible to the Construction Manager and may later be transferred to the maintenance staff. Applications, giving full details of experience, qualifications and salary required, should be submitted in writing to the Personnel Manager, Imperial Chemical Industries Ltd., Wilton Works, P.O. Box 54, Middlesbrough, Yorks, quoting advertisement reference No. ICI/X/33 and appropriate vacancy. (197)

WANTED for Engineering Office, Electrical Engineer, recent graduate or H.N.C. standard with test bed or similar industrial experience. Work is in connection with Power Plant for Telephone Exchange Contracts and alternative experience could be in connection with Exchange Equipment if technically qualified on the power side. Applicants should give full particulars of education and technical training with chronological outline of any experience, and state what salary they regard as commensurate therewith. —Ref. 231, Siemens Brothers & Co., Ltd., Woolwich, S.E.18. (185)

SITUATIONS VACANT

THE Civil Service Commissioners give notice that an Open Competitive Examination for Engineering Apprentices in the following Ministry of Supply Establishments will begin at a large number of local centres on February 5th, 1948: —Atomic Energy Research Establishment, Harwell, Berks; National Gas Turbine Establishment, Leicestershire; Royal Aircraft Establishment, Farnborough, Hants; Royal Ordnance Factories in various parts of England, Scotland and Wales; Signals Research and Development Establishment, Christchurch, Hants; Telecommunications Research Establishment and Radar Research and Development Establishment, Malvern, Worcs.

Candidates must be not less than 16 and not more than 18 years of age on September 1st, 1948.

Full particulars and application forms may be obtained from the Secretary, Civil Service Commission, 6, Burlington Gardens, London, W.1, quoting No. 2010. The latest date for receipt of completed application forms is December 1st, 1947. (236)

DRAUGHTSMEN required by switchgear engineers. Experienced in contract work, protective gear diagrams or design.—Applications in writing, with full particulars, to: Ferguson, Pailin Ltd., Manchester, 11. (84)

FOR SALE

A NUMBER of New Switchboards from surplus disposal at low prices: 25 for 110 v. D.C. 5/20 amps., complete; 25 for use with alternators up to 5 kW, 230/300 v., 1-ph., 50 cycles, with automatic voltage regulators. All panels complete with costly apparatus.—Full details from: The Electroplant Co., Wembley, Middlesex. (120)

ALTERNATORS, all sizes from 2-120 kVA, for quick delivery.—Apply to: The Electroplant Company, Wembley, Middlesex. (119)

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., Electrin Works, Winchester Street, Acton, London, W.3. (247)

BRAND new Electric Cable. Flat Twin 3/029, 250 volts, V.I.R./P.V.C., T.B. and C., £17 15s. 1 000 yards. Sample 100 yards, £2. Discounts quantities. Also Auto, Ignition, Flexs, Radio and Starter Cables at big savings.—Ref. 5003, Magna Ltd., 82-94, Seymour Place, London, W.1. (243)

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)

COUNTRY HOUSE PLANT. One 10 H.P. "Petter" Vertical paraffin engine. No. 30664 direct coupled to 50 volt 80 ampere Dynamo in good condition. One 8 H.P. Preston Proctor & Co., Horizontal paraffin engine No. 37026 direct coupled to 70 volt 75 ampere dynamo. Switchboard and battery of 27—200 amp. accumulators complete with stand. Geo. W. Bentley, Ltd., East Street, Havant, Hants. (252)

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)

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, Goodge Street, W.1. Mus. 5385. (TC114)

FOR SALE

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)

FLUORESCENT Starter Unit. New single unit type, Long life obviating renewals. Used with any fitting. Samples and prices from sole manufacturers.—E. W. Engineering Co., Ltd., 407, Nether Street, Finchley, N.3. Finchley 5974. (109)

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)

KICK SWITCHES, 15 amp., suitable for fires, convectors, wash boilers, etc. Send 3s. P.O. for sample.—SEDWAY ELECTRIC LTD., 80-81, Gt. Hampton Street, Birmingham, 18. Phone: NORthern 2084. (TC110)

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

LAMPS, large stock of SEDWAY LAMPS, 25 W to 150 W, available from stock. Also SEDWAY 1 kW and 2 kW reflector FIRES, and 12 in. rod ELEMENTS. Send for price list.—SEDWAY ELECTRIC LTD., 80-81, Gt. Hampton Street, Birmingham, 18. Phone: NORthern 2084. (TC109)

ONE Stobie High Frequency Induction Melting Furnace, complete with ancillary equipment, capacity 5 to 7½ cwt., H.T. supply 6 600 volts; one EFCO Fixed Roof Arc Furnace, complete with ancillary equipment; also spare Electrodes and three 1-ton Bottom Pouring Ladles, capacity 15 to 20 cwt., H.T. supply, 6 600 volts.—Apply: De La Rue Gas Development Ltd., Portobello Works, Warwick. (249)

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, ex-Czechoslovakia, one new A.E.G. type S, 1 000/640 Generator, 565 kVA, 6 600 volts, weight approx. 4 300 kg.—Enquiries: Rustone Ltd., 13, Bateman Street, London, W.1. Phone: Gerrard 5569. (242)

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

SOUND Reproducing Racks, consisting of two Electric Tables (Garrard Motors), two Photo Electric Cells, Mixer Unit and 50-watt Amplifier, etc.; £20 each. Three only. Carriage paid.—Castle Bromwich Electric, 200, Washwood Heath Road, Birmingham. East 0931. (245)

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. Available from stock or short delivery for larger quantities.—"Renas," 107, Albert Road, South Norwood, S.E.25. Phone: Addiscombe 6055-6-7. (179)

FOR SALE

STRONG WOOD BOXES. 14 in. × 8½ in. × 7½ in., also 11 in. × 8½ in. × 6½ in. and 12 in. × 8½ in. × 8½ in. inside measurements, all complete with lids, 2s. 6d. each; reduction quantities. Ex works. Sample of any size box, passenger train, 3s. 6d.—F. Turner & Co., Colliery Buildings, Bredbury, Cheshire. 'Phone: Woodley 3106. (182)

SWITCHPLUGS, 15 amp., 3-pin. We are now accepting orders for delivery December-January. Price on application. All other types of accessories held in stock.. Write for our 1948 price list.—L. Benn & Co., Ltd., 81, City Road, London, E.C.1. (178)

T.R.S. Telephone Cables, 4-core to 52-core. Samples on request.—L. E. Butler, 225, Cheney Manor Road, Swindon. (189)

THIRTY Charging Sets by Foster, G.E.C., Partridge Wilson, 110 D.C. input/output, 3 circuit, 5, 10 and 20 amps., in transit cases. New. £5 each.—Vaughan, 69, Hainault Road, London, E.11. (244)

TINNED ARMATURE BINDING WIRE. All sizes from 16 s.w.g—28 s.w.g. supplied from stock on 7lb., 14 lb., 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)

V.I.R. Lead-cased Cables, new, on drums: 500 yards 61/103, 8 000 yards 37/083, 2 600 yards 7/036, 4-core, 4 500 yards, 7/036, 5-core.—Enquiries to: S. J. Barnett & Co. Ltd., Barkingside Metal Works, Mossford Green, Ilford, Essex. Telephone: Valentine 2201. (231)

30 AND 50 kVA Diesel engine-driven Alternating Sets, 400/230 volts, 3-phase, 50 cycles. For delivery in October. Alternators and Switchboards can also be supplied.—The Horseshoe Supply Co. (Spalding), Ltd., Horseshoe Road, Spalding. (141)

33.5 kVA Portable Alternating Set, 46 h.p. "Allen" 4 cyl. water cooled petrol/paraffin engine, direct coupled to a 33.5 kW, 400 v., 3-phase, 50 cycles Alternator. Complete with switchboard. Motor Generator Set on chassis. Morris 4 cyl., petrol driven engine with automatic governor, 25 h.p. direct coupled to a Mawdasley Generator, 220 v., A.C./D.C., 57 amps., in continuous rating.—Apply: C. S. Ltd., Staffa Works, Staffa Road, E.10. (208)

450 SATCHWELL Thermostats, tubular type. W.O. variable 10° 90° C., suitable for immersion heaters: 3 000 wire wound potentiometers by Fox and B.E.R., 50 watt, 50 ohm and 500 ohm, 20 watt loading. All brand new tested stock offered, substantially discounted for quantities.—Partridge, Wilson and Co., Ltd., Davenset Electrical Works, Leicester. (33)

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Wembley Park, Middlesex.
Telephone: Wembley 3121 (4 lines).
Also at Phoenix Works, Belgrave Terrace, Soho Road, Handsworth, Birmingham.
Telephone: Northern 0898.
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Long deliveries can often be avoided by purchasing rebuilt secondhand plant. We can redesign or replace surplus plant of any size.
SEND US YOUR ENQUIRIES.
OVER 1 000 RATINGS ACTUALLY IN STOCK HERE. (5)

SACKS AND BAGS in excellent condition for all commodities, as low as 6d. each.—Write: John Braydon Ltd., 230, Tottenham Court Road, W.1. Tel. No. Museum 6972. (8)

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. No permit required.

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, 5¾ in. high, 3½ in. dia. Large quantities available, sample 2s. per return; discount on quantities.

WOOD SWITCH BLOCKS: 3¼ in. round and square, 6 in. by 3 in. by ½ in.; 9 in. by 3 in. by ½ 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: **SCEMCO 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 SCEMCO UNIT** dispenses with starter switch trouble. Guaranteed to strike tubes regardless of Supply Voltage reduction. Each unit guaranteed.—For full details apply: **SCEMCO LTD.,** Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC102)

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

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15 AMP. SWITCHED SOCKET for 3-pin plug top. Of robust design. Manufactured to B.S.S. requirements. Steel casing 5 in. by 3¾ in. by 2¾ in., finished Cream. With 5 knock-out entries for ¾ in. conduit.—Full details from: **SCEMCO LTD.,** Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC107)

TINNED STEEL ARMATURE BINDING WIRE. All even numbered sizes from 16 s.w.g.—28 s.w.g. supplied from stock on 7 lb., 14 lb., or 28 lb. reels.
FREDERICK SMITH & CO., WIRE MANUFACTURERS, LTD., CALEDONIA WORKS, HALIFAX. (9)

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16 new **NECO** geared **MOTORS**, ¼ h.p., 230 volt, D.C. Final shaft speed 26 r.p.m.

2 **CROMPTON PARKINSON MOTORS,** 125 h.p., 3 300 volts, 480 r.p.m. on bedplate with pedestal bearing. As new.

1 **RUSTON HORNSBY DIESEL ALTERNATOR SET,** 85 kVA at .8 p.f. 400/230 volts, 3 phase, 50 cycles, 4 wire, 1 000 r.p.m.

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Various **ALTERNATORS** from 30 kVA in stock.

Large stocks of re-conditioned **A.C. AND D.C. MOTORS,** etc.

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SLIP RING INDUCTION MOTORS, 400/440 VOLTS, 3-PHASE, 50 CYCLES.

ONE 125 h.p. Westinghouse, 725 r.p.m., three bearings with control gear.

One 120 h.p. Westinghouse, 205 r.p.m., two bearings with control gear.

One 60 h.p. L.D.M., 720 r.p.m., two bearings.

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100/110 VOLTS D.C. MOTORS AND GENERATORS.

Three 24 kW Tilling Stevens Generators, 1 625 r.p.m.

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230 VOLTS, 1-PHASE, 50 CYCLES TOTALLY ENCLOSED MOTOR-DRIVEN FANS.

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Three 15 in. diameter, 1 400 r.p.m.

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WANTED

A.C. MOTORS, 1-100 h.p., 500-1 500 r.p.m. Any make fitted with ball and roller type bearings. Must be good machines, such as you yourselves would buy. Alternatively motors for rewinding will be considered.—Oldfield Engineering Co., Ltd., 96, East Ordsall Lane, Salford, 5. (2)

AN unlimited number of modern A.C. motors urgently required for essential work. Highest cash prices paid for suitable units. We also want all types of motors for conversion and rewinding.—Send details to Sales Dept., A. P. Watson, 104, Upper Brook Street, Manchester, 13. (28)

ELECTRIC MOTORS: One 100 h.p. totally enclosed, fan cooled enclosure, ball bearing, continuously rated, slip ring, Induction Motor, suitable for 440 volts, 3 phase, 50 cycles supply, with approximate speed of 1 440 r.p.m., without starter. One 100 h.p. ditto, 750 r.p.m., with starter. One 50/60 h.p. ditto, 960 r.p.m., without starter.—The Morgan Crucible Company, Ltd., Battersea Church Road, London, S.W.11. (198)

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SCEMCO LTD., Fluorescent Lighting Specialists, wish to contact manufacturers of electrical equipment and accessories and appliances. Fluorescent fittings and components of particular interest. Full co-operation given in exchange for Sole Distribution Rights.

Managing Director, **SCEMCO LTD.,** Scemco House, 6 and 7, Soho Street, London, W.1. Gerrard 1461 (3 lines). (TC108)

AGENTS

FLEMING Electrical Corporation wish to appoint Authorised Dealers for the distribution of Descaphone All Loudspeaking Intercommunicators.—Write for full particulars to: Fleming Electrical Corporation of Gt. Britain Ltd., 92, Buckingham Palace Road, London, S.W.1. (224)

REPRESENTATIVES required for all areas, including London, by makers of switchgear, fuse boards, porcelain insulators and fuses, to call on wholesalers, manufacturers, supply companies, contractors, etc. Commission basis.—Please write, giving full details of age, experience, turnover and area, to: Box L.H.C., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4. (238)

RADIO and Electrical Buyer for nation-wide multiple retail business. Excellent prospects. Permanency.—Box L.H.D., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4. (239)

WELL-ESTABLISHED and experienced merchant house requires sole representation of reputable manufacturers.—Interested parties please communicate: Vyas Brothers, 33, Nanabhai Lane, Churchgate Street, Fort, Bombay, 1. Cables: "Maybank," Bombay. (26)

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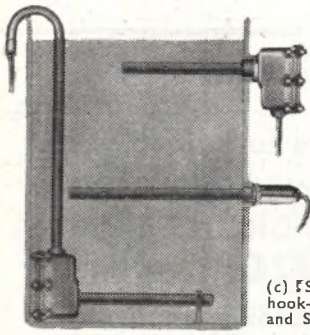
PATENTS, DESIGNS AND TRADE MARKS,
70 & 72, Chancery Lane, London, W.C.2.
Grams: "Patent, London." Phone: Holborn 4405 (4 lines)
And at—NEWCASTLE: 3, St. Nicholas Buildings. (4)

GET your customers to take precautions against frost now. The Santon single-element ANTI-FREEZER effectively prevents freezing up of all kinds of water tanks—domestic and industrial. Easily installed, or available as a submersible unit, the Santon "Anti-freezer" uses very little current, can be connected to existing electrical circuit at any convenient plug point, renders system proof against freezing.



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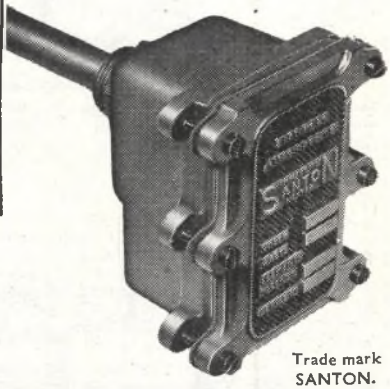

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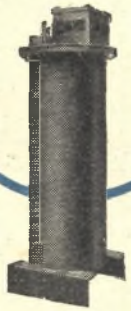

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WESTINGHOUSE BRAKE & SIGNAL CO., LTD.
82, YORK WAY, KING'S CROSS, LONDON, N.1.

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