THE
ELECTRICIAN

Vol. CXXXV. No. 3506. Friday, August 10, 1945. Sixpence

(Registered at the General Post Office. Entered as Second Class at the New York U.S.A. Post Office.)

MISCELLANEOUS ADVERTISEMENTS

TENDER

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD.

THE North of Scotland Hydro-Electric Board invite Tenders for the supply, delivery and erection of 132 000 volt Transmission Lines.

Copies of the Form of Tender, Conditions of Contract, Specification and Schedules may be obtained from the Undersigned on deposit of £5 5s., which will be returned on receipt of a *bona-fide* Tender.

Tenders on the Form supplied must be lodged with the Undersigned not later than 15th October, 1945.

The Board do not bind themselves to accept the lowest or any Tender.

T. LAWRIE,
Secretary.

16, Rothesay Terrace, Edinburgh, 3.
31st July, 1945.

SITUATIONS VACANT

None of the situations advertised in these columns relates to a man between the ages of 18 *and* 50 *inclusive, or a woman between the ages of* 18 *or* 40 *inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order,* 1945, *or the vacancy is for employment excepted from the provisions of that Order.*

A VACANCY exists in an old-established firm of Cablemakers in the London Area for a fully-qualified Electrical Engineer to undertake experimental testing and research work on high-voltage cables, accessories and constituent materials. A thorough knowledge of A.C. power and high-frequency bridge methods of measurement is necessary, and in particular familiarity with the Schering bridge in normal and modified forms.

The appointment will call for ability to assist in designing and developing special forms of test apparatus to meet specific requirements, and experience of impulse testing equipment will also be of value.

Previous industrial experience is desirable, but not essential. Commencing salary £250-£300 per annum, according to qualifications and experience. Participation in the Company's superannuation scheme is a condition of employment, becoming effective after one year's service.

Applications will be treated as strictly confidential, and should give full details of education, training and qualifications, and record of all previous experience if any.—Box L.P.S., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

LIGHTING ENGINEERS required by leading Electrical Manufacturers, capable of planning Industrial and Commercial schemes. Responsible posts for first-class men with initiative and experience.—Write Box H.K.3, c/o 5, New Bridge Street, London, E.C.4.

EXCELLENT opportunity for boy leaving school, to begin work in Illuminating Engineering Department of well-known Electric Lamp Manufacturers.—Write, with brief details of education, to Box H.P.8, c/o 5, New Bridge Street, London, E.C.4.

WANTED, Transformer Assembler, 10-200 KVA. Must be capable of complete assembly from Drawings. Good progress for efficient man in new Department. Exempt from Military Service, over 51, or Class A ex-Service man.—Reply, Box L.P.Q., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

SITUATIONS VACANT

SHEFFIELD CORPORATION ELECTRICITY DEPARTMENT.

APPOINTMENT OF DEPUTY-GENERAL MANAGER AND ENGINEER.

APPLICATIONS are invited for the position of Deputy to the General Manager and Engineer at a commencing salary of £1,100 per annum, rising to £1,400 per annum by three annual increments of £100.

The appointment will be subject to the provisions of the Local Government Superannuation Act, 1937, and candidates must have previous Local Authority Service carrying a transfer value within the meaning of the Act, or otherwise be not more than 40 years of age. The selected candidate will be required to pass a medical examination.

Candidates should be Corporate Members of the Institution of Electrical Engineers, and should have had a sound training in mechanical and electrical engineering. They should be experienced in the construction, operation and control of a large Electricity Supply Undertaking, and have a sound technical knowledge of both modern steam practice and the latest developments of electrical practice.

Applications, which must be made on the application form, copies of which may be obtained (with particulars of the duties, terms and conditions of appointment) from the undersigned, must be received by the undersigned by the first post on Tuesday, the 28th August, 1945.

Canvassing or any communication with members of the City Council, either directly or indirectly, is prohibited and will be a disqualification.

This advertisement is published by permission of the Ministry of Labour and National Service under the (Control of Engagement) Orders, 1945.

JOHN HEYS,
Town Hall, Sheffield, 1. Town Clerk.
27th July, 1945.

WANTED, Storekeeper. Good prospects for efficient and responsible man. Must be exempt from Military Service, over 51, or Class A ex-Service man.—Box L.P.R., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

MANAGER required, with general experience in the manufacture of lead storage batteries. State experience and salary required.—Write Box L.P.O., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

PATENTS

NOTICE is hereby given that A. H. HUNT LIMITED seek leave to amend the Specification of Letters Patent No. 563 080 entitled "Improvements in or relating to processes for the treatment of metallised paper and the manufacture of electric condensers therefrom."

Particulars of the proposed amendment were set forth in the Official Journal (Patents) No. 2 948, dated July 25th, 1945.

Any person may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, on or before the 25th August, 1945.

H. L. SAUNDERS,
Comptroller-General.

FOR SALE

SEARCHLIGHTS (sale or hire), Carbon Rods, Ebonite, Fibre Hightensite, Porcelain House-wiring and other Cleats, Reels and Knobs, Mirrors, Lenses, Lamp Lowering and Suspension Gear, T.R.S., lead and other Cables, Winches (hand), hundreds of thousands in use, etc.—London Electric Firm, Croydon.

LEATHER FINGER STALLS.—Made of Chrome Hide. Very strong and hard wearing. Length 3 in. Price 4s. per doz. Prompt delivery. Sample on application.—Willson Brothers, Industrial Clothing Manufacturers, Epsom, Surrey.

H.K. UNIVERSAL LAMPSHADE HOLDER (prov. patent), will fit practically every lampshade. Price £14 8s. 0d. per gross; £7 10s. 0d. per 6 doz., incl. purchase tax; cash with order. Manufacturers: Oakland Metal Co. Ltd., Oakland Works, Willington, Derby. Tel.: Repton 390 and 399.

TABLE AND STANDARD LAMPS in beautiful colours. Orders now accepted for limited quantities, particularly for the Christmas business. Inquiries invited. Manufacturers: Oakland Metal Co. Ltd., Willington, Derby. Tel.: Repton 390 and 399.

SALE.—Foundry, Building and Plant.—Apply Box L.P.T., "THE ELECTRICIAN," 154, Fleet Street, London, E.C.4.

PATENT AGENTS

MEWBURN, ELLIS & CO.,
PATENTS, DESIGNS AND TRADE MARKS,
70 & 72, Chancery Lane, London, W.C.2.
Grams: "Patent, London." 'Phone: Holborn 0437 (2 lines)
And at—NEWCASTLE: 3, St. Nicholas Buildings.

MANOR ELECTRIC OVEN & FIRE CO.
175, Windsor House, Victoria Street, London, S.W.1 Tel.: Abbey 1782
ELECTRICAL ENGINEERS
Manufacturers of
HOSPITAL FOOD TROLLEYS,
IMPREGNATING OVENS, Etc.
Also Apparatus to Customers' own specifications

This new dual model indicates 2 to 30 volts and 100 to 750 volts: Send for interesting leaflet R.4 on "Testing."
RUNBAKEN·MANCHESTER·1

UHLHORN BROS. LIMITED
ESTABLISHED 1887
PLASTIC RAW MATERIALS
IN SHEETS, RODS & TUBES
EBONITE
LAMINATED BAKELISED SHEET
CASEIN CAST RESIN
ETC.
53b, CITY ROAD
LONDON, E.C.1

THE ELECTRICIAN

Established 1861. *The Oldest Weekly Illustrated Journal of*

Electrical Engineering, Industry, Science and Finance

Bouverie House. 154, Fleet Street, London, E.C.4. Telegrams: "Benbrotric, Fleet, London. Telephone: Central 3212 (Ten Lines).

Midlands Office: Daimler House, Paradise Street, Birmingham. Telephone: Midland 0784.
Glasgow Office: 116, Hope Street, Glasgow, C.2. Telephone: Central 3970.

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

No. 3506. [Vol. CXXXV No. 6] August 10, 1945 Annual Subscription 25s. Overseas 30s.

CHIEF CONTENTS OF THIS ISSUE

Electric Vehicles

THE electric vehicle which offered such promise in the early part of the European war as a saver of petrol, and which but for the still questionable restrictions in 1940 would have done so much to relieve our tanker space, has once again come into the news with the publishing of the 1944 report of the Electric Vehicle Association. It will be remembered that at the end of 1943, the Minister of War Transport attended a demonstration of what was then called a national standard electric vehicle, and though impressed by its performance, the Minister did nothing which resulted in the vehicle going into production. Even now, with the war in Europe at an end, the manufacture of the vehicle is still prohibited under the various restricting controls.

In 1940-41 the story was that the shortage of steel prevented manufacture, while the petrol then available for existing motor vehicles was by no means in short supply. In 1943 the situation was reversed with petrol in short supply and steel, though still scarce, nevertheless available in small quantities. To-day we have both petrol and steel, but so lacking in enterprise are the Government supply departments that the manufacture of the electric vehicle is still prohibited.

The arguments for the electric vehicle, the advantages which it has to offer compared with the petrol driven vehicle, are too well-known to need repetition, while evidence of its economic possibilities has been produced both in this country and in France, in such volume and variety that its non-acceptance by our Government departments as an easy approach to the solution of the commercial delivery van problem, is beyond ordinary understanding. That this state of affairs can continue for much longer, however, is doubtful, for with the steel foundries seeking new fields of consumption for their products, the present restrictions on the building of electric vehicles may need to give way under the force of economic pressure.

Looking forward to that time and in preparation for it, the electrical industry can at this stage do much to interest commerce and trade in the application of the electric vehicle to their particular needs. Before the present war a certain amount of good progress had been made in popularising this type of transport, but oddly enough most of that progress had been brought about without the full support of the supply industry. Some undertakings were, it is true, enthusiastic enough to use the vehicles for delivery vans, but on the whole the supply engineer was lacking that measure of co-operation which would have ensured wholesale success.

Before the E.V.A. can hope to see the electric vehicle become as popular a short journey delivery van as is now its petrol-driven counterpart, the electrical industry must therefore, first, itself be sold

the idea, for only when this has been done is the industry likely to develop an enthusiasm sufficiently great to ensure that the vehicle is placed in the scheme of commercial transport to an extent really worthy of its possibilities. With one or two exceptions the supply industry in the past has shown very little liking for the electric vehicle, either for its own use or as a recommendation for others, and in our view such apathy is a disservice which the industry can ill-afford to carry into the future. Those undertakings which have already adopted battery traction in the dual role of delivery and advertisement are without exception enthusiastic, and with the present restrictions on manufacture prohibiting the production of new vehicles, the services of these vans and of their drivers should be invited to join some national effort in order that those undertakings which still offer resistance might be suitably won over to the E.V.A. view.

The Atomic Bomb

WHEN, in 1940, we commented on the fact that the substance U-235 had been isolated from uranium ore, little did we imagine that five years later we should hear of the knowledge thus gained being used to develop an atomic bomb possessing over 2 000 times the blast power of the largest bomb dropped on Germany. Such, however, is the co-operative spirit of the scientific personalities ranged on the side of the Allied Nations, that work which in peace-time would have taken, in all probability, a life-time to develop, has in war come about in five years. A very high percentage of the investigation which led to the development of the new bomb took place in this country, as is explained elsewhere in this issue, while several of our leading electrical manufacturers also played a part. The results of investigation under the co-operative arrangements of the United States and this country were outlined both by Mr. TRUMAN and Mr. CHURCHILL on Monday, but without in any way wishing to detract from the enormity of such research, the fact that Lord RUTHERFORD made the whole thing possible in the first place must not be overlooked. Scientists without exception give credit where it is due, but the American Press in attempts to wave the flag of the country it represents, too often ignores that part of the story which concerns others, as for instance, Operation Pluto, an understandable enthusiasm perhaps, but one which needs watching nevertheless.

Industry and Atomic Energy

WHEREAS the original efforts made to disintegrate the atom were regarded in terms of service to man rather than of his destruction, the new developments may even yet find application to peace-time industry. Information on the progress so far made and on the form it has taken are, for obvious reasons, not generally available and though possibly a good many years of research may yet have to be devoted to the subject before atomic power may be used instead of mechanical or electrical power, the possibility remains. Sir JOHN ANDERSON, who was responsible as Lord President of the Council, for the research on the new bomb, believes that an entirely new field of scientific investigation has been opened up, which might in years to come revolutionise industrial life, as indeed, any physicist can appreciate. It is understood that an official statement is to be made shortly giving in some detail how the progress to date was achieved, and until this becomes public we must rest content with reading of the results of that progress, via the Japanese news service.

Radio Industry's Wavelength Plan

A NEW plan for allocating the wavelengths of all European broadcasting stations has been drawn up by the radio industry, and the Technical Committee of the British Radio Equipment Manufacturers' Association has given details of the suggestion in the form of a report. Though space precludes us from publishing details of the scheme in full, an abstract of the arrangements, given in this issue, will show that the purpose of the plan is first and foremost to give freedom from radio interference to the broadcast listener. In the past, much of the interference trouble was due to various Continental countries regarding broadcasting as a political weapon, but with most of the offenders now out of business the time seems opportune for sensibly improving the arrangement of wavelengths and controlling the power of transmitting stations, so that the reception of broadcast programmes may be enjoyed with a minimum of inconvenience. The plan conceived by the

radio industry is based on this understanding and its details are born, not of political and other considerations which so abused pre-war schemes, but of recognised engineering principles which, if adopted, would result in an improvement on the Montreux scheme.

Relating Wavelength to Area

IN the proposed new wavelength allocation, the larger the area of the country the longer would be the wavelengths chosen for it, and the power of the stations would be raised to a level which would give adequate coverage over the whole country. At the other end of the scale, restricting the local stations to such power as would give an adequate signal over their own areas, makes it possible to plan more intelligently the use of common or shared wavelengths among stations which are a great distance apart. Under the plan, the former conception of long and medium wavelengths would be replaced by a national waveband extending from 2 000 to 259 m. and a regional waveband from 259 to 192 m. Within these wavelengths it is claimed that every nation in Europe could be given an adequate, and in most cases an improved, national broadcasting service, supported by expanded regional services, and better opportunities than at present for receiving foreign programmes at high entertainment level. The sponsors of the scheme make it clear that their proposed solution of the problem is by no means a hard and fast one, and that it offers considerable elasticity in the wavelength allocation without harming the general scheme. They commend it to the earnest consideration of those who are able, in the proper places, to influence the future development of broadcasting, in the belief that the present phase in Europe holds a valuable opportunity to correct past mistakes.

The E.D.A. and Rural Electrification

THE importance which the industry attaches to the extension of rural electrification lends special interest to the formation by the E.D.A. of a new organisation to be known as the Rural Electrification Advisory Committee, and the thoroughness with which the association intends to approach the problem is indicated by the membership of that committee. So far only one meeting has been held, and that two weeks ago, and though we had hoped to give in this issue details of what transpired, the information is not yet forthcoming. The reason for this is largely due to the difficulties of times in which we live, and though we intend no criticism of the association for what at first glance appears to be undue delay, it is submitted that the whole subject of rural electrification is of such national importance and of such widespread interest that the earliest opportunity should be taken to make public what action the association, and the new committee in particular, propose taking. The work of the old committee was such that we await with impatience details of other good news, which the new committee has no doubt in mind.

Electro-Science and the Weather

THE applications of electro-science to our way of life are many and varied, while on occasion strange. That this is so was made known last week when it was revealed that whereas before the war weather forecasting was done by means of surface charts, the last six years have seen the training of hundreds of forecasters who now think in three dimensions, north-south, east-west, and from ground level to 30 000 ft. This has apparently been made possible by a device known as a "radio-sonde," a weather reporting apparatus that gives its result by wireless as it travels up to perhaps 50 000 ft. through any kind of weather. There is, it is reported, as a result of this development, more work done now in a week in exploring the atmosphere to heights of five to ten miles than was done in a whole year before the war. The radio-sonde, as we understand it, is a small self-contained transmitter about 9 in. high which, carried upward by a balloon, transmits reports of pressure, temperature, and humidity every 1 000 ft. These instruments are sent up every six hours from various points well spaced over the British Isles, and from the readings a complete picture of the isobars and winds up to 30 000 ft. is continually worked out by meteorological plotters and forecasters. The balloon is about 6 ft. in diameter when it is released and expands as it goes up until, on reaching a great height, say, 50 000 ft., it bursts. A parachute then opens which allows the instrument to descend to earth for recalibration and further ascents; one instrument has already done more than twelve journeys into the stratosphere.

Atomic Energy

Early Work Which Led to Development of New Bomb

PAST issues of THE ELECTRICIAN* during the last thirteen or so years, form an interesting record of the work which has led to the development of what the Allied Nations have described this week as the atomic bomb, for it was in this country that much of the original research work was carried out.

1932 Experiments

General interest in the disintegration of the atom first became apparent in 1932, in connection with experiments being carried out at the Cavendish Laboratory at Cambridge by Dr. E. T. Walton and Dr. J. D. Cockcroft. The late Lord Rutherford, under whose direction the work was done, stated at the time, that valuable light had been thrown on new and powerful methods of attacking the problems of atomic disintegration. The manner in which the atom was split in those experiments was, he said, by means of a cyclotron through which millions of particles a second were fired at a speed of 10 000 kilometres a second.

In these experiments energy was procured from atoms as they broke up, 100 times greater than that of the particles by which they were attacked (with a voltage of 120 000), according to an account which appeared in " The Times " of May 3 of that year. A second discovery of importance was that some of the hydrogen atoms as they were bombarded broke into helium.

Some special equipment used in the apparatus—a high voltage transformer, special vacuum pumps, etc.—were, it is interesting to note, supplied by the engineering laboratory of the Metropolitan-Vickers Electrical Co., Ltd., where Dr. Cockcroft received the early part of his training, and the apparatus used embodied the then latest practice of vacuum technique developed in the laboratory by Mr. C. R. Burch.

Thyratrons were used for high-speed automatic counting of the physical phenomena. Experiments with these valves in connection with the counting of alpha particles were first carried out in the Cavendish laboratory in 1930, with a gift of thyratrons prepared by Mr. H. Warren and Mr. T. Wadsworth in the laboratory of the British Thomson-Houston Co. at Rugby, who also supplied the thyratrons employed in the experiments described above.

Further details of the development of the cyclotron came from the Radiation Laboratory of the University of California at Berkeley, when our correspondent visited the laboratory as the guest of Prof. Lawrence. In this connection it is interesting to note that there was placed in the Science Museum at South Kensington in 1938, a cyclotron equipment built at the university in 1931, and subsequently modified in 1932, together with the original apparatus by means of which Dr. Cockcroft and Dr. Walton accelerated protons through 600 to 700 kV. A collection of photographs illustrating the development of the cyclotron, and the then latest type of apparatus which delivered currents of the order of 100 micro-amperes of deuterons, with energies in the neighbourhood of 8 000 kV, or a beam of alpha particles of about one micro-ampere at 16 000 kV, was also placed on view.

It became known in 1938 approximately, that Japan too was becoming interested in the disintegration of the atom, and there was built in Tokio an installation involving a cyclotron with an electro-magnet weighing 23 tons; the erection of a larger apparatus with a magnet of 100 tons was then being contemplated. The equipment used at that time followed the lines of the Lawrence cyclotron, and a 3 000 000 V deuteron beam of about 50 micro-amperes in intensity had been obtained.

U-235

It became known in 1940 that scientists in the United States had been successful in extracting a minute quantity of the isotope called U-235, closely related to uranium. It was claimed at the time that if one pound of the metal could be produced and suitably harnessed, it would equal 5 000 000 tons of coal in power output. The same quantity would contain as much energy as 15 000 tons of T.N.T. After various laboratories had experimented with the help of a 150-ton cyclotron, relatively large samples of U-235 were isolated, when it was found that the substance was inactive by itself but when in contact with water, energy was released.

From that date information on the subject of the disintegration of the atom has been scanty until this week, and in connection with the later developments mention may be made of the fact that among the leading personalities in the work referred to by both Mr. Truman and Mr. Churchill were:—

Prof. Niels Henrik David Bohr, Professor of Theoretical Physics, Copenhagen University, and Nobel Prize winner, who es-

* THE ELECTRICIAN, May 6, 1932; February 10, 1933; October 2, 1936; September 16, 1938; January 20, 1939.

caped from Denmark to Britain in the late autumn of 1943. While a Reader in Mathematical Physics at Manchester University he worked with the late Lord Rutherford.

Sir George Paget Thomson, Professor of Physics at the Imperial College of Science, and scientific adviser to the Air Ministry since 1942.

Sir James Chadwick, a Nobel Prize winner. Professor of Physics at Liverpool University, in 1932 he discovered an uncharged particle, the neutron, and thereby transformed the conceptions of the constitution of matter.

Sir Charles G. Darwin, Director of the National Physical Laboratory.

Prof. J. D. Cockcroft, of Cambridge, who 13 years ago took part in the experiments referred to above.

Prof. N. Feather, also of Cambridge, claimed to be the first man to split the oxygen atom artificially.

Prof. M. L. E. Oliphant, Professor of Physics at Birmingham University.

Mr. W. A. Akers, research director and a member of the board of Imperial Chemical Industries, Ltd.

Dr. Robert Oppenheimer, physicist. He went to Harvard and then came to England. Studying at Cambridge from 1925 to 1926, he took his doctorate of Physics at Göttingen University, in Germany, the following year. He later became Professor of Physics in California University.

Prof. Rudolf Peierls, British-naturalised German-born Jewish refugee. Professor of Applied Mathematics, Birmingham.

Dr. Franz Eugen Simon, also a naturalised German-born Jewish refugee. Reader in Thermodynamics at Oxford.

A number of others whose names may be linked in future with that of the late Lord Rutherford, are as yet not made known.

Progress of work in Germany with respect to the disintegration of the atom is somewhat lacking in detail, though it is known that their knowledge on the subject is not far behind our own. As revealed in Mr. Churchill's statement on Monday, the "heavy water" or deuterium oxide, D_{20}, production plant of Norway was looked upon by the enemy as of immense value in the development of their work.

Before the war heavy water, a superhydrogenated form of ordinary water, was produced as a by-product of the Norsk Hydro-Electric Co's. plant at Rjukan in Central Norway, though owing to the highly specialised processes involved, only a few pints a day could be produced. This was exported by Norway, in peace time, to any country in the world where scientists were engaged upon research in the possibilities of disintegrating the atom. When the Germans occupied Norway they immediately took control of the Norsk Hydro-Electric Co.. the plant used for the manufacture of nitrogenous compounds, and the electrolytic cells from which heavy water could be distilled. Production was stepped up, and as much of it as possible was transported to Germany. In February, 1943, a party of parachutists was dropped over the wooded mountains above the Norsk-Hydro-Electric undertaking and was able to destroy parts of the major plant, thus delaying further German development.

Vector Algebra and A.C. Power

By G. W. STUBBINGS, B.Sc., A.M.I.E.E.

As sinusoidal alternating currents and voltages can be combined by the rules of vector addition, a rotating vector $V_m e^{jwt}$ is sometimes considered to be representative of an alternating voltage of maximum value V_m and frequency $+$ where $w=2\pi f$, because the projection of the rotating vector on the horizontal, or its real part, is $v=V_m \cos wt$, the instantaneous value of the voltage. If this voltage is applied to an impedance of Z ohms, with a leading phase angle of Φ, and represented by the vector $Ze^{j\Phi}$ then, dividing the rotating vector of voltage by that of the impedance gives $\frac{V_m}{Z} e^{j(wt-\Phi)}$, by the rules of vector algebra. The real part of this product vector is $I_m \cos (wt-\Phi)$ where $I_m=\frac{V_m}{Z}$ and this is i, the instantaneous value of the impedance current at the time t. If, however, we try to obtain the power loss in the impedance by multiplying the voltage and current rotating vectors, we obtain $V_m I_m e^{j(2wt-\Phi)}$. Both the real and imaginary parts of this product vector are oscillating at double the supply frequency, the average value of each over a complete number of cycles is zero, and neither of these parts gives the required power loss which is known to have an average value of $\frac{V_m I_m}{2} \cos \Phi$. For this reason the multiplication rule for vectors is sometimes said to have broken down, and the question is asked, why is this so ?

To ask a question like this seems indicative of a lack of understanding of the sense in which the rotating vector $V_m e^{jwt}$ is representative of the alternating voltage. $V_m e^{jwt}$

is algebraically equal to $V_m \cos wt + j V_m \sin wt$. The real part is the instantaneous value of the voltage we have considered, while the magnitude of the imaginary part $V_m \sin wt$ is the instantaneous value v_1 of a second alternating voltage, similar in every way to the first excepting that it lags it in phase by a quarter cycle. The algebraic equivalent of $V_m e^{jwt}$ is therefore $v + jv_1$. Similarly the algebraic equivalent of the rotating current vector $I_m e^{j(wt-\Phi)}$ is $i + ji_1$, where i and i_1 are respectively the instantaneous values of the currents produced by the voltages v and v_1 in an impedance of Z ohms and Φ phase angle. If we multiply the two rotating vectors and their algebraic equivalents, we obtain $V_m e^{jwt} \times I_m e^{j(wt-\Phi)} = V_m I_m e^{j(2wt-\Phi)} = (v + jv_1)(i + ji_1) = vi - v_1 i_1 + j(vi_1 + v_1 i)$. Now vi and $v_1 i_1$ are respectively the instantaneous values p and p_1 of the power due to the associations v and i, and v_1 and i_1; $p - p_1$ is the real part of the rotating vector $V_m I_m e^{j(2wt-\Phi)}$. Thus $p - p_1 = V_m I_m \cos(2wt - \Phi) + i$). This result merely shows us that $p - p_1$ is purely oscillating at double the voltage frequency, and that the average values of p and p_1 must be equal, which is evident from a prior consideration, since these power losses are produced by similar voltages in equal impedances. We have so far failed to obtain the power value we require, not because of any breakdown of the rules of algebra, but because the rotating vectors we have used contain in their algebraic equivalents the voltage and current in a second supply, so that our vector product contains a second and unwanted power term $v_1 i_1$ arising from a voltage v_1 90° out of phase with v.

The alternating voltage $v = V_m \cos wt$ is also the real part of the rotating vector $V_m e^{-jwt} = v - v_1$. If this vector is multiplied by that representative of current $I_m e^{j(wt-\Phi)} = i + ji_1$ we obtain $V_m e^{-wt} \times I_m e^{j(wt-\Phi)} = V_m I_m j\Phi = (v - jv_1)(i + ji_1) = p + p_1 + j(vi_1 - v_1 l)$. Equating the real parts of both sides of this equation we find $p + p = V_m I_m \cos\Phi$ - - - (ii). If we add equations (i) and (ii) we obtain $2p = V_m I_m \cos(2wt - \Phi) + V_m I_m \cos\Phi$, or $p = V_1 I \cos(2wt + \Phi) + VI \cos\Phi$, where V and I are r.m.s. values. This is the desired value of the instantaneous power; it consists of an oscillating component having zero average value over a complete number of cycles, and a constant component, the value on which the magnitude of the power is assessed. This result has been obtained, not by any subterfuge, but by a straightforward algebraic process whereby we have eliminated from our equations the unwanted product $p_1 = v_1 i_1$.

If we deal in a similar algebraic way the imaginary parts of the products of rotating vectors, we find that $VI \sin\Phi$ is the average value of $V_1 i$ or $V_m \sin wt \times I_m \cos(wt - \Phi)$. This latter expression is the instantaneous power due to the association of an alternating current with a voltage lagging 90° on that actually producing it, and objectively its average value is a quantity equal to the lagging VAr in the circuit carrying the current i produced by the voltage v.

The apparent failure of the multiplification rule in the calculation of a.c. power by vector algebra is thus due to the confusion of a rotating vector, representing an alternating quantity in a geometrical sense, with the true algebraic equivalent of this quantity, which is the sum of two rotating vectors moving in opposite directions, $V_m \cos wt$ is algebraically equal to $\frac{V_m}{2}(e^{jwt} + e^{-jwt})$, this equation being, of course, merely a restatement of the ordinary text-book exponential expression for $\cos\Theta$. Thus, in the previous working in which the rotating current vector was multiplied first by $V_m e^{jwt}$ and then $V_m e^{-jwt}$, to obtain the alternating and the constant components of a.c. power, we simply obtained the partial products in the multiplication by $V_m \cos wt$. If we had expressed $i = I_m \cos(wt - \Phi)$ in a similar way as the sum of two rotating vectors, and then had multiplied by algebra, we should have arrived, by another route, at the ordinary text-book trigonometrical transformation of $\cos\Theta \cos(\Theta - \alpha)$.

Because alternating voltages and currents can be combined geometrically as vectors, attempts have been made to represent a.c. power as a composite vector consisting of a fixed part to represent the nominal or scalar value with a rotating part to represent the oscillating component, the justification of this representation being that the projection of the composite vector on a reference line gives the instantaneous power value. The vector combination of alternating voltages and currents is based upon a mathematical fiction which is justified because it gives an easy solution to such a problem as that of finding the resultant of a number of currents, of unequal magnitudes and phase angles, flowing in parallel circuits. The method of calculation works out correctly because the projection of the resultant vector is the sum of the corresponding projections of the components. No similar problem arises in reference to the power in parallel circuits; the total watts is the arithmetical sum of the component watts. The so-called power vector, consisting of a fixed and a rotating part is not homogeneous. Two such vectors cannot be compounded in the usual sense; the dissimilar parts must be compounded separately, and although oscillating components can be compounded by the vector method, this, as applied to parallel circuits, is merely another way of compounding currents.

European Broadcasting

New Wavelength Scheme Proposed by Radio Industry

EVER since organised broadcasting began in this country just over 22 years ago, the question of wavelength allocation has been attended by difficulties, and though successive international conferences achieved some success, the results from the public point of view were not as desirable as they would wish.

Now that European broadcasting arrangements have in large measure to be re-established, it is suggested by the British radio industry that a new wavelength scheme which would enable every Continental country to improve its broadcasting service be given serious consideration. The suggestion has been pursued to its logical conclusion by the Technical Committee of the British Radio Equipment Manufacturers' Association, and a scheme has been drawn up, based on the fact that the longer the wavelength of a broadcasting station, the greater the area over which it can give a reliable service. Since stations at the lower end of the medium waveband are thus naturally restricted in their useful range, it is better that they should be used for local or regional services only, leaving the upper part of the medium band and the whole of the long waveband for stations which would have a nation-wide range.

Details of the scheme have been incorporated in a report prepared by the Technical Committee and issued by the Radio Industry Council, and this makes clear that the Committee confined their attention to the transmission side only; such expedients as partial side-band transmission, emphasis or de-emphasis of part of the modulation spectrum with subsequent correction, narrow-band f.m., or other methods rendering obsolete all existing receivers were, however, not investigated.

Cover Distances

In the scheme outlined, the coverage of stations is assumed to be determined by the fading radius; that is, sufficient power is assumed at the transmitter to provide within radius a signal strong enough to effectively overcome static noise. A minimum signal strength of a value greater than 2 mV per metre is suggested in order to overcome the present noise level in certain industrial areas. The average fading radius of any given station cannot be exactly determined, of course, but the findings of the Committee are based on the assumption that the primary service mileage range of a medium wave broadcasting station is roughly 25 per cent. of the wavelength used.

The broad possibilities of a properly-arranged European broadcasting system are incorporated in a simple specification in terms of the ordinary listener's requirements, and the report records in detail six basic criteria, which may be summarised as under:

National Programmes

To provide for every country one national programme (and preferably two) which can be received on a normal wireless set in any part of the country served. To these must be added a system of localised programmes to suit the special needs of any important regions or language groups in each country.

To arrange wavelengths in relation to the location and power of transmitters, so as to minimise interference between any two stations, and to permit reasonable quality or reproduction from receivers in all parts of the service area of each station. Power as well as wavelength would have to be specified in order to ensure good service over each area, while still avoiding serious interference with other transmitters.

To plan the entire system to give every listener easy reception of foreign stations, as an adjunct to the domestic service.

The plan described in the report satisfies these requirements by applying to the problem well-known engineering principles. The first is that a broadcasting station cannot give a satisfactory service beyond its direct receiving range, and that the latter is related to the wavelength used, being greater in the case of long waves than for short.

It follows that the longer waves should be used for covering the countries of largest area (subject to the reservations that mountainous countries must be treated as large areas, and that long waves are unsuitable in latitudes lower than about 40° N., because of atmospheric noise). To be fully effective over the large areas they cover, long-wave stations should be of high power; while shorter-wave stations should, because of their limited useful range, be restricted in power and employed solely for short-range services.

The conclusion therefore is that all national services should, in general, be conducted on the longer wavelengths (in each case selecting that most suited to the

size, shape and contours of the country concerned), and all regional programmes should be operated on the limited-range, shorter wavelengths.

This is what the new plan provides. Clearing all the purely local services from the longer wavelengths, and slightly extending downwards the present coverage of the long-waveband, provides enough channels to give every country—and every large language group as well—two reliable national programmes. At the same time it allows the separation between stations to be increased from 9 Kc/s to 11 Kc/s, with a consequent reduction in mutual interference, and a much-needed opportunity for making some improvement in musical quality both in transmission and reception. The present separation of 9 Kc/s has been condemned by Sir Noel Ashbridge as " only an expedient," and it is a handicap on truthfulness of reproduction in radio set design which all would be pleased to avoid. Further, by limiting the power of the shorter wavelength stations to the actual requirements in each particular case, it is possible to plan more intelligently the use of common frequencies among stations which are a great distance apart. With a few exceptions, the regional requirements of the nations can thus be satisfied by the use of the shorter wavelengths. It is recognised that there is a limit to the number of stations which can be operated on the same wavelength within the confines of Europe; but the number of channels available on these shorter wavelengths appears to be sufficient.

Study of the full report appears to justify the claim that under the plan described every nation in Europe could be given an adequate (and in most cases an improved) national broadcasting service, supported by good regional services, and much better opportunities than at present for receiving foreign programmes at high entertainment level.

Foreign Listening

On the longer wavelengths the listener might expect to find all the foreign listening he could possibly require, unmarred by interference and only disturbed by natural fading. On the shorter wavelengths, the only stations receivable could be the lower powered local units, and these would be free from interference by transmitters from other countries.

These advantages obviously need no emphasis, and they clearly justify the most careful consideration. In addition, however, such an orderly arrangement of national and local services would simplify their presentation on the tuning scales of radio receivers, and would make the tuning of stations easier for users. The realisation of the whole plan would therefore produce a really significant advance in receiver design, and thence in listener-acceptance and appreciation of the broadcasting service.

It is also worth pointing out that if it proves possible to re-engineer the broadcasting services of Europe on the lines described, due attention should be given to the relation between national and regional allocations (particularly the latter) and the intermediate frequencies used in broadcast receivers. In the past designers have been faced with the problem of finding suitable intermediate frequencies after any wavelength plan has become a *fait accompli*. The problem would be simplified by collaboration, so that certain undesirable combinations of frequencies could be avoided in any one area.

National Service Wavelenths

This list sets against each of the principal European countries the general order of wavelength(s) required, according to the size of the country, to provide it with a satisfactory national broadcasting service. Where appropriate, each main language division within a country is regarded as requiring a separate service.

Country	Languages	Wavelength (m.)
Albania	1	300
Austria	1	400
Belgium	2	250
Bulgaria	1	500
Czechoslovakia	2	400
Denmark	1	400
Eire	1	400
Estonia	1	300
Finland	1	800
France	1	1 200
Germany	1	1 200
Great Britain	1	1 600
Greece	1	500
Holland	1	300
Hungary	1	400
Iceland	1	1 500
Italy	1	1 000
Latvia	1	300
Lithuania	1	400
Luxembourg	1	200
Norway	1	1 600
Poland	1	900
Portugal	1	300
Roumania	1	750
Russia	3	1 500-2 000
Spain	1	1 000
Sweden	1	1 800
Switzerland	3	500
Yugoslavia	1	500
Turkey	1	750

1. Any small country is regarded as a region and excluded from the national allocations. 2. Only large linguistic areas are considered. 3. It is realised that there are one or two cases where the national coverage is slightly inadequate. In such cases extra very low power transmitters would have to be provided to fill the gaps. 4. Sicily and North Italy are considered as regions. 5. Mountainous countries must be treated as having greater than their actual areas. 6. Longer wavelengths are undesirable below Lat. 40° N. owing to the prevalence of atmospheric interference.

E.D.A. Activities

Formation of New Rural Electrification Committee

THE importance of the extension of electrical facilities to rural areas has long been recognised by the E.D.A., and before the war one of the association's most active sections was the Rural and Agricultural Electrification Committee. Because of war conditions this Committee has not functioned since 1940, and the Council have now formed a new organisation, representative of both electrical and agricultural interests, which will be known as the Rural Electrification Advisory Committee. The first meeting of the Committee was held during the last week of July, when officers and sub-committees were appointed.

A Comprehensive Representation

The Committee is made up of an observer from the Ministry of Agriculture and Fisheries; Mr. C. H. Glossop, representing the Royal Agricultural Society of England; Mr. H. N. Palethorpe, chairman of N.F.U. Commercial Committee; Mr. H. G. Robinson, the British Dairy Farmers' Association; Mr. W. C. Mallett, the National Poultry Farmers' Association; Mr. Eric G. Quested, the Milk Marketing Board; Mr. S. S. McKay, the Institution of British Agricultural Engineers; Mr. H. W. Grimmitt, the Electricity Commission; Mr. S. E. Britton, Chester electricity deparment; Mr. C. A. Cameron Brown, Edmundsons Electricity Corporation; Mr. P. G. Campling, Bedford electricity department; Mr. H. F. Carpenter, West Midlands J.E.A.; Mr. V. A. H. Clements, North Eastern E.S. Co., and E.D.A. Northern Counties Area Committee; Mr. J. P. Crowther, Electrical Distribution of Yorkshire Ltd.; Mr. C. R. Marshall, Northmet Power Co.; Mr. J. S. Pickles, Dumfries electricity department; Mr. J. A. Summers, Norwich electricity department and E.D.A. South East and East England (Eastern) Area Committee; Mr. J. R. Wilson, Northampton E.L. and P. Co.; Mr. C. F. Wells, Provincial Electric Supply Association; Mr. W. Riggs, E.C.A.; Mr. F. E. Rowland, General Electric Co., Ltd.; and the following representatives of E.D.A. Area Committees; Mr. C. L. Townsend, West Cambrian Power Co., S.W. England and S. Wales (Northern); Mr. E. W. Tole, North Somerset E.S. Co., S.W. England and S. Wales (Southern); Mr. W. E. Jones, Basingstoke electricity department, S.E. and E. England (Gr. London); Mr. F. J. Elliott, Wolverhampton electricity department, Central England; Mr. H. Payn, Boston and District E.S. Co., Mid-East England; Mr. W. Fennell, Mid-Cheshire E.S. Co., N.W. England and N. Wales; Mr. C. H. A. Collyns, Lothians Electric Power Co., Scotland.

The pre-war Committee carried on its work by means of conferences, lectures, exhibits at agricultural shows, cinema films and educational literature, and had the satisfaction of seeing electricity mains being extended to more and more of the rural areas. In 1929 there were only 3 700 miles of mains in rural areas whereas in 1939 there were over 20 000 miles, and 67 per cent. of premises in rural areas had supplies available to them.

During the early years of the war all material and labour available for the extension of rural distribution systems were urgently required for the construction of lines to supply aerodromes, camps, factories and other military installations, and as an indication of the extensive availability of electricity in rural areas it may be noted that supply from the public mains was made available wherever required, even to remote gun sites.

The stepping up of home agricultural production to meet the growing food scarcity, and the increasing shortage of farm labour made farmers turn their thoughts to the adoption of electricity as a solution of some of their problems, and during the last two years it has been possible to connect several thousand farms within easy reach of the mains, frequently with the approval of the County War Agricultural Committee who granted a certificate that the introduction of electricity would increase the production of the farm.

Testing House Progress

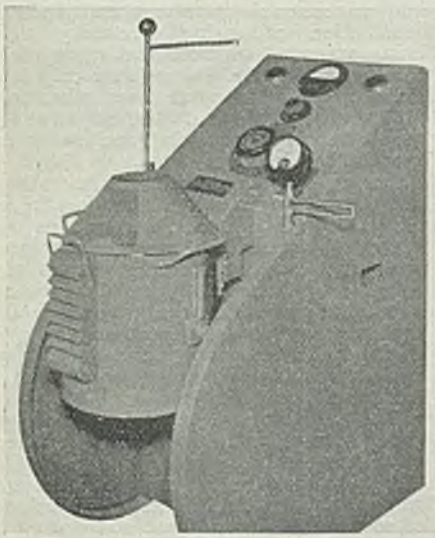
The question of the establishment of a national testing house has again been before the Council. In January the Council received a report of the Testing House Committee which recommended the establishment of a testing house with the objects of testing electrical apparatus to be used by consumers—particularly domestic appliances and accessories—for safety, reliability, performance and ease of maintenance. On that occasion the Council agreed to forward the report to the area committees for their views including the question of whether a " mark " scheme (indicating approval) on the apparatus should be adopted.

The Council has now referred the report, with the area committees' observations, to the Testing House Committee with authority to consult with representatives of the areas and to take counsel's opinion on the legal aspect of adopting a suitable mark.

New Equipment

Electrode Salt Bath for Small Scale Output

READERS are familiar with the electrode salt baths used for hardening "substitute" and high speed steels, for the consistently high quality results obtained by their use has made them popular



The E.S.B. Minor electrode salt bath

throughout the engineering industry. Their performance so far as quantity of production is concerned, however, means that relatively few firms have a sufficient volume of work to keep them fully occupied, whilst their general design and construction is not generally considered to be ideal for intermittent use. The power consumed in heating up to working temperature is appreciable and whilst this is of little importance if a high output is to be maintained with the bath in use for several hours, it is obviously uneconomic where the bath is not fully employed to maximum capacity. To overcome these disadvantages in certain cases, and to make the well-known advantages available to firms whose production has not warranted the relatively high expenditure on large productions units, **Wild-Barfield Electric Furnaces, Ltd.,** have developed a small unit called the ESB Minor, which occupying little floor space, is capable of being extended as necessary to form a battery of units for treatments which have to be carried out in sequence. The equipment is designed to cover not only the various treatments of high speed steel, but also cyanide hardening, reheating and general hardening and brazing, and its versatility makes it useful in those shops where the treatments are various but the volume of work requiring any one treatment is limited. The equipment is self-contained and all wiring between components is carried out prior to dispatch so that installation on site merely necessitates the connection to the main supply. The bath is mounted on the front extension of the main framework, which forms the chassis for carrying the furnace and the panel on which are mounted the various controls; the electrical equipment is also housed within the framework. The furnace or bath consists of a cylindrical rolled steel case, built with insulating bricks which surround a moulded refractory pot made in two main sections, which together form the salt chamber.

The electrical equipment comprises the main switchgear unit, transformer, tapping switch, energy regulator, ammeter, pilot lights and interlocks. The transformer, a double wound air-cooled unit, has tappings to provide for connection to 200/210, 220/230 or 240/250 V supplies and further tappings for temperature and input control. These latter tappings are connected directly to a rotary type tapping switch which, with interlocks, permits of on-load operation. The use of the tapping switch enables the power input to the bath to be adjusted to suit requirements, the full input being applied whilst heating up, a reduced rating being adequate to maintain temperature. In addition, fine control is achieved by means of the energy regulator, the two controls being complementary. The secondary winding of the transformer supplies the heavy current at low voltage for the electrodes. Substantial busbars connect between the transformer and the fixed contacts of the knife switch, with which the blades mounted on the furnace body engage. No satisfactory materials are so far available to provide suitable sheaths for the permanent immersion of a thermocouple to give continuous temperature indication at the more elevated temperatures, while the size of salt pot is such that any thermocouple permanently immersed would restrict the space available for work. Temperature measurement, on the other hand, is important for correct heat-treatment and a special dip-type combined pyrometer and thermocouple unit has been developed and is available as an optional extra. Another optional extra is a patented electric radiation type dryer.

Electricity in India

From Our Own Correspondent

THE estimates of the Department of the Ceylon Government Electrical Undertakings form a separate budget this year. The total estimated revenue is Rs. 5 210 000 and the total estimated expenditure Rs. 4 392 972. There is thus an estimated profit of Rs. 817 028. Out of this the annuities due to general revenue on account of loans, and the interest due on advances which amount to Rs. 787 000 will be met. Credit for this sum has been included in the general revenue estimates. A sum of Rs. 3 000 has been set apart for bad debts.

Ceylon Hydro-Scheme

A full statement on the present position of the Ceylon Hydro-Electric Scheme was made by the Minister of Communications and Works, Mr. J. L. Kotalawala, at a meeting of the Executive Committee of Communications and Works. Out of a total extent of 8 000 ft. of tunnelling it is stated that 80 per cent. is now completed. Work has been speeded up in the past few months, and while prior to January this year, only 70 tons of cement were used, since January, 250 tons are being consumed monthly to expedite the work.

Good progress is reported with regard to the scheme. The contract has been divided among four parties. The constructional work which was carried out by a private company has now been completed, and the Public Works Department has taken over the work. Even the tools have been bought up by the Government.

With regard to cables, turbines and generators, the contractors in the United Kingdom have informed the Ceylon Government that prices have gone up by 90 per cent. They have, therefore, asked for a revision of rates for these. The Executive Committee expressed the desire that the work should proceed without a break, and requested the Minister to investigate further and report with regard to prices.

The first part of the scheme is to be completed in three years, and this will provide 25 000 kW. At present the two power stations of the Government—the Stanley and the Pettah power stations, both in Colombo—provide 9 000 kW. The Director of Electrical Undertakings has informed the Ministry of Communications and Works that as from January next year the general current position may be eased, and this will allow of more consumption by the public.

The Act further to amend the Madras Electricity Duty Act has received the assent of the Madras Governor. The previous Act provided only for the levy of a duty on sales by the licensee of electrical energy at prices exceeding two annas per unit. The Act did not provide for the levy of duty on the consumption of electricity by the licensee for purposes unconnected with his electrical undertaking. If the licensee had sold the electrical energy for similar use to a private consumer he would have been liable to pay duty on sales.

The Government, therefore, considered it necessary to amend the Act so as to impose a duty also on the energy consumed by the licensee for purposes other than those connected with the construction, maintenance and operation of his electrical undertaking, the levy, however, being limited to energy consumed, which if sold to a private consumer under like conditions, would have fetched a price of more than two annas per unit.

A two-crore rupees scheme to carry electric lighting to all towns in Sind, India, has been initiated. As a first step in this hydro-electric project, the Tandomastikhan Falls, situated across one of the largest canals of the Indus, is being shifted fifteen miles up-stream, involving the deepening of the canal with its dual purpose of raising the electrical potentialities of the falls, and also to prevent water-logging which has been the cause of long-standing dispute between Sind and the Khairpur State Government since the construction of the Sukkur barrage.

Meanwhile, an electrical survey has been undertaken simultaneously with a view to the installation of hydro-electric generators capable of producing 20 000 kW—enough to meet post-war lighting and other needs of Sukkur, Shikarpur, Larkana and eight other towns round about the new site of the falls. The system covers Upper Sind, while two other systems, designed to serve Central Sind round Hyderabad, and Lower Sind round Karachi respectively, are being worked out by the Government.

Supply in Calcutta

Calcutta Corporation has decided to purchase the Calcutta electric supply undertaking on the due date in 1948 as provided in the licence. Accepting the recommendations of its Public Utilities and Markets Standing Committee, the Corporation reiterated its policy of acquisition of the electrical undertaking comprised within the Calcutta licence. It decided to write in the meantime to the Bengal Government to accord their sanction to the option of the municipality to purchase the undertaking.

News in Brief

I.E.E. South Midland Students.—The South Midland Students' Section of the I.E.E. are to hold a dance on September 15 at the Botanical Gardens, Edgbaston, Birmingham. The price of a double ticket will be about 10s. 6d. Full details will be issued later.

Arbroath Street Lighting.—The T.C. has approved that street lighting in its new Carnegie Road housing scheme should be by electricity and not by gas. Electricity is already being used for the domestic lighting of the scheme, by overhead cables, while underground cables will be used for street lighting. There was no support for a motion by the Gas Manager that the streets should be lighted by gas.

Marine Engineering Developments.—A lecture entitled " Survey of Marine Engineering " was recently given by Mr. P. B. Johnson, managing director of Hawthorn Leslie and Co., before American and Dominion Forces at Durham University, in the course of which he stated that the marine industry had instituted a research association on Tyneside to study the problem of improvements and designs of the steam turbine and to investigate the gas turbine.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of August 6, 1920: An interesting test has been carried out at Wolverhampton on the economy of refuse collection by electric vehicles. An "Orwell" electric vehicle was employed for a period of 21 days, and 178 tons of refuse were collected, or an average of 3 tons per load. The cleansing superintendent stated that it required three horse-drawn vehicles and six men to do the same amount of work.*

Broadcasting in Palestine.—It is announced that the administration of the Palestine broadcasting service has been separated from the General Post Office and a new department of broadcasting has been formed in Jerusalem. The new department has appointed an assistant controller of the English programmes and separate controllers of the Arabic and Hebrew transmissions.

Electricity versus Gas.—The Billingham-on-Tees U.C. recently issued a questionnaire to local residents on the question of using gas and electricity in future council houses. 109 persons preferred electricity for cooking and 47 gas. Those in favour of electric washing facilities numbered 111 while those who wanted gas were 45. 124 persons favoured electric fires and 20 preferred gas fires. The Council has therefore agreed to use electricity in future houses, and is in touch with the North-Eastern Electric Supply Co. Ltd., on the subject.

Hamilton Radio Factory.—It is reported that production may begin before the end of this year in the large factory which is to be opened in Hamilton by Philips Lamps Ltd., and for this Scottish extension of the firm's activities a new company, Philips Hamilton Works, Ltd., is, it is reported, being formed.

Automatic Landing Device.—A new device which synthesises automatic pilots and instrument landing systems was recently disclosed by signal officials at the Air Technical Service Command in Europe. It is stated that this equipment will make it possible for Army Air Force pilots to bring their aircraft to within a foot of the runway without touching the controls.

Trolley-bus Schemes.—The Newcastle-on-Tyne City Council is to spend £8 376 on further developments of the trolley-bus system. The cost will be borne by the Trolley Vehicles Renewals Fund. The South Shields Ministry of War Transport has sanctioned the borrowing of £18 000 by the T.C. for the purchase of six trolley buses.

Portable Tool Demonstration. — At a recent meeting of the Cheltenham Electricity Committee the Electrical Engineer reported upon the demonstration of portable electric tools for use in the building trade held at the central depôt, and suggested that the use of such tools might be facilitated by providing an early electricity supply to building sites, and making such tools available on reasonable hire terms. The Committee approved.

Control of Mining Industry.—Speaking at Rhos, Denbighshire, recently, Mr. Gordon MacDonald, Regional Controller of the Ministry of Fuel and Power in the North-West, said that his three years' close contact with every aspect of the coal problem had satisfied him that no system of control would secure the best results from the industry if it failed to win the whole-hearted approval and support of those engaged in it. The prospects of coal supplies for next winter were far from encouraging, and even with the best efforts of the coal producers' economies would be necessary on the part of consumers.

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. J. F. Fardell, who before the war was deputy manager and chief assistant engineer to the Reading transport undertaking, has been appointed traffic manager at Maidstone.

Mr. G. E. Collier, assistant sales manager, Edinburgh electricity department, who has been in the service of the Corporation for 17 years, has been appointed consumer engineer at Stafford.

Due to the retirement of **Mr. Neil Thomson,** the firm of Messrs. Neil Thomson, Motherwell, will be carried on by the surviving partner **Mr. Arthur Aldwell Heron,** under the same name, and on his own account.

The Minister of Supply has released **Sir Cecil Rodwell** from his appointment as controller of industrial diamonds and **Mr. F. A. Mathias** from his appointment as deputy controller. The industrial diamonds control has been disbanded.

Mr. Geo. C. Milnes, city electrical engineer, Lancaster, has been appointed to the Council as a representative of the North-West England Centre of the I.M.E.A.

Consequent upon the death of Mr. Richards, Keith Blackman, Ltd., announce that **Mr. D. S. Woodley** has been appointed technical manager and chief engineer, and **Mr. D. M. Brown,** commercial manager.

Mr. G. M. Campbell has relinquished the position of director of manufacture, of the British Thomson-Houston Co., Ltd., but remains on the board as advisor to the managing director, Mr. H. Warren. **Mr. W. W. Vinsen,** assistant director of manufacture, has been appointed director of manufacture, and **Mr. H. J. Armstrong** has been appointed manager of the Coventry works, in succession to Mr. Vinsen. **Mr. E. H. Ball,** assistant sales director, has relinquished the managership of the transformer sales department, to which position **Mr. L. G. Axe,** has been appointed. Mr. Axe graduated in electrical engineering at Bristol University, and served his apprenticeship with the B.T-H. Co. During the war he has been superintendent of the company's transformer factory, at Rugby.

Mr. E. Stroud, who is a director of the Brighton Lighting and Electrical Engineering Co. Ltd., and president of the Illuminating Engineering Society, is also a vice-chairman of the Electric Light Fittings Association, and has recently been re-elected chairman of the Street Lighting Section for 1945.

Mr. R. E. Luff has been appointed a managing director of Cable and Wireless (Holding) Ltd., and of Cable and Wireless Ltd. The **Hon. Jocelyn Denison-Pender** has been appointed a managing director of Cable and Wireless (Holding) Ltd. The Hon. Jocelyn Denison-Pender was appointed early in June to a seat on the boards of all the companies within the group and was made joint managing director of the operating company, Cable and Wireless Ltd.

It is announced that the members of the E.D.A. Building Centre Electrical Section Committee for the current year are Capt. J. M. Donaldson, Mr. T. W. Heather, Coun. J. Selwyn Jones, General R. F. Legge, Mr. E. A. Mills, Mr. H. G. S. Peck, Mr. C. Rodgers, Mr. A. E. Tanner and Mr. H. T. Young. At their first meeting the Committee re-elected Mr. Young and Capt. Donaldson as chairman and vice-chairman respectively.

Mr. L. G. Axe

The Metropolitan-Vickers Electrical Co., Ltd., announce that **Mr. D. MacArthur,** director, has been appointed general sales manager; that **Mr. W. A. Coates,** while retaining his position of sales manager of the switchgear department is appointed assistant to the general sales manager; and that **Mr. G. W. G. Canter** has been appointed manager of the marine and special contracts department.

Mr. B. T. Hawkins, borough electrical engineer, Wallasey, was the chief guest at a luncheon given by the Mayor of Wallasey on July 31, when he was presented with a silver salver engraved with the names of the chief officers of the Corporation, to mark his retirement after 24 years' service.

Over 500 men and women from the Bradford, Leeds, Huddersfield and Sheffield districts took part in the Yorkshire Industrial Fire Brigades Competition at the Sports Ground of the English Electric Company, Ltd., Dick Lane, Thornbury, Bradford, on July 28. There were 91 entries in six classes, and the competing teams represented 45 works in all parts of Yorkshire. The results in the large trailer pump drill were: Laycock Engineering Co., Ltd., Sheffield. Time: 39.3 seconds, first, and the English Electric Co., Ltd., Bradford, 53.3 seconds, second; the light trailer pump drill was won by

Brook Motors, Ltd., Huddersfield, 44 seconds; in the class 5 competition, the General Electric Co., Ltd., Ingleby Road, Bradford, 18.2 seconds, won first position.

Among the new Cabinet appointments may be noted **Mr. J. Chuter Ede,** Home Secretary, president of the E.D.A., 1937/38, and a one-time chairman of the London J.E.A.

Viscount Stansgate, D.S.O., D.F.C., whose appointment as Secretary for Air in the new Government was announced last Saturday, was in his early years an active member of the family firm of Benn Brothers Ltd. He is the second son of the late Sir John Williams Benn, the founder of the business, and brother of Sir Ernest J. P. Benn. First elected to Parliament in 1906, Mr. Wedgwood Benn, as he then was, continued as an M.P. until 1942, when he was elevated to the peerage. In the last Labour Government he was Secretary of State for India. He was in the Yeomanry and the Air Force in the last war, and went back to the Royal Air Force at the beginning of the present war, serving first as Squadron Leader and later holding the post of Director of Public Relations at the Air Ministry with the rank of Air Commodore. Lord Stansgate was Vice-President of the Allied Control Commission for Italy in 1943-44.

New members of the E.C.A. Council are Mr. H. L. Bush (Bath), Mr. C. Dale (Leeds), Mr. T. C. Gray (Newcastle), Mr. John Hall (London), Mr. J. R. Halliwell (Manchester), Mr. A. V. Milton (Liverpool), Mr. C. R. Sponge (Lincoln) and Mr. S. N. Watkins (Birmingham). Members of the Council who have retired are Mr. E. W. Andrews (Newcastle), Mr. L. A. Evans (Bristol), Mr. Harold Jones (Liverpool), Mr. R. G. Payne (Nottingham), Mr. H. E. Walker (Birmingham), and Mr. J. Whiteley (Manchester). Messrs. T. E. Alger (Newport), J. G. Briggs (London), A. G. Bruty (Dublin), J. Douglas Green (Leeds), W. T. Hellaby (Birmingham), G. F. A. Norman (London), E. A. Reynolds (Birmingham), A. Smith (Bradford), John Walsh (Blackburn), and W. H. Walton (London), have been elected to serve on the Council's Executive Committee.

Mr. Leslie Gordon, clerk and solicitor to the London J.E.A., who was due to retire on August 18, has agreed to continue in office for a term not exceeding one year.

Mr. Victor Dale and **Mr. J. I. Bernard** have been appointed as the E.D.A.'s delegates to the conference of the Association of Public Lighting Engineers to be held in Glasgow, from September 11 to 13, inclusive. Mr. Dale has also been nominated to serve on the Building Industries National Council.

Mr. A. P. Quarrell, who was appointed a director of British Oil Engines (Export) Ltd., on its formation in March last, has now taken up his duties with the company, operating from their offices at 27, Gilbert Street, London, W.1, and has relinquished his appointment as the London manager of the Brush Electrical Engineering Co. Ltd. Mr. Quarrell is a member of the Council of the Institute of Marine Engineers, and represents the British Internal Combustion Makers' Association on the B.S.I. Sparking Plug Committee.

De La Rue Plastics Ltd., announce that **Mr. F. T. Fletcher** has ceased to be associated with the company as from August 1 last. **Mr. C. Milton Marshall** has been appointed works manager of the London factories.

The Minister of Supply has released **Mr. H. Nuttall** from his appointment as Director of Wood Working Machinery in the Machine Tool Control. **Mr. E. Catley,** at present Assistant Director Wood Working Machinery (M.T.C.7) will be in charge of this branch as Deputy Director.

Obituary

Mr. W. B. Richards, director and general manager of Keith Blackman Ltd., on July 27, in his 69th year. Mr. Richards joined the company in 1892, was elected to the board in 1929 and appointed general manager in 1941.

Dr. M. L. Kahn, chief engineer of the Witton Engineering Works of the General Electric Co. Ltd., on July 25, in his 68th year. Dr. Kahn was educated at Karlsruhe University and was awarded his doctorate in 1902 for original work upon the characteristics of the contact resistance of carbon brushes. As a result of this he was invited to collaborate with Prof. E. Arnold and Mr. J. L. La Cour in the preparation of a series of text books; the seven volumes covering the design and construction of electrical machinery are now generally considered as classics. In 1904, he was appointed chief designer of the Brush Electrical Engineering Co. and proceeded thence to Witton as chief designer, succeeding to the post of chief engineer in 1933. During the 32 years that he served the G.E.C. he was closely associated with the great developments that have taken place in electrical machinery during this period. Chief amongst them may be mentioned rotary converters and latterly the mercury arc rectifier which has largely superseded them, the design of rolling mill motors, colliery winding motors, electrical propulsion motors for ships and traction motors. His work in connection with generators was particularly noteworthy as he had been responsible for the design of some of the largest turbo-generators manufactured in this country.

Industrial Information

Factories Act and Steel Industry.—The United Steel Companies, Ltd., have sent us a copy of a booklet written by Mr. E. L. Macklin, who is the consulting safety and welfare officer to the United Steel Organisation. The title of the booklet is the " Factories Act 1937 " and it consists of a concise summary of the sections of the Act devoted to iron and steel works. The necessity for producing the booklet has, it is stated, been apparent for some time and in this direction attention is drawn to the foreword by Mr. Gerald Steel, assistant managing director, iron and steel production of the United Steel companies. Copies of the booklet are being distributed to all officials of the company in any way responsible for the safe operation of plant in their steel works, and as the company have already found that other steel companies recognise the need for such simplification of the " Factories Act 1937," arrangements have, therefore, been made to produce additional copies for sale to any interested in these sections of the Act. The United Steel Companies Ltd., whose address is 17, Westbourne Road, Sheffield, are therefore prepared to receive orders in bulk only, provided applications are made at an early date. The book can be supplied either in rexine binding (2s. 6d. net) or in paper covers (1s. 3d. net). Individual orders cannot be supplied owing to the difficulty in handling such inquiries, and the labour involved in distribution.

Sewage Pumping Costs.—The National Bulletin for July published by the National Gas and Oil Engine Co. Ltd., gives details of the Fareham U.D.C. system of using sludge gas for reducing the power cost of sewage handling. Equipment of the disposal works has been enlarged and developed at various times to keep ahead of the progressive increases of population in the Council's area. Part of the recent improvements embodied aeration of the incoming sewage by a process evolved by Activated Sludge, Ltd.; it includes the use of diffused air prior to sedimentation and filtration; the purpose of this is to condition the sewage, facilitating treatment in subsequent operations. The National Company supplied the aeration equipment, including two electrically-driven air blowers. At various points around the premises are electrically-driven plant items, including a rotary screen and a disintegrator; many of the machines are automatically controlled. The average simultaneous load is of the order of 15 kW. The margin of power provided in the two generating sets allows for future extensions and parallel working. This may be required if certain developments now proposed come to fruition. Until some two years ago the current needed for pumping and auxiliary services was purchased. Then the arrangement was revised to allow the use of mains current, or current from one of two identical oil-engined alternators. These latter were National totally-enclosed direct-injection three-cylinder engines (10-in. bore, 13-in. stroke), rated on a 12-hr. basis at the site at 105 B.H.P. at 500 r.p.m. Each had an electrically-heated stream-line by-pass-connected oil purifier attached. A hand pump supplied oil fuel to a pair of 140 gal. service tanks. The directly coupled alternator in each case was rated at 70 kW, 87.5 kVA., 50 cycles, four-wire three-phase with a tandem exciter. An electrically-driven compressor provided starting air. This plant allowed independence during a single-shift working day, and control of peak-load conditions, with consequent moderate maximum demand kVA charges, in respect of the purchased supply. The next forward step was to plan the best use of the natural fuel of sewage stations—sludge-gas—with only a moderate additional capital outlay over and above that for a " straight " oil engine in the case of one of the units. To-day at Fareham are a 70 kW sludge-gas-engined alternator; a 70 kW oil-engined alternator; a mains supply. Recent tests showed that the gas engine on a load of about 70 kW consumes from 19.6 to 21.7 cu. ft. of sludge-gas per unit generated. The oil engine generates 13.7 kW-hrs. per gallon of fuel. It is hoped to convert the gas engine in future from electric ignition to dual-fuel, thus getting even more useful work out of the available gas.

Supply of Domestic Electrical Apparatus. — According to the I.M.E.A. Journal the various electricity supply associations, and other bodies, connected with the industry, have made strong representations to the Board of Trade, Ministry of Health, and Ministry of Fuel and Power, pointing out the difficulties now being experienced with regard to the provision of domestic electrical equipment, such as electric cookers and cooking apparatus, kettles, hot-plates, irons, etc. The common complaint of local authorities, who are responsible for the erection of houses under the Government scheme, is either that the apparatus and utensils cannot be obtained, or that it is too expensive. Attention was par-

ticularly directed to the fact that whilst certain equipment provided by a Government department in connection with the provision of temporary houses is purchaseable free of purchase tax, local authorities and other authorities are not permitted to obtain such equipment, except subject to purchase tax, thereby penalising those members of the public who are anxious to purchase, hire, or hire-purchase any such equipment or apparatus. With this handicap, local authorities are unable to serve the public by providing housing accommodation fully equipped with the necessary electrical appliances, and the matter is a serious one, both from a national housing point of view and providing the public with an adequate domestic electricity service. One Ministry in replying stated it was a matter for the Board of Trade. The Board of Trade advise that representations should be made to the Treasury. It thus appears that there is an entire lack of co-ordination between Government departments, and responsible bodies are not prepared to accept this delay in dealing with an urgent problem. There are, says the Journal, two points worthy of consideration. The first, why should local authorities, who are providing houses at the request of the Government, have to pay purchase tax on necessary electrical equipment, when the Government themselves are freed of this tax ? Secondly, the local authorities are only rendering a public service, again at the request of the Government, and the least that can obtain, is that both should be placed on an equal footing. The electricity supply industry is anxious to render assistance in the rehabilitation of those about to return from war service, but unless there is a clear cut policy and proper co-ordination between Government departments, the schemes will be doomed to failure.

Cheerful Rationing.—The current issue of this popular series of cards issued by the Electrical Association for Women, gives a number of seasonable recipes, together with some fuel economy reminders with regard to electric cooking.

The Henley Telegraph.—The Summer 1945 issue, printed with a red, white and blue cover, gives further details and illustrations of the part played by the W. T. Henley's Telegraph Works Co., Ltd., in Operation Pluto, and the defeat of the magnetic mine. A wealth of personal news is given, together with a number of very readable stories.

The British Export Trade Research Organisation.—The latest list issued by the association, of firms elected as ordinary members includes The British Thomson-Houston Co. Ltd.; Chance Brothers Ltd.; Crompton Parkinson Ltd.; Falk, Stadelmann and Co. Ltd.; the Hackbridge Electric Construction Co. Ltd.; London Electric Wire Co. and Smiths Ltd.; Mather and Platt Ltd.; the Metropolitan-Vickers Electrical Export Co. Ltd.; Murex Ltd.; A. Reyrolle and Company Ltd.; Ultra Electric Ltd.

Inspection Equipment. — Wild-Barfield Electric Furnaces Ltd., point out that at the exhibition which has been organised by the Sheffield Society of Technical Inspection, which will be held at the Cutler's Hall, Sheffield, from August 20 to 25, inclusive, they are arranging to have available both a Spekker photo-electric absorptiometer and a Spekker steeloscope which will be found on Stand 5. Both these instruments are, of course, well known to the industry generally, but a representative will be in attendance to demonstrate and offer any assistance or advice that may be required. After the initial opening on August 20, at 3 p.m., the exhibition will be open from 11 a.m. to 8 p.m. on weekdays, and from 10 a.m. to 6 p.m. on Saturday. Admission to the exhibition will be by the programme guide, price 6d.

Approval of Permitted Prices.—The Central Price Regulation Committee have approved the following prices exclusive of purchase tax for the electric wash boiler manufactured by Arthur Dodgson (Airframe) Ltd., Whitefield Works, Victoria Street, Nelson: Manufacturer's selling price £4 16s.; wholesale selling price £6; retail selling price £8. The Committee have also approved the following prices exclusive of purchase tax for the Londalex electric iron, manufactured by Lonsdale and Co. (Electric), Ltd., Elco Works, Cromwell Grove, Levenshulme, Manchester, 19: Manufacturer's selling price 15s.; wholesale selling price 18s. 9d.; retail selling price 25s.

A.S.E.E.-N.E.F.A. Agreement. — An agreement dated July 16, 1945, and drawn up between the National Federated Electrical Association and the Association of Supervising Electrical Engineers, includes in its chief points, the fact that a staff foreman (electrical installation contracting) is a man who assists a supervising electrical engineer, or the employer, is employed in charge of any job or jobs where electrical labour is employed, has under his control one or more charge-hands, and who is present on the site or sites during working hours. His duties shall include planning the layout of work on the site or sites, the requisitioning of plant and materials, the keeping of correct records of progress of job or jobs and dealing with installation matters raised by the client or his agent in connection with the contract or contracts on which the foreman is employed. He

shall be responsible to his employer either direct or through a supervising electrical engineer. Staff foremen shall be paid according to their merits, and as agreed between themselves and their employers, provided that firms, members of the N.F.E.A., shall pay staff foremen, members of the A.S.E.E. not less than £6 15s. per week in London district, and £6 5s. per week in other districts. When his duties necessitate the staff foreman lodging away from his home he shall be paid the sum of 6s. per night, plus any additional legitimate expenses incurred due to special circumstances. For the purpose of the agreement, a supervising electrical engineer is one whose duties include complete responsibility for the preparation of estimates, the scheduling and requisitioning of materials, the technical details of electrical installations, and supervision of work undertaken, of the checking of time sheets and advice notes, of the preparation of draft accounts, and may, if required by the employer, include administrative and executive responsibility. He shall be paid according to merits and as agreed with the employer, providing that firms, members of the N.F.E.A., shall pay supervising electrical engineers, members of the A.S.E.E., not less than £450 per annum in London district and £400 per annum in other districts.

Electronic Ohmmeter Deliveries. — Jackson Automatic Electric Controls Ltd., Windsor House, Victoria Street, London, S.W.1, announce that as special priorities have been afforded them to facilitate the Government's reconstruction programmes, deliveries of their electronic ohmmeter have in consequence been speeded up. The instrument was described in THE ELECTRICIAN of June 15 last.

Enemy-Owned Patents.—The Chartered Institute of Patent Agents, Staple Inn Buildings, High Holborn, London, W.C.1, has issued its recommendations in the form of a printed memorandum, respecting the position of enemy-owned patents and patent applications and certain other matters arising from war conditions.

Cables for Switchboard Panel Wiring.—A specification B.S.1231 has just been issued by the B.S.I. for cables, flexible cables and cords for switchboard (metering and control) panel wiring. The cables are intended for use at voltages not exceeding 250 V, and the insulation is polyvinyl chloride (p.v.c.). The specification prescribes the dimensions of the conductors and standardises seven colours for the insulation. Voltage tests are also specified.

Contracts Open

WE give below the latest information regarding contracts for which tenders are invited. In the case of overseas contracts, particulars are to be had from the Department of Overseas Trade, Millbank, London, S.W.1 (corner Horseferry Road), unless otherwise stated.

Manchester City Council, August 11.—Supply and delivery of overhead equipment materials for trolley-bus operation. Specifications from the General Manager, Transport Department, Manchester, 1.

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

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

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

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

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

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

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

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

Overseas

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

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 meaning of the term " capitalisation of losses " and how is it applied to economic calculations?

In selecting any item of electrical plant such as a motor or transformer it is usual to take into account the capital cost and the cost of the losses which occur in it during the life of the plant and, other

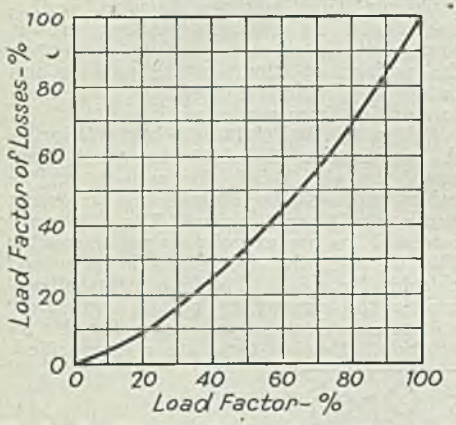


Fig. 1.—Load factor of copper loss with typical shapes of load curve

things being equal, to select the particular plant which makes the sum of these costs a minimum.

Two methods of calculation are available :—

(i) to calculate the yearly capital charges (yearly interest on the capital borrowed to purchase the plant plus the yearly sinking fund payments to cover depreciation) and the yearly cost of the losses and select the plant which makes the sum of these a minimum.

(ii) to capitalise the value of the losses and add this to the initial capital cost to get a figure for the total investment cost. The plant with the smallest value of this is the most economic.

Both methods, of course, give the same result and are, in fact, very similar in procedure.

Suppose a motor has a yearly cost of loss of £L—if the rate of interest upon which calculations are to be based is p per cent. per year, the capital sum which would involve a yearly expenditure of £L would be $£L \times \frac{100.}{p}$ This sum is known as the *capitalised value* of the yearly cost of loss.

The application of this may be illustrated by considering a case where a choice between two alternative makes of transformer has to be made—a 100 kVA transformer has to be purchased to supply a circuit which has a load factor of 30 per cent. and which has to be supplied continuously throughout the year (i.e., for 8 760 hours per year). Two transformers A and B are available; A costs £250, has an iron loss of 0.5 kW and a full-load copper loss of 1.75 kW; while B costs £200, has an iron loss of 0.6 kW and a full-load copper loss of 2.0 kW. The maximum load on the transformer may be assumed to be equal to its full-load rating. The rate of interest and depreciation is 8 per cent. per year and the tariff for energy is £4 per year per kW of maximum demand plus 0.7d. per kWh.

Transformer A: Yearly iron loss (since this occurs continuously)

$= 8\,769 \times 0.5 = 4\,380$ kWh.

Yearly cost of iron loss =

$$£4\,380 \times \frac{0.7}{240} = £12.75.$$

Full-load copper loss = 1.75 kW.

The load factor is 30 per cent., but since the copper loss is proportional to the (current)^2 the load factor of the copper loss is less than 30 per cent. and the total yearly loss in kWh is equal to full-load copper loss × 8 760 × load factor of copper loss.

The precise value of the load factor of the copper loss depends on the shape of the load curve on which the transformer is operating but for typical load curves found in distribution practice the curve of Fig. 1 may be used to find the load factor of the copper losses for any given load factor. the actual figure for any particular case may diverge from this by 5 to 10 per cent. of the value given. In the case under consideration where the load factor is 30 per cent. the load factor of the copper losses may be taken from the curve as 16 per cent.

Hence—yearly copper loss =

$1.75 \times 8\,760 \times 0.16 = 2\,450$ kWh;

yearly cost of copper loss =

$$2\,450 \times \frac{0.7}{240} = 7.13$$

Increase in maximum demand charge (assuming that the full-load on the transformer occurs at the same time as the maximum demand on the rest of the purchaser's plant)

$= £4\ (0.5 + 1.75) = £9.0.$

Total cost of losses

$= £(12.75 + 7.13 + 9.0) = £28.93.$

Capitalised value of loss

$$= £28.93 \times \frac{100}{8} = £362.$$

Total investment cost
$= £(362 + 250) = £612.$

Transformer B: With a similar procedure:—

Yearly cost of iron loss

$$= £8\,760 \times 0.6 \times \frac{0.7}{240} = £15.3$$

Yearly cost of copper loss

$$= £8\,760 \times 2.0 \times \frac{0.7}{240} \times 0.16 = £8.15.$$

Increase in maximum demand charge
$= £4\ (0.6 + 2.0) = £10.4$
Total cost of loss = £33.85.
Capitalised value of loss

$$= £33.85 \times \frac{100}{8} = £424.$$

Total investment cost
$= £(424 + 200) = £624.$

The more expensive transformer (A) thus has the lower total investment cost and should, therefore, be selected.

The use of the capitalisation method also enables a purchaser to calculate how much more be can economically pay for a plant of higher efficiency—for instance in the above case the reduction in capitalised value of losses by the use of the more efficient transformer is £(424 − 362) = £62. So long, therefore, as transformer A does not cost more than £62 more than transformer B it will be the most economical transformer to employ. E.O.T.

Electricity Supply

Rotherham.—The T.C. has agreed to supply electricity to Mexbro' urban district.

South Shields.—The T.C. is to spend £6 210 supplying electricity to temporary housing sites.

Bolton.—Sanction to borrow £9 050 for additional coal handling plant and £600 000 for extensions, has been obtained by the Electricity Committee.

St. Marylebone (London).—The Electricity Committee has obtained sanction to borrow £5 000 for apparatus in connection with the change of system and pressure.

Barnard Castle.—The R.C. has written to the North-Eastern Electric Supply Co., Ltd., and the Board of Trade, stressing the need for supplying electricity to all parts of the rural area.

Littleborough.—The D.C. has approved the expenditure of £1 950 on l.t. mains to serve the new housing site in Lake Bank. The Clerk announced to the Council that work costing about £8 000 for electricity was already being done, or would be done in the near future.

Liverpool.—Arrangements are being made by the Liverpool Electric Power and Lighting Committee to inspect the electricity development in the rural districts of the Corporation's area of supply next month and to invite the Chairman and Engineer of the Carlisle electricity undertaking to attend.

St. Marylebone (London).—The Electricity Committee reports that the surplus for the year is £68 850 and, with the sum of £24 463 recovered in respect of income tax, the deficiency is reduced to £56 467. The Committee hopes that with a continued output, and the recovery of a further sum of £15 000 in respect of income tax, this amount will be substantially, if not wholly cleared by the end of the current year.

Herne Bay.—At a meeting of the Housing Committee the Surveyor reported that the Ministry of Works wished to know whether gas or electricity cookers, refrigerators and wash-boilers were required in the temporary houses. He had ascertained from the gas and electricity companies comparative annual costs to the tenants for gas and electricity as follows: Electricity, £9 1s. 1d. per annum (excluding current for water heating for which the company could not give any figure at the moment); Gas, £10 14s. 5d. per annum. The Committee recommends all electric equipment.

Enfield.—The Northmet Power Co. has written to the Housing Committee, pointing out that it would be unable to offer free extensions of mains in the case of temporary houses owing to the short life of the houses and the Council would, therefore, be required to contribute on the following basis:—Part electric sites: Lighting, immersion heater, and socket outlets, 50 per cent. of the estimated cost of high voltage mains, sub-stations and l.v mains. All electric sites: Lighting, immersion heater, socket outlets, cooker and wash-boiler, 25 per cent. The Committee recommended that these terms be agreed upon.

Northern Ireland.—In the course of a debate the Minister of Commerce, Sir Roland Nugent, said that nothing was so essential to industrial development as cheap and abundant supplies of electrical power. The power available at the Harbour Power Station, added to the new station at Ballylumford, in which a second 33 000 kW set had been recently installed was sufficient to meet the present needs. Further expansion, however, was foreshadowed, and additional plant would have to be installed eventually in both stations to meet it. His department had under active

consideration the amplification of existing supplies of power drawn from hydro-electric sources. Col. Gordon, M.P., wanted a more definite outline of policy in regard to rural electrification.

Cheltenham.—At a meeting of the Electricity Committee, the Electrical Engineer reported that the Borough Engineer had requested him to submit a price for wiring houses to be built on the Lynworth estate. He pointed out that the Council had no wiring department and the work would have to be done by local contractors. The Committee felt that as it had agreed to lay the first 50 ft. of service cable free of charge, it was for the Housing Committee to wire the houses. The Committee agreed that the service charge of £6 be allowed to cover the cost of additional outlets to those recommended by the Housing Manual and in addition, a further £1 6s. per circuit for a cooker, and £1 for water heater outlets irrespective of whether these were connected in the first instance. The Electrical Engineer would, if necessary, arrange for the tenders for wiring.

Company News

Rheostatic Co., Ltd.—Intm. on ord. 4% less tax (same).

Farnham Gas and Electricity Co. Ltd.—Intm. 3 1/16% (same).

Engineering Components, Ltd.—Intm on ord. 10%, less tax (same).

Greengate and Irwell Rubber Co. Ltd.—Intm. on ord. 1s. 3d. per sh. (same).

Falk Stadelmann and Co. Ltd.—Div. on ord. 10% (7½%) for yr. to Mar. 31 last, payable Aug. 21.

Dermatine Co., Ltd.—Net pft. to June 30, £12 046 (£12 079). Fst. and fin. 30% (same) and bonus 10% (same).

City of London Electric Lighting Co. Ltd.—Intm. div. on ord. 2½% for 1945. Div. resumed after lapse of 2½ yrs.

Silentbloc Ltd.—Fin. div. 12½%, mkg. 25%, less tax (both same). Pft. for yr. to May 31 is stated as £20 648 (£25 006).

Newton Bros. (Derby).—Fst. and fin. 17½%, less tax (same). Net pft. (after tax) for yr. to Mar. 31, £13 645 (£13 431).

London Electric Supply Corporation.—Intm. div. 3% on 6% £5 pref. for 1945. Consideratn. of paymt. on ord. is defd. until end of yr.

Victoria Falls and Transvaal Power.—pft. for 1944, £575 921 (£555 579); brot. in, £327 153 (£328 866); to res. £150 000 (same); ord. div. 15% (same); fwd. £342 240.

Bristol Industries Ltd.—Fst. and fin. on ord. at 10% (same), for five mos. ended Mar. 31, 1945. Pft. and loss credit balce. £24 693 (net pft. (after tax) for yr. to Oct. 31, 1944, £36 066); credit balce. (includg. £5 585 brot. in) £28 924).

Southern Canada Power.—Gross earngs. 12 mos. to June 30, $3 518 755 ($3 231 469). Operatg. exes. $1 171 830 ($1 121 584), taxes $892 524 ($711 167), int. divs., deprecn. $1 437 315 ($1 418 339), leavg. surplus $17 086 (deficit $19 621).

George Kent Ltd.—Trdg. pft. to Mar. 31, £83 452 (£156 550). To deprecn. £14 127 (£15 765), redemptn. of premises premiums £388 (same), deb. int. £8 975 (£9 087), dirs.' fees £800 (£867), tax £14 419 (£15 499), E.P.T. provisn. £15 000 (£81 000), leavg. net pft. £29 743 (£32 944). Fwd. £39 887.

W. G. Allen and Sons (Tipton) Ltd.—Accts. for yr. to Mar. 31 last show net pft., after deprecn. and taxatn., £8 995 (£8 350). Addg. £6 569 (£6 359) brot. in, available balance is £15 564 (£14 709). Dirs. propose transferrg. £3 000 (£2 000) to res. and to pay fin. div. 7½%, making 10% (same), and carry fwd. blce. of £6 424.

Vanadium Corporation.—It is stated that the discovery of means to release atomic energy and of the production and use of the atomic bomb, in which uranium is used, has caused a demand on Wall Street for Vanadium Corporation shares, which rose more than 3 points on Tuesday night's close of $24.

Electric Power and Light (U.S.).—Consd. operating rev. of subsids. for 1944 $138 383 401 ($132 024 807). Exes. and Federal tax $90 015 999 ($83 479 004), net income $9 200 616 ($6 335 303), earned per fst. prefd. sh. $11.95 ($8.23). Net income parent co. $2 186 810 ($1 001 606), per sh. $2.84 ($1.30). Consd. earned surplus $36 164 116 ($38 812 682).

Charles Churchill and Co., Ltd.—Tradg. pft. to Mar. 31, after E.P.T. and deprecn., £110 649 (£113 500), plus £9 165 (£8 790) other income. To dirs.' fees £1 500 (same), tax £64 642 (£72 792), net pft. £53 872 (£48 198). Brot. in £31 049 mkg. avail. blce. £84 921 (£79 774). To gen. res. £35 000 (£7 000), conting. res. nil (£25 000). Pref. div. £3 600 (same), intm. ord. div. 10% (same) £3 750, fin. 25% (same) £9 375, fwd. £33 196.

Kalgoorlie Electric Tramways Ltd.—The concession under which the tramways are operatg., due to expire on Dec. 5, 1945, has been extended by the local authorities for a further 12 mos. £8 000, being £3 685 pft. for the yr. to Dec. 31,

1944, and £4 315 surplus funds, has been pd. to the trustees to enable them to distribute 8% on acct. of cap. on " B " debs.

ISLE OF THANET ELECTRIC SUPPLY CO.—A circular to holders of £202 238 4% deb. stk. reminds them that notice has bn. given by the two local authorities of Margate and Broadstairs and St. Peters requiring the co. to sell on Jan. 1 next its electricity undertakg. to a joint electricity board, representative of the two authorities.

BENN BROTHERS LTD. (Publishers of THE ELECTRICIAN).—Trdg. pft. to June 30, £137 118 (£126 809), plus int. and divs. £3 890 (£3 323), rents £6 061 (£5 798) and trans. fees £3 (£1), mkg. £147 072 (£135 933). To trade exes. £8 925 (£9 634), salaries and wages, incldg. dirs.' remun. £25 112 (£28 371), discnts. £12 437 (£10 850), deprecn. £200 (same), taxn. £55 325 (£24 680), dirs.' fees £691 (£690). Net pft. £44 380 (£61 504). Brot. in £16 343, mkg. avail. blce. £60 723 (£77 163). To Jubilee pension fund £4 000 (£3 000), leasehold res. £1 500 (same), gen. res. nil (£10 000), taxn. res. nil (£14 000), pref. div. £4 805 (same), intm. ord. div. 5% and fin. 12½%, mkg. 17½% (all same) £24 890, 3s. 6d. per defd. sh. (same) £2 625, fwd. £22 903.

Company Meetings

E. AND H. P. SMITH, LTD.—In the course of his address at the annual meeting held in London on July 31, Mr. Ernest Smith, the chairman, said the company had renewed old, and entered into new, agreements and contracts with several of the leading manufacturers of radio, television and electric domestic appliances. This fundamental, major side of their business, although severely restricted throughout the past five years, had been as far as possible maintained, and therefore change-over problems caused no concern.

BIRMID INDUSTRIES LTD.—At the annual meeting held at Birmingham on August 3, Mr. Cyril C. Maudslay, the chairman, referred to their allied company, Birmabright Ltd., which was formed to manufacture and sell the corrosion-resisting alloy the company developed for marine, architectural and decorative purposes. The length of service, some of it done in exceptionally trying conditions, proved beyond argument that this material was the finest so far produced for many marine purposes. They anticipated very important developments of Birmabright for shipbuilding.

BRITISH TIMKEN LTD.—In the course of his address at the annual meeting, Mr. Michael Dewar, the chairman, pointed out that it was quite impossible to manufacture any war machine without the use of anti-friction bearings. He, therefore, suggested that probably the simplest way to control the armament industry in Germany would be to prohibit the manufacture in that country of anti-friction bearings, and to insist on their importation. Before the war, Germany employed some 20 000 people in this industry and at the peak of their production during the war reached 55 000. Everyone was aware of the vital need of this country for exports. It was, therefore, regrettable that, owing to our inability to obtain the necessary labour, bearings were having to be imported into this country from America and Sweden.

GLOBE TELEGRAPH AND TRUST CO. LTD.—The annual meeting was held in London, on July 31. In the statement issued with the report, Mr. F. A. Johnston, the chairman, said, the company's " net " investment income was £189 529, compared with £187,127 twelve months ago. After payment of the same dividend as last year they had been able to carry forward £142,143, against £134 812 brought in. There had been no abnormal change in the list of investments. As regards the present capital value of their investments, which amounted on June 30 last, to £2 582 514 in excess of the book values, that satisfactory feature was predominantly due to their long connection with the cable companies in the past, and their successor, the great Cable and Wireless Company of the present day.

PALESTINE ELECTRIC CORPORATION, LTD.—The annual meeting was held in London on July 31. In the statement issued by the chairman, Mr. Thomas Nightingale, he said the report and accounts reflected once again the continued growth of the undertaking. The gross revenue was 18.1 per cent. higher than in the preceding year; 55 transformers with a total capacity of 5 665 kVA were put into commission in 1944; 46 kilometres were added to their transmission and distribution system. The total length of h.t. transmission lines and cables in service on December 31, 1944, was 1 389 kilometres, and of l.t. distribution lines 1 260 kilometres. The capital expenditure during the year amounted approximately to £P.100 000, mainly on the construction of the " Sharon " transformer station in course of erection (halfway between Tel-Aviv and Haifa) and on the construction of the additional transmission and distribution lines already referred to. The operating costs exceeded those in the preceding year by approximately 20 per cent. This increase was attributable in the main to increased expenditure on fuel and to the cost of overhaul of generating plant carried out during the year.

CHLORIDE ELECTRICAL STORAGE CO. LTD.—At the annual meeting held at Manchester on July 25, Mr. W. S. Naylor, the chairman, said that after providing for directors' fees and for income tax and

bringing into account the balance brought forward from last year, £176 005, there was available £477 939. The directors were maintaining the policy of strengthening the company's reserves and finances to meet the uncertainties of the future. The reserve created last year for development and research received a further £50 000 (making it £150 000), and its scope was extended to cover reconstruction. The balance retained in the profit and loss account to be carried forward to next year had been increased. During the war the company's depôts, and many "Exide" service agents, by giving local service, had played an important part in their organisation, and had been a very real asset in the war effort of the country. Export orders had, of course, had to be side-tracked, but a considerable volume of orders was on hand to be dispatched as soon as Service priorities were relaxed and shipping space was available. They regretted the shortage in supply of "Drydex" batteries to their Service agents, and the inconveniences thus caused to the public during the black-out period. The enormous demands of the Services, at home and oversea, came first. They proposed to extend their trainee scheme under which promising juniors were systematically trained in the technical and commercial sides of the business. The scope of this scheme was being enlarged so that their organisation might be assured of a steady flow of personnel of character and ability, capable of taking responsibility. They had kept in touch with their employees during the war, and they knew that many of them were looking forward to returning to the company.

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.*

ALFRED DODMAN AND CO., LTD., Kings Lynn, engrs.—July 13, £12 000 debs.; general charge. *Nil. Nov. 11, 1944.

County Court Judgments

NOTE.—*The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be actions. But the Registry makes no distinction. Judgments are not returned to the Registry if satisfied in the Court books within* 21 *days.*

LLOYD DAVIDSON AND CO., LTD., R/O 18, St. James Street, Nottingham, electrical appliance specialists. £28 10s. 9d. May 4.

RILEY, A. (male), 14, Slater Street, Great Bridge, Tipton, electrical goods dealer. £13 5s. 7d. June 22.

ELECTRICAL INSTALLATION (BIRMINGHAM), 112, Alum Rock Road, Birmingham, electrical engineers. £25 4s. 3d. June 4.

Notice of Intended Dividends

RALPHS, William Boyce, residing at 30, Ayresome Street, Middlesbrough, lately residing and carrying on business at 2, Mulgrave Road, Middlesbrough, electrical contractor. Claims to be sent by Aug. 18, 1945, to the trustee, Mr. Charles Lucas Townsend, 80, High Street, Stockton-on-Tees.

YOUNG, Robert Allan, Gullet Passage, Shrewsbury, electrical and mechanical engineer. Claims to be sent by Aug. 14, 1945, to the trustee, Mr. Percy Manley Milward, 12, Lonsdale Street, Stoke-upon-Trent, Official Receiver.

Application for Discharge

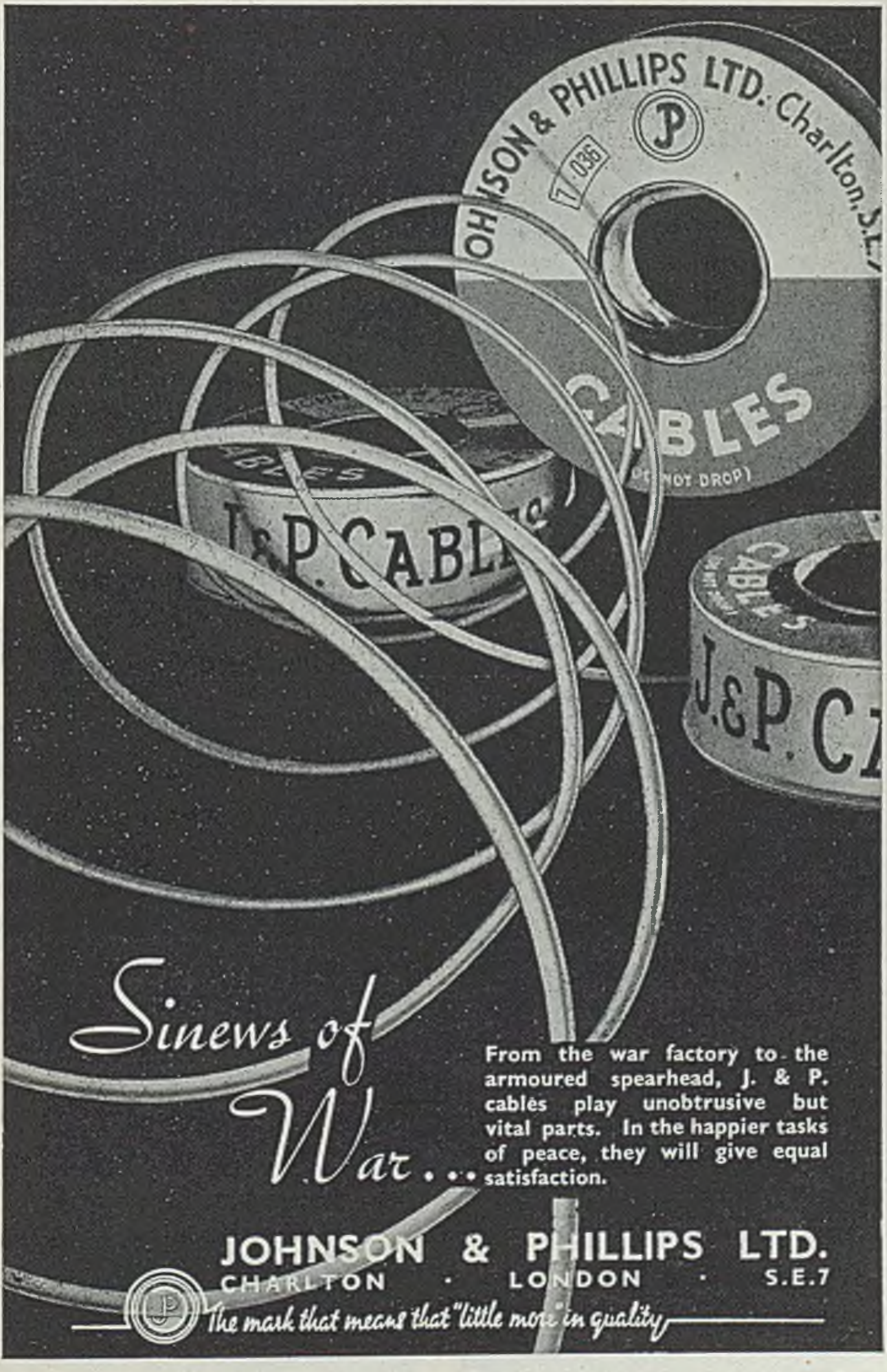
BROWN, John James, 79, Fairholm Road, Benwell, Newcastle-upon-Tyne, carrying on business at Handysides Arcade, Newcastle-upon-Tyne, wireless agent. Date of hearing, Aug. 16, 1945, 10 a.m., The Court House, 56, Westgate Road, Newcastle-upon-Tyne.

Metal Prices

Tuesday, August 7.

		Price.	Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars ...	„	£62 0 0	—	—
H.C. Wires, basis ...	per lb.	$9\frac{7}{16}$d.	—	—
Sheet	„	$11\frac{1}{16}$d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	„	1s. $0\frac{7}{16}$d.		—
Brass (60/40)—				
Rod, basis	„	—	—	—
Sheet „	„	—	—	—
Wire „	„	$11\frac{1}{4}$d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)...	per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in. ...	„	£28 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in. ...	„	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G. ...	„	£26 0 0	—	—
Lead Pig—				
English	„	£31 10 0	—	—
Foreign or Colonial	„	£30 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity) ...	„	£303 10 0	—	—
Wire, basis... ...	per lb.	3s. 10d.	—	—
Aluminium Ingots ...	per ton	£85 0 0	—	—
Spelter...	„	£31 5 0	—	—
Mercury (spot) Warehouse	per bott.	£69. 15 0	—	—

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


JOHNSON & PHILLIPS LTD. Charlton
CABLES
J.&P. CABLES
Sinews of War . . .
From the war factory to the armoured spearhead, J. & P. cables play unobtrusive but vital parts. In the happier tasks of peace, they will give equal satisfaction.
JOHNSON & PHILLIPS LTD.
CHARLTON · LONDON · S.E.7
The mark that means that "little more" in quality

Printed in Great Britain by Straker Brothers Ltd., 194-200, Bishopsgate, E.C.2, and published by Benn Brothers, Ltd., at Bouverie House, 154, Fleet Street, London, E.C.4.—Friday, August 10, 1945