THE
ELECTRICIAN

Vol. CXXXIV. No. 3496. Friday, June 1, 1945. Sixpence

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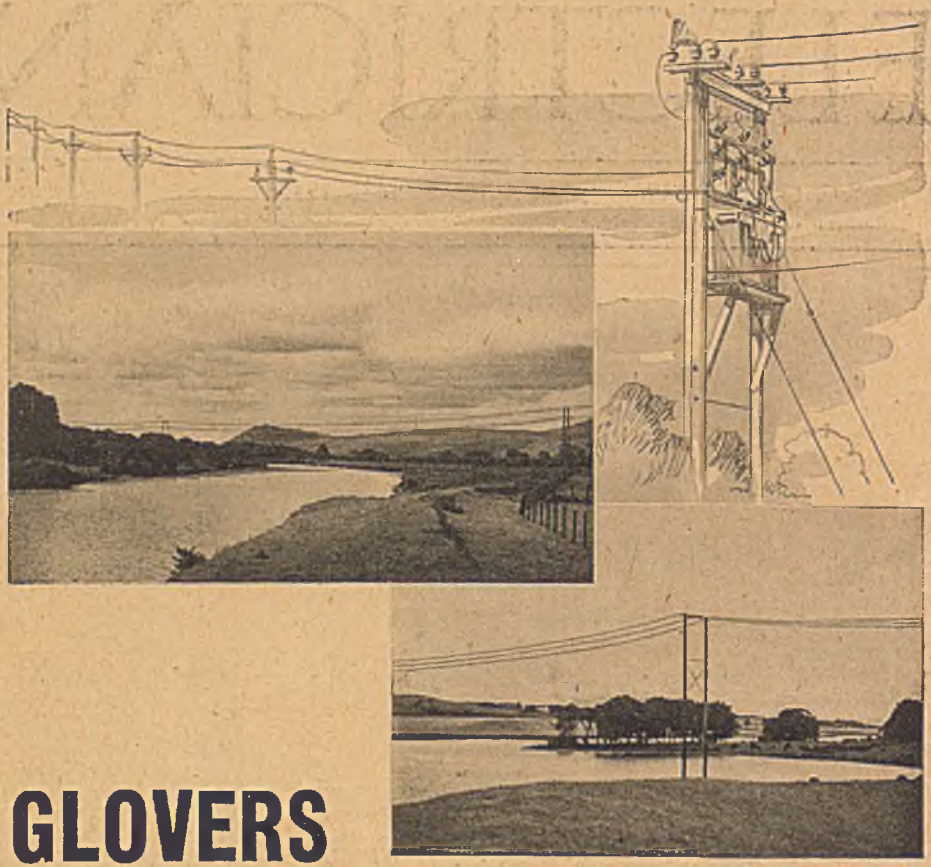

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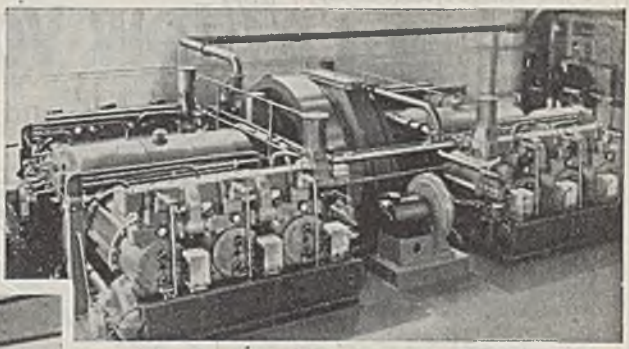
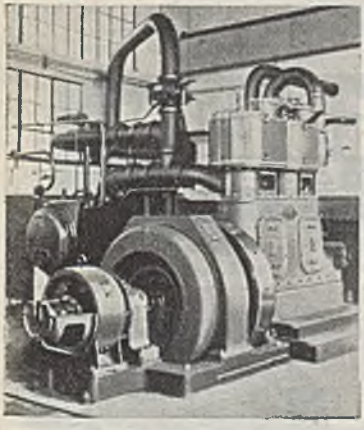
"Engine Type Generators"

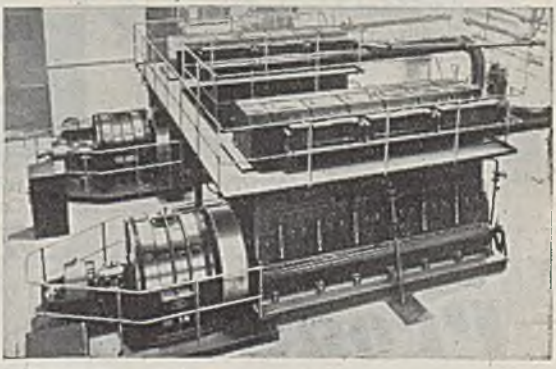
The illustrations on this page show a few installations of Metrovick Engine Type Generators.



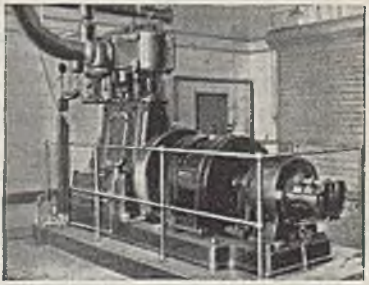
1,000 kW Metrovick Engine Type Alternator with closed circuit ventilation. Installed in the West Indies and driven by a Crossley Premier Vis-a-Vis 212 r.p.m. Gas Engine.



375 B.Hp. 375 r.p.m. Browett Lindley Steam Engine driving a Metrovick 250 kW 4,000 Volt Alternator at a Chinese Coal Mine.



450 kW Metrovick Alternators driven by Belliss & Morcom Diesel Engines in a British Power Station.



1 of 2 Metrovick 120 kW 500 r.p.m. Alternators driven by a Belliss & Morcom Steam Engine at a Laundry.

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Forms of application may be obtained from the undersigned and must be returned by 11th June, 1945.

B. HANDLEY,
Engineer and Manager.
111, High Street, Portsmouth.
16th May, 1945.

PATENTS

NOTICE is hereby given that Douglas Thomas Shaw seeks leave to amend the Specification of the application for Letters Patent No. 563,411, entitled "A fastener for insulators."

Particulars of the proposed amendment were set forth in the Official Journal (Patents) No. 2939 dated May 24th, 1945.

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

H. L. SAUNDERS,
Comptroller-General.

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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.

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No. 3496. [Vol. CXXXIV No. 22] June 1, 1945 Annual Subscription 25s. Overseas 30s.

CHIEF CONTENTS OF THIS ISSUE

Stimulus of War

IN the scientific field the war has been a stimulus, not only to technical developments even now scarcely credible to the man in the street, but it has, too, so whipped the imagination into finding new applications that few would dare to prophesy what the next ten years will produce. The conception of the cable pipe-line for conveying oil supplies across the bed of the English Channel is a case in point, and it stands to the credit of the industry that the realisation of the idea was made possible by the ingenuity of the electrical engineer, in first building the cable pipe-line and then in designing the necessary equipment for laying it. First details of the scheme were given at length in THE ELECTRICIAN last week, and in the present issue are given as many particulars as censorship regulations will allow, of how the pipe-line was made, how it was stored, and how it was laid; the story is rich in names well known throughout the electrical manufacturing world.

Looking back through the war years and reviewing the achievements of science and engineering so far revealed is an experience which no other country can share. First, the combating of the magnetic mine and the development of the method known as "Double L" or double longitudinal sweep, by means of which a self-buoyant electric cable is used to subject 10 or more acres of the sea bottom to a magnetic field of sufficient strength to explode all the mines therein; followed by the defeat of the acoustic mine; radio-location and the Battle of Britain; the distant reading compass; transportable power stations; radio for communication with troops behind the enemy's advanced positions—to name only a few of the many achievements associated with electro-science.

All these things developed in our efforts to beat a ruthless enemy have not only been rewarded with success, but have, too, the added advantage that the energy put into their realisation is not, as in the case of so many other munitions, likely to be wasted. Electro-scientific achievements of the type developed during the last six years for conducting total war have in most cases a vital part to play in a peaceful world, and their success is yet another illustration of the ways and means by which electricity can be used to make the world a better and safer place to live in.

The stimulus of war, if nothing else, has helped to overcome the practical difficulties of conducting research at pressures above those hitherto operative in industrial processes; the same stimulus has intensified team work among engineers, physicists, chemists and metallurgists; and it has, too, broken down any excessive specialisation. When the world is at last rid of war these things should be remembered, for while a few months ago there was much publicity given to the subject of research, already

since VE-Day, there is little reference to it; apart from mention at the annual meetings of those companies which have shared in the development of its results. This is a pity, for, while it is appreciated that many war-time investigations may have little relation to economics, there is every necessity for keeping the public informed of the importance of peace-time research, and the part which it can play in developing our export trade. Much of the enthusiasm born of the war for new industrial achievements must be fostered in the years to come, so that we may continue to lead the world in science and engineering; so that we may sell to other countries goods which foreign manufacturers are unable to produce—in the same way as we have shown that we can fight with weapons no one else has even thought of.

Operation Pluto and the B.B.C.

THOSE readers who heard the broadcast by Mr. A. C. HARTLEY in the B.B.C. Forces programme on May 25 on the subject of Operation Pluto felt, no doubt, like ourselves, that the talk would have been even more interesting if the speaker had been permitted to mention the names of the firms whose ingenuity made the pipe-line possible. It is appreciated that in order to comply with the B.B.C. regulations anything appertaining to advertising is not allowed, but in the case of Operation Pluto, which was a wholly British achievement, carried out by British arms with equipment produced by British manufacturers, opportunity should have been taken of informing listeners to the Forces programme of the names of the firms which contributed to its success. It may be our national policy to keep the world in ignorance of the achievements of our manufacturers, but what justification can there be for withholding the information from our Armed Forces—many of whom were possibly, employed in happier days by the firms concerned?

A Col. Crompton Centenary

HAD he lived, that grand old man Col. R. E. CROMPTON, F.R.S., would yesterday have reached the age of 100 years, and though his name lives on in the firm of Crompton Parkinson Ltd., he will be best remembered for his work as a pioneer in the industry, the battle of the systems and as a retailer of adventures connected with the development of lighting in the days of Queen Victoria. His association with armoured fighting vehicles in the early part of the century and before, makes one wonder what he would have thought of their use in total war. He was in many ways a remarkable man, and it seems fitting that the centenary of his birth should not pass without small tribute to his memory.

The Magnetic North

APART from its influence upon things to come in civil aviation using polar routes, the flight of the British Lancaster aircraft Aries which returned to its base last week after a non-stop flight over what was reckoned to be the true position of the magnetic North, the trip is of special interest to the electrical industry. First, the aircraft bears the distinction of having been built by the Metropolitan-Vickers Electrical Co., Ltd., and, second, a preliminary examination of the special instruments fitted to the Aries suggests that the magnetic pole, which was flown over for the first time in history, is between 200 and 300 miles north-north-west of its last presumed position, and probably within 75 miles of the location estimated by the Astronomer Royal, with whom the expedition was in touch before setting out. It may now be proved to be in the Sverdrup Islands. The effect of this correction in the position of the magnetic North may have far-reaching results in the physical world, though it will be some weeks before the results of the flight are thoroughly analysed.

Underground Factories

IN a letter to "The Times" last week, a correspondent suggested that in view of the fact that the majority of above-ground factories have during the last five years been worked in artificial light because of black-out precautions and night work, and because a great deal of manufacture has, too, been undertaken below ground—inquiries should be made into the advantages and disadvantages which have been derived both in this country and on the Continent from these practices. Apart from the traditional

and sentimental advantages of above-ground buildings for manufacturing purposes, there seems in the opinion of the correspondent to be no positive advantage in perpetuating and re-creating industrial facilities in buildings above ground. There is no doubt that fluorescent lighting and ventilation by electrical means can create in an underground factory conditions of working superior in many respects to those in some cases obtaining above ground, but whether those employed in them would respond to their surroundings as do those working above ground is a vexed question.

Mercury Arc Rectifiers

THE discussion on steel tank rectifiers which followed the reading of the papers by Messrs. BEVAN and READ at the I.E.E. last week, shows that opinion on the mercury arc rectifier is by no means final. This is just as it should be, for the successful application of both glass bulb and steel tank types, many years before the war, to the requirements of electric traction, left no doubt as to their reliability. Their use in connection with radio transmission was also tried before the war to good effect, and as time progresses such applications will become wider. The glass bulb rectifier is perhaps the better known, and though it formed no part of the I.E.E. paper mentioned above, it is interesting to note that such rectifiers established an extraordinary reputation for reliability during the 1940-41 "blitz."

Edmundsons' Report

THE report of Edmundsons' Electricity Corporation, Ltd., details of which are made available to-day, tells a story of remarkable progress covering five war years, in spite of the restrictions applicable to increasing and replacing generating capacity, in spite of coal costs and other rising charges. Connected to the mains of its subsidiary companies in 1938 were 404 781 domestic and commercial consumers, and by 1944 this figure had increased to 504 433, with an average consumption per consumer of 1 000 kWh, at an average price per unit of 2.77d. in 1938 and 1.94d. in 1944. In the same period coal costs showed an unhappy rise of from 20s. 10d. per ton to 37s. The policy of the corporation apparently is one of stability and steady progress throughout its sixteen electrical subsidiaries, and the figures reproduced elsewhere in this issue show how this has been achieved, in spite of taxation which rose from £95 332 in 1938 to £1 076 612 in 1944. When circumstances connected with the war permit, it is the intention of the corporation to expand under what has been called a five-year plan, designed to cater mainly for rural development. It has been estimated that a minimum of 30 000 new premises will sooner or later be erected in the territory served by the group of companies, and the corporation proposes making electricity available to at least 85 per cent. of these within the years covered by the plan, raising the number of consumers to at least 750 000. If the last five years are any criterion, the objective is by no means too ambitious.

Birmingham's Training Scheme

DETAILS reached us on Tuesday of the engineering training scheme which has recently been adopted by the Birmingham electric supply department, with a view to providing the means and opportunity, for selected youths and young men, to obtain organised training in all branches of electricity supply work. The scheme, in brief, provides for trade apprentices, student trainees and graduate trainees, no fees or premiums being required. A well-produced brochure has been issued giving details of the scheme, together with particulars of the work and organisation of the electric supply department, and this warrants the careful attention of everyone interested in technical education. Similar training schemes are, of course, in operation elsewhere, but Birmingham in particular is worthy of special mention for the clear presentation of the arrangements made. The training of engineers for the electrical industry in general has become of major importance for, in addition to the extra numbers required once expansion starts, the industry is likely to be denied for some years the services of those still in the Armed Forces, while its ranks have, too, suffered many casualties. The supply industry is apparently fully conscious of the position and has made the necessary arrangements for training; the schemes should now be given as wide a publicity as possible.

"Pluto" in Production

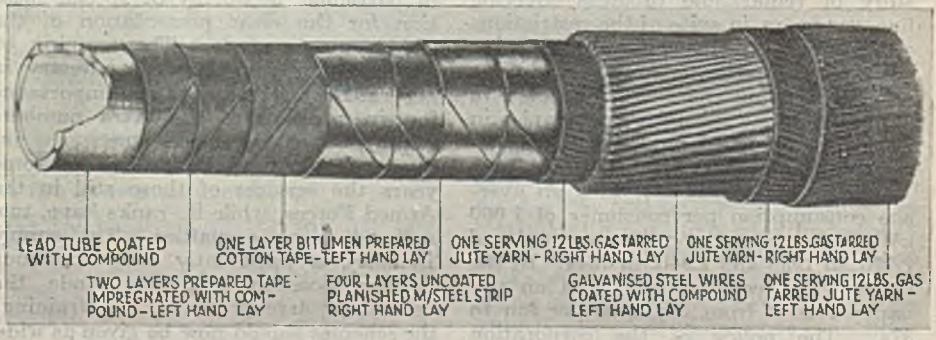
The Hais Pipe-line Cable—And How It Was Laid

THE story of "Operation Pluto," published in THE ELECTRICIAN last week, can now be supplemented by further technical details of the Hais submarine cable oil pipe-line and some particulars of the contributions made by British cable-makers and other electrical firms in its production.

The making of a flexible oil pipe-line presented structural and other problems related to stresses and pressures not met with in the manufacture of the ordinary submarine cables, but by the co-operation and collaboration of all the firms concerned these were solved and difficulties were overcome.

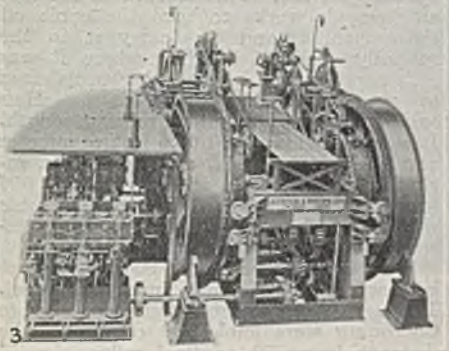
On receiving the order from the Petroleum Warfare Department in April, 1942, Siemens Brothers and Co., Ltd., drawing on experience gained in the manufacture of submarine cables and using standard plant and materials at hand, produced the 200-yards 2-in. prototype of the Hais cable in three days, and basically that design was not departed from, the only change being in the number and type of steel tapes used for the reinforcement of the lead alloy tube. This reinforcement was an important feature of the structure of the cable. Originally it had two reinforcing tapes and was designed for a maximum internal pressure of 350 lbs. per sq. in. The latter figure was increased to 750 lbs. This proved to be a conservative estimate. Progressive pressure tests went on with sections of 2-in. cable reinforced with two tapes taken from stock to ascertain the bursting pressure. The figure of 1 950 lbs. per sq. in. was reached and this was increased to over 3 000 lbs. per sq. in. At the request of the Petroleum Warfare Department two lengths, each a mile long were made. One was laid in the Thames and the other in the Clyde. That laid in the Thames was subjected to very severe tests. The cable-laying ship made acute turns in order to simulate any bad conditions that might be found. When the cable was pulled up it was found that some of the steel tapes had moved and as a result some parts were tending to expand. This test proved that two tapes were insufficient because of their being liable to disarrangement, and that four were necessary. The type of tape finally decided upon was of planished high tensile steel, 2 in. wide by .022 in. thick. One of the difficulties was in obtaining steel of the right tensile strength and every length had to be tested for tensile strength and elongation. The four tapes were wound simultaneously and a big problem was to get the right tension and maintain a harmonious process of laying. It was vital that each tape was accurately and securely positioned. It was found from previous experience that the most suitable bedding was compound, compounded paper and then compounded cotton tape. Each coil of steel tape covered about 50 yards of cable. The steel tapes were spot welded with a number of spots—usually ten—in a diagonal line, two diagonals overlapping. The welds were staggered as between one weld and another. The armouring wires were also welded. These were of .192 in. in diameter and were applied with the usual servings of gas-tarred jute as in submarine cable practice.

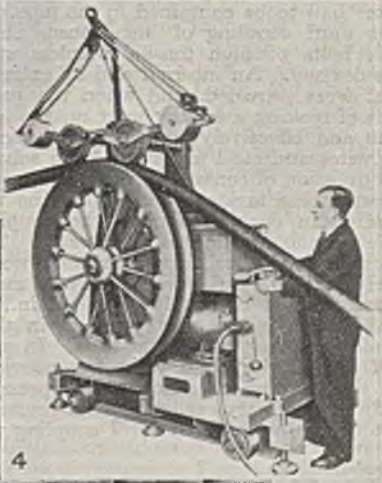
By their special method of manufacture Siemens were able to turn out the lead alloy tube in a continuous length of over 30 miles, and the burnt joints were so good that the outer diameter of the tube was not increased and so strong that the pipe would burst before the joint would give. One of the problems was to provide suffi-

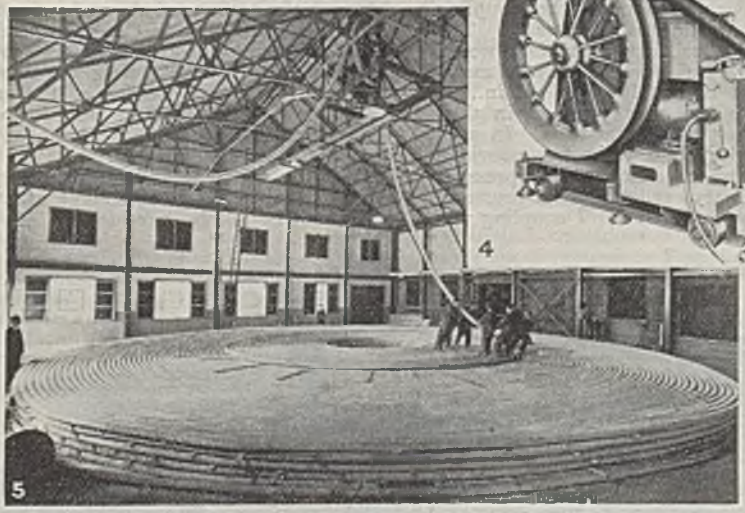


Section of Hais cable, showing constituent parts, made at Siemens' works

"OPERATION PLUTO" IN PICTURES







(1) Coiling Hais cable on river front ready for shipment (Henley photo). (2) The Henley straight-through lead press. (3) J. & P. special double combined picking-up and paying-out cable gear for handling Hais cable. (4) J. & P. electric hauling gear (d.c. motor). (5) A 30-miles length of 3 in. Hais cable being coiled at Siemens' works

cient internal pressure to prevent crushing or crumpling of the tube during the reinforcing and armouring process. After gas had been tried hydraulic pressure was adopted. Thereafter the cable was manufactured with an internal water pressure up to 100 lbs. per sq. in., which later was reduced to 70 lbs. per sq. in. When the lead alloy tube had been made a valve was fitted at each end and water was pumped through and kept circulating at the necessary pressure during the process of reinforcing and armouring. The water remained in the cable throughout its handling and laying until it was forced out by the flow of petrol. This was necessary to prevent any kinking of the cable.

The design of a suitable coupling for joining and handling the ends of the cable also presented some problems. It had to provide a tight mechanical grip on the armouring wires to stand any strain, and the steel tapes and exert sufficient pressure on the lead sealing joint. In addition, the water had to be contained in the pipe. A split muff coupling of high tensile steel, with bolts of high tensile stainless steel was devised. An internal and an external joint were provided, and when the problems of making a sealing joint on the lead tube and effectively securing the armouring wires and steel tapes had been solved, the question of containing the water under pressure was tackled. A copper disc was inserted in each section of the coupling thus forming a double diaphragm. The discs were so designed that they would hold the water, but would burst at a maximum pressure of 400 lbs. per sq. in., so that when the oil was pumped in they would blow out along the tube. In each half of the coupling a valve was provided for the purpose of checking the pressure and, if necessary, reducing the pressure. The object of the split muff coupling was to enable a quick joint of two ends of cable to be made and to facilitate handling. The sealing joint was tested to withstand a hydraulic pressure of 3 336 lbs. per sq. in., and the grip on the armouring wires was subjected to a tensile strain of 30 tons per sq. in. It held, but the wires broke.

It was after the successful laying of the experimental 2 in. cable across the Bristol Channel that it was decided to increase the diameter to 3 in. to give greater capacity.

Teething troubles having been overcome and the technique of manufacture established, production proceeded with remarkable smoothness.

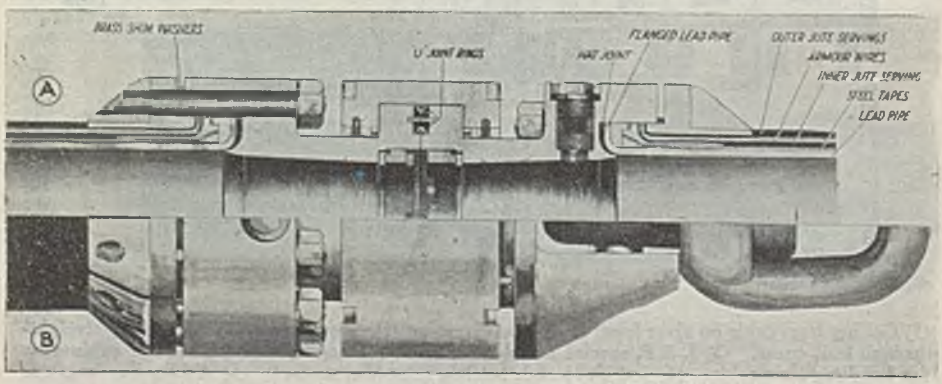
Because of the tremendous weight, special gear had to be erected in the roof at Siemen's works to take the cable off the machine and to carry it to the specially designed building where it was coiled and housed before being transferred to the cable ship. The longest Hais cable made was 35 nautical miles in length. It was wound in a coil 65.6 ft. in diameter and 10 ft. 6 in. high, and its weight, including the water in the pipe, was 2 000 tons. In its finalised design the cable was tested to a maximum bursting pressure of 4 350 lbs. per sq. in.

Several single lengths of Hais cable were laid across the Narrows in the Channel. The lines running from Sandown Bay to Cherbourg were joined by couplings, the distance being 70 nautical miles.

Among the tests carried out by Siemens it was demonstrated that it was possible to make submarine splices in the cable, and a number of such splices were made.

Valuable aid in the laying of the cable was given by Captain Hill, who was with Siemens for many years as captain of the cable-laying ship "Faraday."

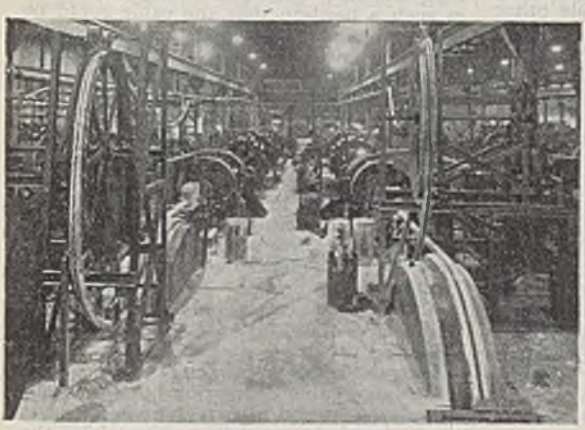
After the initial tests had been carried out the co-operation was sought of other cable makers in the production of the



The Hais cable coupling, (A) showing method of coupling two cable ends by means of the split muff, (B) coupling end with swivel yoke end attached

cable. First to share in the development of the Hais cable were W. T. Henley's Telegraph Works Co., Ltd., and they made one of the two 30-mile lengths of cable with the 2 in. internal diameter, each weighing a thousand tons, that were tested in the Bristol Channel. Siemens made the other.

The integrity of the lead alloy tube throughout the whole length was of major importance, and for this purpose the Henley design of straight-through lead press proved to be most suitable. Consequently, all cable makers having this type of press were consulted with a view to their assisting in producing part of the very large quantity of lead alloy tube required for the purpose of the Hais cable, and it is believed over 80 per cent. of the total was produced on presses of this type, mostly in the Henley factories, but partly in the works of other cable manufacturers.



Two armouring machines engaged in reinforcing Hais cable steel tapes and wire armour at Callender's Erith works

No lead press or cable makers' works was capable of producing or handling lead alloy tube of the total length required for these cables, and consequently operatives had to be trained in the technique of making the special lead burnt joints which enabled individual lengths to be joined up without affecting the overall integrity of the tube, the resultant weld being at least as strong as the tube itself. The 3 in. tube was of .190 in. minimum thickness, and was made of lead alloy E to B.S. 801.

The armouring and reinforcement of the cables necessitated intensive research. Special reinforcing tapes had to be produced in collaboration with the steel manufacturers and the armouring machinery specially adapted to ensure the greatest perfection throughout the whole length.

Some idea of the quantities of raw materials required for this vast project may be gathered from the fact that approximately 12 000 tons of lead, 5 600 tons of steel wire and strip, as well as large quantities of other materials were consumed at Henley's works.

In his B.B.C. broadcast on the Hais cable, Mr. A. C. Hartley mentioned that a second cable firm were consulted and that they were able to produce suitable lead tubing on the lead presses of their own special design, thus making the project a practical proposition. He was referring to the Henley straight-through lead press.

Henley's were, too, able to put forward certain modifications in the design of the cable, particularly in regard to the reinforcement, which contributed very materially to the success of the scheme.

More than 250 miles of Hais cable were manufactured at the Erith works of Callender's Cable Construction Co., Ltd. Of this quantity 160 miles are in operation between Dungeness and Boulogne. Miniinimum individual lengths of 30 nautical miles were demanded by the Petroleum Warfare Department and the ability to withstand an internal pressure of 1 500 lbs. per sq. inch was also specified. Each run of cable manufactured at Erith works was tested and certain lengths, when afterwards tested to destruction, proved to have a final bursting pressure of 3 500 lbs. per sq. inch.

With the special equipment in the very large new armouring shops at Erith works the special manufacturing features were handled satisfactorily. Four large armouring machines were used (no other manufacturer was able to employ more than one armouring machine). These were run 24 hours a day for 7 days each week and during the manufacture of over 250 miles the following quantities of material were used: Lead, 6 843 tons; steel tape, 2 500 tons; galvanized steel wire, 4 250 tons; cotton cloth, 275 000 yards; jute, 540 tons; petroleum pitch, 1 100 tons.

Side by side with problems of manufacture was the difficulty of handling the enormous quantities involved. In addition to facilitating loading direct into ships, special arrangements were provided for coiling down the 30 nautical-mile lengths on sites also convenient for subsequent reloadings. From the Erith armouring shops a steel gantry 1 584 ft. long was erected on towers across the works sports ground

to a jetty on the bank of the Thames. On this gantry were mechanical facilities for handling five separate Hais cables simultaneously, and at the extreme end, alongside the river, were housed powerful winches for pulling the long lengths of cable either direct from the works or from the coiling-down sites.

To protect the coiled-down cables new buildings were erected, the largest being 487 ft. long by 75 ft. wide. While other manufacturers were able to load only one cable at a time, from Erith works two could be loaded simultaneously. The steel gantry and other handling equipment were designed and constructed by Callender's civil engineering department and when called upon to operate under the stress of maximum cable production proved to be completely satisfactory.

From the Erith works, by means of the cable gantry, Hais cables were loaded direct into the holds of the special cable ships operated by the Royal Navy for this purpose. The period for loading each individual cable occupied several days and for long periods one or other of these cable ships was continuously alongside the works jetty.

Daily Output of 1.75 Nautical Miles

During the period of peak production, when daily output was 1.75 nautical miles, the manufacture of Hais cable was being considered in America and at the request of the Petroleum Warfare Department Callender's plant engineer visited U.S.A. to organise production.

The paying-out and picking-up gear supplied by Johnson and Phillips, Ltd., for laying the pipe lines across the English Channel were made to designs that had proved themselves in varying conditions in many parts of the world. To meet the urgent need the G.P.O. placed at the disposal of the Petroleum Warfare Department a complete J. and P. submarine cable picking-up and paying-out gear which had just been completed for them, and also gave to the company technical information which assisted in the re-designing of the haul-off arrangements. Because the first Hais cable with a 2 in. bore had in no circumstances to be bent to a smaller radius than 5 ft., an alteration to the standard design was necessary. A new haul-off drum of 10 ft. diameter and fleeting ring, together with roller-type bow and stern gear, were produced and the final equipment was fitted to H.M.S. "Holdfast." In spite of very bad weather the laying of the cable between Swansea and Ilfracombe during Christmas, 1942, was a success. The decision in June, 1943, to increase the bore of the pipe-line to 3 in. necessitated further alterations and additions to the gear on H.M.S. "Holdfast." This and other ships were equipped to take and handle 100 miles of 3 in. cable, weighing approximately 6 000 tons, each.

Problems of Storage

Johnson and Phillips were asked to provide sites for storing cable at the East India and Surrey Commercial docks. These sites were equipped with large tubular steel bridges with overhead hauling gear, erected in such a position that the cable could be taken from a ship's cable tank, placed on land, and finally replaced in the hold of the cable-laying vessel. To protect the cable from enemy action circular blast walls were built to encase it. The cable was fed out of the protective brickwork tanks over special pulleys. The storage of the finished cable became a great problem, and in November, 1943, further wharf accommodation was found at King George V Dock, and equipment was provided to handle and store seven 30-mile lengths of 3 in. cable. Tubular steel bridges, 60 ft. above the ground, were erected and extended for a total length of 480 ft.

During the trials at Swansea the shore ends were handled by tank landing craft using large cable drums, but this was not entirely successful. Five shore-end barges were, therefore, specially equipped by the Admiralty.

At the central store for Force "Pluto" at Southampton J. and P. tubular steel overhead bridges and handling gear were provided as for the London docks, and instruction in their use was given to Naval ratings by J. and P. engineers.

In response to the ever-increasing demand for Hais cable, Johnson and Phillips, after a short experimental period, produced three 700 yd. lengths of the cable per 24 hrs.

As soon as possible after D-Day two cables were laid between the Isle of Wight and Cherbourg in two days—one from H.M.S. "Latimer" and the other from H.M.S. "Sancroft."

Eight cables were laid from Dungeness to the Boulogne area.

Other electrical firms who contributed to the success of the Hais Cable, included Pirelli General Cable Works, Ltd., W. T. Glover & Co. Ltd., Standard Telephone & Cables, Ltd., the Ediswan Electric Co., Ltd., the Telegraph Construction and Maintenance Co., Ltd.

Incidentally, the electrical industry was also concerned with the Hamel pipe-line for among the firms who took part in its manufacture and operation were, the A. I. Electric Welding Machines, Ltd., B. I. Cables Ltd., the B.T-H. Co., Ltd., Mather and Platt Ltd., A. Reyrolle & Co., Ltd., the Isle of Wight E. L. and P. Co., the Folkstone E.S. Co., Ltd., and Clesco.

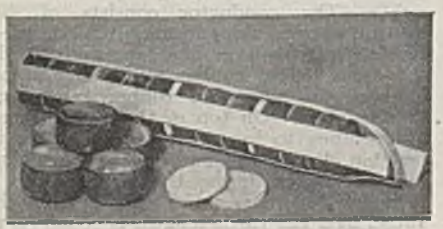
Now It Can Be Told—II

How Self-Buoyant Electric Cable Defeated Magnetic Mine

IN the last few days the veil of secrecy has been lifted from the electrical device which destroyed Hitler's first "secret weapon" of the war—the magnetic mine—and thus removed one of the most serious menaces that threatened our sea lifelines.

The story has already been told of how a party from H.M.S. "Vernon" secured one of these mines in the Thames Estuary, and Lieut.-Commander Ouvry dismantled it, laying bare its secrets. At first ships were protected by a de-gaussing girdle, and then the problem of devising some effective method of destroying the mines was tackled by scientific and technical experts. Success was achieved as the result of collaboration between the Admiralty and the electrical cable-making industry.

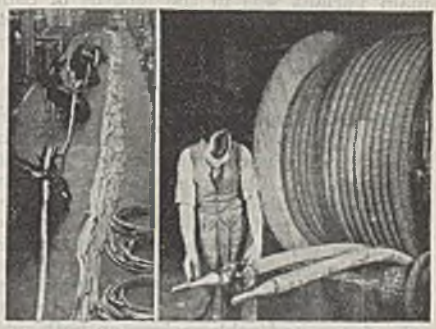
In the early days, low-flying 'planes of the Wellington type were fitted with a large metal hoop and special equipment producing a magnetic field of sufficient intensity to explode any mine lying beneath as they passed over the water. This method had several disadvantages, and after a few months it was abandoned in favour of the "Double L," or double longitudinal, sweep, comprising two mine-sweeping ships, each towing a long tail of self-buoyant electric cable carrying two electrodes. Current generated in the ships was stored momentarily in batteries and passed through both cables as a large "surge." By this means ten or more acres of the sea bottom was subjected to a rectangular magnetic field of sufficient strength and duration to destroy all the



Section of buoyant cable core showing method of assembly

mines therein. As they proceeded on a parallel course the ships towing the sweeps made successive "surges" of magnetic field, and in this way cleared a continuous lane of the sea bottom, providing a safe channel through which ships could pass.

It was in the middle of December, 1939, that the Admiralty decided that some form of buoyant cable to float on the surface of the water was desirable, and cable-



Left: Applying covering to complete electrodes. Right: Preparing end terminals on a pair of finished cables

makers were invited to produce suitable designs.

On Christmas Day of that year Dr. Percy Dunsheath, director and chief engineer of W. T. Henley's Telegraph Works Co., Ltd., conceived the idea of making inflated cylindrical rubber elements on the principle of the core of the tennis ball and using these as the basis of the buoyant core of the cable. By the middle of January the resultant design had been found satisfactory, and an order was received for a number of complete sets. The first length was delivered in a fortnight, and from then onwards, although some detailed modifications have been made in the design, the construction of the buoyant cable has been continuously carried on.

The cable incorporated several ingenious features. It had to be flexible as well as buoyant, and also contain a fairly large cross-sectional area of copper in order to carry the heavy current necessary to detonate the mines. The Henley design was achieved by mobilising the combined resources of the company's cable factories and of Henley's Tyre and Rubber Co. In peace-time the latter produced large quantities of tennis balls, and the machinery for this purpose was adapted to make the millions of inflated cylindrical rubber elements, which, together with suitable reinforcement, formed the buoyant centre on which the conductor wires and their insulation could be built, resulting in a cable of approximately 3½ in. in diameter.

During the war years many hundreds of complete sets, comprising over a million yards of cable, were constructed and put into effective operation. As time went on and the Admiralty were able to bring other types of vessel into service for this class of minesweeping, the types of buoyant cable supplied, resolved themselves into three patterns: those used with Fleet minesweepers, trawlers and drifters. The main variant was in the lengths of cable employed, since these had to be modified to a considerable extent to suit the speed of the vessel being used.

A United Effort

The combined resources of those firms which had been able to undertake the work initially were insufficient to meet all requirements. Consequently Henley's and Callender's Cable and Construction Co., Ltd., which had each developed satisfactory designs of cable based on the facilities and materials afforded in their own factories, were requested by the Admiralty to make available details of their designs to other interested cable makers on both sides of the Atlantic. This, in the national interest, was gladly done and resulted in a still further increase in the amount of buoyant cable available in the minesweeping service.

The production of the buoyant cable did not represent the whole story. Two lengths of cable, one short and the other long, were used behind each of the minesweeping vessels. In addition, means had to be provided to enable the current in the conductor to leave and return in accordance with the stated requirements of the Admiralty. This involved the manufacture of large quantities of copper electrodes, which, together with the necessary fittings, gave Henley's engineering department plenty of scope for their ingenuity.

A Different Type of Cable

In the early part of 1941 a further demand was received from the Admiralty for an entirely different type of buoyant cable. This was of much smaller sectional area, and required for an entirely different purpose. In this case Henley's were able to provide an answer within a few days, as it so happened that one of the original designs prepared for the main buoyant cable was readily adapted for the new application. In this case the rubber elements were not employed, but buoyancy was obtained by stranding the conductor on to a fairly large diameter steel spiral, having plugs inserted at intervals so that the cable centre would not become completely flooded in the event of damage to the external sheath. In this case the cable was not to be towed behind a vessel, but was intended to be man-handled and used in the form of a complete loop, so that end fittings in this case were not of great importance.

In the early part of 1944 an entirely new service requirement arose which had to be supplied in addition to the continued production of the large buoyant cable. The supply of these cables was urgently required, and for this reason it was decided not to adopt the inflated elements, but to modify an alternative design of the large size cable which had been produced in some quantity, employing cork cylinders and expanded rubber. All essential requirements were met and gave complete satisfaction.

The operation of the "Double L" sweep was demonstrated by the use of model ships and gear and a magnetic "mine" in a tank at the Gravesend works of W. T. Henley's Telegraph Cable Co. Ltd., on Monday, when representatives of the technical Press saw the buoyant cable in the various stages of manufacture. Dr. P. Dunsheath welcomed the visitors and gave a general description of the structure of the cable.

Twenty-three Million Tennis Balls

The equivalent of 23 million tennis balls—one for every other man, woman and child in the United Kingdom— have been incorporated in the buoyant cables. Each rubber element forming the core of the cable is subjected to a pressure of 3 tons. Any that burst are rejected. Between every three elements is inserted a plywood disc to give stability, and the whole are held together by longitudinal adhesive tapes. There are usually 2 000 of these buoyant elements in each length of cable. The core having been completed, the conductor, which carries a heavy current, is applied in two layers wound in opposite directions—one left hand and the other right. The conductor consists of 400 .040 in. copper wires forming 0.5 sq. in.—196 being wound in one lay, and 204 in the other. Two rubber reinforcing tapes, followed by two more rubber tapes, are then applied. On top of these are placed proof tapes to keep the rubber tapes in position during the curing, or vulcanising process, which forms the rubber into a homogeneous mass. For this process the cable, in a 725-yards length, is coiled on to a steel drum and dropped into the curing vessel, where steam pressure is applied. At the end of the cable the conductor is drawn to a point over a wooden former and sweated to a terminal, or a towing eye.

When the cable is attached to the towing vessel the mechanical pull, which may be anything up to three tons, is carried by a "stocking" made of gal-

vanised steel wires, which encases the cable for the first 50 or 60 feet.

Up to a few months ago Henleys were turning out a maximum of 18 large sets a week. They are now making four sets a week.

A.c., generated in the ships, is sent out in large surges. The reasons for using pulsating a.c. are that the pulsation prevents overheating of the conductors and the a.c. conserves the copper cable electrodes. Each of these is enclosed in a canvas sheath which retains much of the copper salts removed by electrolytic action, which, otherwise, would be swept away by the sea water, so that as one surge takes the copper off the electrode the next puts much of it back.

Views on Nationalisation

AT a luncheon of the Birmingham Electric Club on May 26, when covers were laid for some 250 members and their guests, Mr. C. Heathcock, chairman of the West Midlands J.E.A., offered a warning as to the consequences to consumers of the nationalisation of the electricity supply industry. Mr. A. T. Haywood, president, was in the chair.

In the course of his remarks, Mr. Heathcock pointed out that the proposal to nationalise was no step in the dark. The results of national direction were an open book for all to read. "our penny post now costs us 2½d.; and our telephone service does not shine in comparison with that of other countries."

A Vital Protection

With regard to electricity, politicians when introducing the 1926 Act which set up the Central Electricity Board, promised that if we adopted the grid scheme of interconnecting selected generating stations, the savings effected would make it possible for the Board to supply at a cheaper rate than any single undertaking had been able to generate. The industry did not share this optimism and pressed for protection against increased costs. Special protection was incorporated in Section 13 of the 1926 Act, which provided that where undertakings proved, to the satisfaction of the Commissioners, that they could have produced their requirements at less than the charges then current by the Board, such charges would be reduced to the cost the undertaking would have incurred in generating. This had proved to be a vital protection to all reasonably efficient undertakings, and the West Midlands J.E.A. received a credit exceeding £200 000 a year which is shared among consumers. Birmingham must have a much greater credit similarly shared. Under nationalisation of the industry these credits would be lost in the common pool.

With respect to fuel—the largest single ingredient of generating cost—under Government direction during the war the price had doubled, quality had deteriorated and industrial production had been curtailed due to shortages of supply.

This record invited no confidence that electricity would be cheaper under national ownership and control, and it seemed certain that it would be appreciably dearer in the Midlands if existing undertakings were merged in a national pool.

ELECTRICITY AND POLITICS

Regret that such an important public supply service as electricity was being made the butt of political parties, was expressed by Mr. W. P. Lilwall, president of the Incorporated Municipal Electrical Association, when he attended a luncheon given to members of the Scottish Centre in the City Chambers, Glasgow, recently. During the last 10 or 11 years, he said, the industry had been badly handicapped by the fact that a sword was hanging over its head, and no one knew exactly what was going to happen. Whatever the outcome of future re-organisation, it would not be so bad as the uncertainty which had prevailed throughout the last few years. Lord Provost James Welsh said he had no doubt that the tendency would be more and more towards public control of such important series of undertakings. A vote of thanks was given by Mr. W. J. Cooper, chairman of the Scottish Centre.

BOOKS RECEIVED

1945 Year Book of the E.C.A. of Scotland. (Edinburgh: E.C.A. of Scotland.) Pp. 100. 3s. net.

British Journal Photographic Almanac, 1945 (London: Henry Greenwood & Co). Pp. 388. 3s. 6d. net.

"Costing for Builders." 4th Ed. Revised. By W. A. Swith (London: Moore's Modern Methods). Pp. 58. 5s. net.

Journal of the I.E.E. Vol. 92. April. Part 1, No. 52 5s. net; Part II, No. 26, 7s. 6d. net. (London: Spon.).

"An Introduction to Electronics." By Ralph G. Hudson. (New York: Macmillan Co.) Pp. x + 97. $3.00.

"Rebuilding Britain—A Twenty Year Plan." By Sir Ernest Simon. (London: Victor Gollancz). Pp. 256. 6s. net.

"On." Some Irresponsible Jottings.—Scientific and Otherwise. By "H. W." (London: A.E.I. News) Pp. 164. 5s. net.

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. A. Amschel has retired from the board of Lightalloys, Ltd., on account of ill-health.

Mr. Louis John Hunt, retired at the end of May and has resigned from the board of the Electric Construction Co., Ltd.

Mr. W. A. Mortimer, of Blackpool, retired electrical engineer, left £14 570 (net £12 174).

Mr. G. A. Reynolds, Yorkshire Electric Power Co., has been appointed mains superintendent at Fulham, at a salary of £652 per annum.

Sir George E. Bailey, a vice-chairman of Associated Electrical Industries, Ltd., has been appointed managing director. Sir George is chairman of the Metropolitan-Vickers Electrical Co. Ltd., and a director of the British Thomson-Houston Co., Ltd.

Mr. E. Binns has been appointed chief electrical engineer and manager of the Oldham electricity undertaking. The vacancy had been caused by the retirement of **Mr. R. G. Whitehead,** who had been joint chief electrical engineer and manager with Mr. Binns.

Last week, at Magnet House, Kingsway, a presentation was made to **Sir Harry Railing** (chairman of the company) on behalf of nearly 400 members of the I.E.E. in the G.E.C., to commemorate his year of office as President, and as a token of the subscribers' affection and esteem. The presentation, comprising a silver cigarette casket and a book containing the signatures of subscribers inscribed on vellum, was made by **Dr. C. C. Garrard,** chairman of the organising committee, supported by **Dr. C. C. Paterson.** There were also present representatives from the various sections of the organisation and the armed Forces. Sir Harry expressed his gratitude and appreciation.

Presentation to Sir Harry Railing by G.E.C. members of the I.E.E.

Sir Ernest Fisk, having arrived in this country, has now assumed his new duties as managing director of Electric and Musical Industries, Ltd. Formerly chairman and managing director of Amalgamated Wireless (Australasia), which he founded, he was appointed to E.M.I. last November.

Mr. T. R. Thomas is to be president of the S. Wales branch of the A.M.E.M.E.

Mr. A. V. Milton, head of A. V. Milton and Co., has been elected chairman of the Merseyside district branch of the Electrical Contractors' Association. The vice-chairman is **Mr. T. R. Jones,** managing director of Tom Jones (Electrical Engineers) Ltd.

At the meeting of the Council of the London Chamber of Commerce recently, **Mr. John McLean** (director, George Wills and Sons, Ltd.), chairman of the Council, and **Mr. G. F. Newton** (managing director, Cape Asbestos Co., Ltd.), deputy-chairman, were re-elected for the ensuing year.

Few electrical contractors can look back fifty years and place on record that some of their employees have been with them for over forty years, as did Mr. H. E. Walker, managing director of Walker Bros. (Electrical Engineers), Ltd., when he presented war savings certificates to employees of over twenty-five years' service at a jubilee dinner given by him at Birmingham to the staff and employees. Alderman Walter S. Lewis, J.P., past Lord Mayor of Birmingham and former employee of the firm, proposed the toast of the company. Major G. N. Walker, presided, and other directors present were Mr. N. C. Walker, and Mr. E. M. Walker.

OBITUARY

Mr. Philip G. Gossler, chairman of Columbia Gas and Electric Corporation, aged 74 years.

Earth Leakage Protection

By "SUPERVISOR"

FOLLOWING on my previous* notes concerning the inadequacy of current regulations dealing with voltage-operated earth leakage protection, further points should now be considered. As with all voltage-operated equipment an important thing is, of course, operating voltage, and it seems clear that the compilers of I.E.E. Regulation 1006, together with the members of the committee responsible for the Report presented to the I.E.E. Council on Multiple Earthing of the Neutral Conductor (Journal I.E.E., July, 1942), have not completely visualised the conditions prevailing in the circuits to be protected. By bracketing the report and the regulation together, one comment can apply to both; the report serves, too, to illustrate several points.

Need of Clearer Understanding

Regulation 1006 is not, of course, inaccurate in this respect, but it is very misleading. It states that leakage protection must be "capable of disconnecting the live conductors of the whole installation or, if desired, of only the faulty circuit (or circuits) when the potential between the metal to be protected and earth exceeds 40 volts." The report makes no reference to operating voltages, but describes the devices as "responsive to very small leakage currents" (para. 1.57 and Fig. 5, clearly representing the conventional voltage-operated device). In Appendix 4.2, however, some mention is made of voltage, the extract quoted last month—"if fault conditions giving rise to a voltage above earth (on the framework of apparatus) of less than 40 volts might result in a leakage current from the apparatus to earth through a fortuitous contact (i.e., in parallel with the relay coil) of considerably greater magnitude than the current in the relay circuit itself, and sufficient to produce danger from fire." This insistence upon current in connection with a voltage-operated device was commented upon in the previous notes.

Two important points remain to be dealt with, therefore; one, voltage of operation, and two, the location of the protection. It will be agreed that the picture presented by the regulation and the report is that a leakage voltage may be expected to grow from zero to some lethal value, and as soon as this reaches, or exceeds, 40 V, then the device should operate. Surely this is the reverse of what actually happens, which is, that the leakage current rises from a low value to a higher, but that the leakage voltage starts from maximum and falls to some lower value depending upon circuit conditions.

Take, for instance, an earth fault developing at some point in a heating element of cooker, kettle, or similar appliance; at the time of contact between the phase line and the framework of the apparatus the voltage present upon the equipment is full line voltage, say 230 V. As soon as current starts to flow from the element to earth then the voltage on the framework will fall to some lower value, which will obviously depend upon the length of element remaining in circuit and the current flowing over it. The latter will again be dependent upon other resistances in the earth circuit, but the full mains voltage will exist between the fault and the earth electrode, pending isolation of the circuit. The point is, however, that the leakage voltage present upon the framework has fallen from a high value to a lower.

Granting this fundamental fact, it is clear that a revised idea of legislation for the voltage-operated device is overdue and the present insistence upon strict voltage limitation meaningless. Voltage of operation is in its right place in B.S.S. 842, which deals with a device; it is quite out of place in a regulation, however, which has to deal with circuit conditions as found in practice. This point should also dispose of a theory advanced in connection with another report—that voltage-operated leakage devices should be graduated for different voltages, so as to provide selective operation. It should be clear that, however graded, all leakage trips throughout the installation would operate simultaneously, as the full mains voltage instantaneously appears upon all circuit enclosures and all metal to be protected connected in the same earth or protective circuit.

A Noteworthy Suggestion

It is conceded that considerable experience with voltage-operated devices is necessary before the full implications of their application are completely realised. Owing to our secluded method of preparing and producing regulations, persons who may have used and studied the principles of the devices never have an opportunity of expressing an opinion; they are presented with a *fait accompli* in the shape of a new edition. Representation then made cannot see the light before the next edition, or revisions, even if accepted. Is it too much to hope that regulations produced in the future may rest

* THE ELECTRICIAN, May 18, 1945, p. 439.

upon a rather more democratic basis, and published in draft for comment by all who may be concerned? At present, regulations are conceived in an atmosphere of secrecy scarcely less than that accorded to international treaties; it is difficult to see why this should be considered necessary.

Next, regarding location of the point of application of voltage-operated protection. It is clear from the wording of the regulation, that the device is considered to be some sort of main switch, or main circuit breaker, although the regulation relaxes to the point of suggesting circuit protection. Surely the proper place to apply protection is at the apparatus; if wiring systems require inclusion then a further device located at the main-switch position might be contemplated. The report referred to above must receive a good mark in this connection, as it at least shows one of the devices " operated by very small leakage currents " placed between the distribution board and the equipment to be protected.

Group Protection

Most people still consider that group protection against overload for lighting or small power circuits is adequate, although the ring-main and fused plug idea seems to be overcoming this to some extent. But it would never be advanced that motors, cookers, and so on should be grouped for overload protection; why, then, should group protection against leakage be considered? A cooker is self-contained as regards overload protection, and should also be for leakage protection; it follows, therefore, that the proper place for this protection is in the control unit. The same thing applies to the washing machine, and to any equipment located in vulnerable positions; it need not, and should not, apply to each and every radiator scattered about the house, the majority of which need no earth leakage protection whatever.

Voltage-operated leakage protection will find its greatest field of application in the rural area, where solid earthing conditions are admittedly difficult—and expensive. Lighting circuits in these areas can be catered for by means of insulated wiring systems, but individual farm equipment will need leakage protection. It is considered that in all cases local application of protection should be made available, if only to ensure that faulty equipment alone is isolated. The idea of placing one leakage-circuit breaker at the main switch position, or even of applying it to sub-circuits, will not meet requirements, as the total disconnection of supply on the occurrence of one earth fault cannot be contemplated.

It is pointed out that with this local method of application no objection can be raised to the utilisation of conventional earth electrodes—water pipes or cable sheaths—although objectionable where group protection is applied, and for the reasons set out last month. It is essential, however, that no additional provision of solid earthing can be contemplated if water-pipe earths are to be used, for reasons that will be obvious. It will be remembered that the Note to Regulation 1006 appears to approve of direct earthing in addition to the use of leakage protection by means of voltage-operated devices, but this must clearly lead to further difficulties in other directions.

This point is, however, closely bound up with the larger matter of protective circuit check and testing, which must be dealt with in my notes next month. Sufficient has probably been said, however, to indicate that the whole matter of circuit protection is overdue for consideration, in the light of experience both in this country and on the Continent. In passing, it might be pointed out that some Continental rural installations utilise a socket—single- or three-phase incorporating leakage protection in addition, and this had, just before the war, enjoyed what might be regarded as considerable popularity.

NAPIER " SABRE " EXHIBITION

The development of the 2 400 H.P. Napier " Sabre " engine which enabled " Typhoon " and " Tempest " aircraft to operate with devastating effect against the Germans in the final stages of the war was briefly outlined by Sir George Nelson, chairman of D. Napier and Son, Ltd., at a private view of the Napier exhibition in the showrooms of the English Electric Co., Ltd., Queen's House, Kingsway, London, on Monday. Reference was also made to the " Sea Lion " engine for high-speed motor boats, many hundreds of which have given excellent service.

Among the exhibits of electrical interest is an ignition tester, manufactured by the English Electric Co., Ltd. This instrument was applied in the first instance as a rapid means of locating ignition faults in tank engines and it will be a valuable aid in the servicing of civilian motor vehicles after the war. The ignition tester gives a complete indication on a cathode-ray oscillograph of the condition of every part of the ignition, including each plug, without requiring direct access to either the plugs or the engine.

Another instrument on view is a low tension booster coil, which replaces the hand starter magneto for engine starting. It is manufactured under licence by Rotex, Ltd.

Steel Tank Rectifiers

Their Application to Radio Transmission Plants

AT a meeting of the Institution of Electrical Engineers on May 24, two papers dealing with high voltage steel tank mercury arc rectifiers, were read. The first, by Mr. J. C. Read, dealt with steel-tank mercury-arc rectifier equipments developed and built in this country in recent years for the supply of high-voltage direct current for radio transmitters. The arrangements adopted, and the reasons for them, were described in detail; and an account was given of certain problems encountered in the development of these sets. The effect of the circuit adopted on some of the factors affecting backfire at high voltages was briefly discussed.

The second paper by Mr. P. A. T. Bevan, described the types of high-voltage steel-tank rectifier used in the higher-power radio stations constructed by the B.B.C., including a recent type of pumpless air-cooled equipment, and gave a review of their performance in service. Appendices contained some analytical and design data for the various types of rectifier connection used in practice, smoothing circuits, and grid-control features, with particular reference to stations in which rectifiers formed the bulk of the load, and in which, owing to Class B modulation, the load on the rectifier fluctuated over wide limits at syllabic frequency.

Mr. B. N. MacLarty (B.B.C.) said the history of the development of these machines began in this country at the end of 1932 when the B.B.C., was contemplating the design of the high power 1 500 m. transmitter at Droitwich and the question of power cost was of preponderant importance. Three types of h.t. converter were available at the time, but it was decided to adopt the steel tank rectifier on the score of efficiency, which was of the order of 96 per cent. as against 84 or 85 per cent. for the h.t. machine. The rectifier also had the advantage that it could be started up quicker than the machine, which meant that spare plant could be introduced with a far shorter programme break. After two years' experience with the steel tank rectifier, the B.B.C. turned over to it entirely but not without some regrets, because the h.t. machine was almost 100 per cent. reliable and appeared to be able to carry on for ever. For instance, the Brookmans Park sets, which were installed in 1929 were still running, and as far as could be seen would do another 50 years work.

Mr. W. T. Ditcham (Marconi's W.T. Co., Ltd.) said that in 1928 he visited a certain chemical factory in Germany and saw there a steel tank mercury arc rectifier, operating at about 10 000 V. At that time the mercury arc rectifier was well known to us but was used principally for traction purposes. The Marconi Co. placed an order for a 400 kW, 12 000 V equipment and it was installed in the Chelmsford laboratories in 1929 where it was used experimentally. The results were extremely satisfactory although naturally there were some troubles, and a little later a large number of Continental broadcasting stations were fitted with similar equipment. Remarking that he had the impression—which might be shared by others—that any piece of apparatus containing mercury vapour was likely to be temperamental, he doubted whether it was appreciated that a tremendous amount of painstaking, and sometimes heart-breaking, development work was required to produce the reliable equipment described by the authors.

Mr. J. E. Boul (English Electric Co., Ltd.) said that whilst at first sight this subject might appear to be of interest only to radio engineers and users, with the growth of high frequency heating for industrial purposes, a larger field of interest had been opened up. As regards the statement by Mr. Bevan that backfires occasionally occurred and were the principal obstacle to the simplification of the equipment, he asked in what direction it was felt that simplification would follow the development of a rectifier which was immune from backfiring. At the moment, he could only visualise the omission of the a.c. trip circuit for operation of the high speed relay. Arc suppression and automatic voltage recovery would presumably still be required to cope with transmitter faults, etc. In connection with the plea for simplification implied by Mr. Bevan, he asked whether radio engineers could give rectifier manufacturers any hope of being able to dispense with the feature of gradual restoration of voltage following upon the application of arc suppression to clear a transmitter fault. This would do much to pave the way for simplification of the rectifier auxiliary circuits, especially if output voltage adjustments could be confined to the transformer tap-changer and the rectifier grids reserved for arc suppression. As regards the ignitron in relation to future developments, he suggested that its simplification had been over-emphasised. American experience at voltages as low as 600 V d.c., had shown that anode baffling was necessary. Admittedly, there was no ionisation from other sources during the

negative half-cycle of anode voltage, but the rate of de-ionisation after arc extinction did not appear to be sufficiently rapid in the absence of anode baffles to withstand the voltage jump which occurred when commutation of the arc released the anode from cathode potential. Backfires due to these conditions could, and did, arise.

Turning to Mr. Read's paper he said he did not subscribe to the view that with the pumpless type rectifier the complication of refrigeration or water cooling of the air was either desirable, or necessary unless ambient temperatures exceeding 130 to 140° F. were experienced. One factor favouring the pumpless type which had not received the attention it merited was that of maintenance. The omission of vacuum pumps and vacuum gauges and of water cooling auxiliaries, had done much to simplify the auxiliary equipment—both electrical and mechanical—and this had been its principal advantage. It would be a retrograde step to introduce refrigeration or water cooling of the air.

Mr. E. Gallizia (G.E.C.) emphasised that the development of the high voltage pumpless rectifier was entirely a British venture, and asked the authors whether there would be any difficulty in storing these rectifiers for, say, 12 months, and then putting them immediately on load, or were the best results obtained when the apparatus was kept in continual use? He also stressed the importance of designing the equipment as a whole to avoid the possibility of other parts reducing the performance of the rectifier.

Dr. W. G. Thompson (G.E.C.) said the papers were the most clear and frank exposition of the problem of the high-tension mercury arc rectifier that had ever appeared in the British, American or Continental Press, and it was a measure of the confidence of the rectifier manufacturers that their engineers were prepared to come forward and discuss troubles and show how they had been overcome. With regard to backfire, he suggested that in this country we looked to a higher standard of prevention than did the Americans, but with the pumpless rectifier it was essential to reduce backfire to the absolute minimum. As regards the automatic restoration of voltage, so far as operation was concerned, there was no new phenomenon, but in the mercury arc vapour there was a new medium with which to establish the necessary dielectric strength.

Mr. H. T. Ramsay (M.O. Valve Co., Ltd.) said that Mr. Read's paper conveyed the impression that the hot-cathode mercury rectifier was limited in size to 50 kW, but some dozen were in service in this country and elsewhere of 150 and 200 kW capacity. He thought the economic range would be from 150 to 200 kW, although below that there was a field for other purposes. The comparison between the hot-cathode and steel tank types of rectifier was of great interest because at the moment it was by no means clear which type would be used on a given job.

Mr. S. G. King referred to the possible use of the steel tank rectifier for industrial heating with powers of the order of 1 000 kW at radio frequencies. Developments in this direction might also have a bearing on the radio transmitter as it was now known. Pictures had been shown of a tank on which were hung a number of components, but at the moment they were all at high voltage. If radio equipment users could possibly take the positive as earth and the negative as the high tension, it would very much simplify the rectifier, although he admitted there would be difficulties. But there would be no isolating transformers and the rectifier itself would be able to be stood on the ground; the size of the enclosure would also be very much reduced. It would be interesting to have the views of the authors on the use of these devices for inversion from 50 cycles to frequencies of the order of 1 000 or 2 000 cycles. He had in mind induction heating, for which reliable machines were available at the present time. There were some of 1 500 kW capacity in this country, running at 1 000 cycles, and the efficiency was 89 per cent. at full load, although it fell away considerably at half-load.

Mr. J. L. North remarked that he was a little irritated by one or two things the authors had said. They had stressed the extreme simplicity of the metal-clad unit—meaning the tank unit—and suggested that development would continue on this basis; personally he did not think that was necessarily so. In his view, the interior of the pumpless rectifier tank was extremely complicated. Mr. Bevan had stated that so far as he was aware no fully grid-controlled high-voltage units of the mercury-vapour hot-cathode and glass bulb rectifier type had been constructed with ratings suitable for high power broadcasting duty. As a matter of fact there was installed in 1938 a water-cooled glass bulb 500 kW rectifier for broadcasting. There was some trouble at first, but it was overcome by an alteration to the grid control circuit, and another glass bulb rectifier of the same type was installed which gave better results than did the steel tank type. With regard to smaller units, 50 kW glass bulb cold-cathode rectifiers were available, and experiments were going on with 100 and 150 kW types which would certainly be seen in this country within the next twelve months.

The A.C.E.

Importance of Consulting Engineers in World Trade

FOLLOWING the annual general meeting of the Association of Consulting Engineers, on May 24, a luncheon was held at the Waldorf Hotel, London, with Mr. David M. Watson, in the chair, supported by among others, Mr. I. A. Kirkpatrick, Chief of the Control Commission for Germany (British Element); Mr. Spencer Summers, Parliamentary Secretary, Department of Overseas Trade; Sir Herbert Williams, M.P.; Mr. Arthur Mullins, Controller General, Department of Overseas Trade, and Sir Percy Herbert Mills, head of the Economic Section of the Central Commission for Germany.

Mr. Spencer Summers stressed the importance of overseas trade for the future of the country, and said that it was not yet sufficiently appreciated that the additional burdens brought about by the war and which we had to bear could only be overcome by increased exports. During the war we had imported goods of all kinds on credit terms. Those countries which had sent the goods believed that the only satisfactory payment for them would be by receiving goods from us in exchange. It was, however, necessary to exercise some caution and discretion in speaking of exports, in that before the manufacturer could play his part and transfer his operations from war to peace, there were many things he needed but which as yet he could not have. More men and materials were required. The spearhead of British trade abroad was the consulting engineer, for it was he who first made contact with averseas projects. It was the desire of his department to facilitate the ambitions of both the consulting engineer and the manufacturer, and to this end his department was concerned, not with politics but with trade.

Dr. J. F. Crowley, a member of the association, said that the best engineering machinery was made in this country, and the designers in our engineering works had contributed as much as anybody to the victory we had just celebrated.

A tribute to the profession was paid by Sir Herbert Williams, who likened the consulting engineer to Cæsar's wife. He was the person the customer had to trust, and he occupied the same status as the doctor, the lawyer and the accountant.

Needs of the Continent

Mr. Watson, said that the problems in connection with reconstruction were of vast proportions. The volume of work to be done in the devastated countries alone was of unprecedented magnitude. Though consulting engineers were all very busy and had as much to do in this country as they could possibly manage, he was nevertheless convinced that their help would be urgently required abroad. It might not in the circumstances be possible to undertake such work by established methods or without sacrifice; but the consulting engineer's experience was such that ways and means would be found whereby the work would be done. The shortage of staff was a very real trouble.

Sir Cyril Kirkpatrick, past-chairman of the association, also spoke.

Illuminating Engineers

THE annual meeting of the Illuminating Engineering Society was held in London on May 15, when the president, Mr. E. Stroud, in presenting the annual report drew attention to the progressive growth in membership, which now exceeded 1 600, and to the fact that ten centres and seven groups were now in operation. Centre status was about to be granted to the recently formed groups in Edinburgh and Liverpool, and since the opening of the present year a new group had been formed in Halifax. Reference was made to the successful publication of the Lighting Reconstruction Pamphlets, now six in number. It was recalled that during the past year an increase in subscriptions, to provide for extension of administrative arrangements at headquarters and to facilitate the development of post-war activities, had been approved by members. In this connection the Council had appointed, as secretary of the society, Mr. Raymond Pye, the hon. secretary of the Leeds Centre, whom, it was hoped, would enter upon his duties in July. A resolution approving the adoption of the report and accounts was proposed by Mr. A. E. Darlington, seconded by Mr. S. D. Lay, and declared carried unanimously.

In the course of the meeting it was reported that new officers and members of Council for the forthcoming session would be Mr. H. C. Weston, president; Messrs. Howard Long, H. E. Chasteney, and J. M. Waldram, vice-presidents; Mr. N. V. Everton, hon. treasurer; Mr. J. S. Dow, hon. secretary and Messrs. J. N. Aldington, M. G. Bennett, W. M. Hampton, A. G. Higgins, J. S. Preston, A. J. Pashler, E. B. Sawyer, W. S. Stiles, W. D. Wright, members of Council.

After the transaction of formal business had been completed, an address on Daylight and its Penetration into Sea Water, was delivered by Dr. W. R. G. Atkins, F.R.S.

News in Brief

I.E.E. London Students.—A River Day will be held on July 22, when the "Richmond Belle" will leave Richmond at 10.30 a.m., proceeding upstream as far as Walton. Catering arrangements will be announced later. Tickets, 9s. single, exclusive of refreshments, are available from Mr. G. H. S. Mogford, the Entertainments Secretary.

X-Ray Installation.—The Worcestershire C.C. is to install X-ray apparatus at the Oldbury dispensary at a cost of £1 200.

Humber Lighting.—The Conservancy Board at Hull has approved the recommendation relating to the restoration, at peace-time brilliancy, of navigational lights on the Humber, and also of the peace-time lighting at dock entrances and on piers and jetties.

I.E.E. Transmission Section.—An informal dinner is to be held at the Connaught Rooms, London, W.C.1, on June 19, at 5.30 for 6 p.m. The charge for tickets will be 12s. 6d. each, including gratuities, but exclusive of wines.

New I.E.E. Measurements Group.—The I.E.E. Council has sanctioned the formation of a Measurements Group in the North-Western Centre. An informal meeting of the Group was held in the Engineers' Club, Albert Square, Manchester, on May 30.

Electric Farming in Cheshire.—Sixty Cheshire farmers and members of the St. Helens Electricity Committee, a few days ago, visited the all-electric farm of J. Heyes and Son, at Rainford. Mr. T. S. Parkinson, deputy borough electrical engineer, Mr. Tomlinson and Mr. B. Heyes explained and demonstrated the advantages of electrical methods in various farm operations including grain drying, pea vining, sterilising and milking.

Electricity in Fleetwood.—Addressing the I.M.E.A. Council at Fleetwood recently the Mayor, Coun. W. Ward, vice-chairman of the electricity Committee, said Fleetwood was an example of what could be accomplished in electricity supply under the guidance of a committee and engineer who were members of the I.M.E.A. All street lighting and the bulk of cooking was electric. The inland lighthouse was also electrically lit by a 60 W lamp.

Hammersmith Cooker Supply.—The Chief Electrical Engineer has been in touch with a number of manufacturers with regard to the supply of electric cookers, and has been informed that, for the time being, there is no likelihood of obtaining cookers of the post-war type.

Golf Competition.—The Council of the Birmingham Electric Club has decided to recommence the series of golf competitions, and a meeting is to be held on June 25 at Walmley Golf Club, commencing at 4 p.m. The entrance fee will be 2s. 6d., the green fee, 1s. 6d. and the charge for supper, 3s.

Telephone Kiosk Lighting Charges.—The Hackney Electricity Committee reports that the question of a suitable charge for lighting public telephone kiosks has been considered by a representative body of undertakings in the London area, which suggests a charge of 35s. per annum and the Committee considers this is a reasonable tariff. The previous charge was £1 11s. 6d. per annum. In Hackney approximately 120 kiosks are affected.

X-Ray Crystallography.—By the courtesy of Prof. C. E. Tilley, F.R.S., and of Prof. Sir Lawrence Bragg, F.R.S., a summer school in X-ray crystallography will be held again this year in the Department of Mineralogy and Petrology, Cavendish Laboratory, Cambridge. The school will be held from September 3 to 14 inclusive. A detailed syllabus and form of application may be obtained from Mr. G. F. Hickson, Stuart House, Cambridge.

Severn Barrage Scheme.—Mr. Tom Smith, when joint-Parliamentary Secretary, Ministry of Fuel, stated recently in the House of Commons that no Government decision had been taken on the Severn barrage scheme but the proposal had not been shelved. The Minister, Mr. Smith added, had not completed consideration of the report of the experts on the scheme, but the report suggested that the barrage was feasible. It would involve an expenditure estimated at £47 000 000.

TWENTY-FIVE YEARS AGO

FROM THE ELECTRICIAN *of May 28, 1920: It is announced that the Radio Corporation of New York has purchased about 6 000 acres of land at Rocky Point, Long Island, for the erection of what will be the largest wireless station in the world. It will cost $20 000 000, and will be able to communicate with France, Italy, Poland, Scandinavia, Germany and Argentina. The wireless station at Nauen is the biggest now operating but that at Bordeaux, with eight 800 ft. towers will be bigger. Rocky Point will even surpass Bordeaux.*

Electricity Supply

Tynemouth.—The Electricity Committee is seeking sanction to borrow £3 230 for extensions.

Stoke Newington (London).—The Electricity Committee is to extend mains at a cost of £142 to supply temporary houses and a factory in Cowper Road.

Glusburn (Yorkshire).—The Council has asked the Electrical Distribution of Yorkshire, Ltd., to table proposals for an all-electric street lighting service.

Darlington.—Application is being made to the Electricity Commissioners for sanction to borrow £10 000 for installing coal-handling facilities at East Mount.

Victoria (British Columbia).—Central electric stations generated 245 908 000 kWh of power in January, compared with 231 958 000 kWh in January, 1944.

Keighley.—The Electricity Committee recommends that the existing basic charges of electricity to power consumers be increased 5 per cent., and 10 per cent. on all other charges for consumption of electricity.

Stoke Newington (London).—The Electricity Committee recently asked for the observations of the Electricity Commissioners on a proposal to abolish discounts, and is now informed that the Commissioners have no objection thereto.

Billingham-on-Tees.—The North-Eastern Electric Supply Co., Ltd., has asked the U.C. to indicate the extent to which electricity is likely to be used in 300 houses to be built at Billingham Junction and also the internal fittings to be provided.

Saint John, New Brunswick.—It is announced that the central electric stations have expanded their power output considerably this year over last, the January production being £53 060 000 kWh, compared with 32 514 000 kWh in January 1944.

Bedford.—It was reported at a recent meeting of the Electricity Committee that the latest increase of 3s. 6d. per ton for coal represented an aggregate increase of about £12 600 per annum, of which approximately £4 500 would be recoverable from the power consumers under the coal clause in the tariff of charges. Since the outbreak of war the cost of coal had increased by 97 per cent., which represented an additional expenditure of £86 000 per annum.

Dartford.—Representations and quotations received from the South Suburban Gas Co., and the electricity department, have been considered by the Housing Committee with reference to the supply to temporary houses as follows: Gas, cost of laying services £650 12s. 2d.; estimated cost to consumer, 3s. 2d. per week; meter rents 1½d. per week. Electricity: Laying of service, no charge; estimated cost to consumer, 2s. 11d. per week; estimated cost (including lighting) 3s. 3d. per week. The committee recommends that electricity be installed for lighting, cooking, wash-boilers and refrigerators.

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.

Barking B.C., June 4.—Supply, delivery and erection of 6.6 kV switchgear. Specification from the Borough Electrical Engineer, Ripple Road, Barking.

Manchester City Council, June 5.—Supply and erection of low-pressure pipework—Stuart Street, generating station (Specification No. 828); 10 000 kVA transformer—Denton (West) sub-station (Specification No. 829). Particulars from Mr. R. A. S. Thwaites, Electricity Department, Town Hall, Manchester, 2; deposit, £1 1s. each specification.

Seaham U.D.C., June 6.—(1) Supply and laying of approximately 2 000 yds. of l.t. 600 V cable and (2) supply, erection and making up of three overground disconnecting boxes. Particulars from the Electrical Engineer, Blandford Place, Seaham.

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

Leeds Waterworks Department, June 11.—Supply of two electrically-driven centrifugal pumps, 700 g.p.m., with motors and float-operated switchgear. Particulars from the Manager and Engineer, Waterworks Department, Civic Hall, Leeds, 1.

Amble U.D.C., June 14.—Supply, laying and jointing of l.t. mains and distributors, supply, erecting and connecting of feeder pillars and laying, jointing and connecting of services. Specification from Mr. W. C. Roy, Electricity Department, Dilston Terrace, Amble, Northumberland.

Industrial Information

"Look to Your Lights."—Under this title the E.D.A. has published an illustrated booklet emphasising the need for planned effective street lighting and giving guidance to local authorities in the matter.

E. K. Cole, Ltd.—The head office of E. K. Cole, Ltd., has returned to Ekco Works, Southend-on-Sea, and matters regarding sales, export, publicity, secretarial and accounts should be referred to that address. Telephone: Southend 49491.

A.E.I. News.—The May number of this magazine contains a report of the annual meeting of the Associated Electrical Industries, Ltd., and accounts of staff and employees' activities and news from the companies in the group.

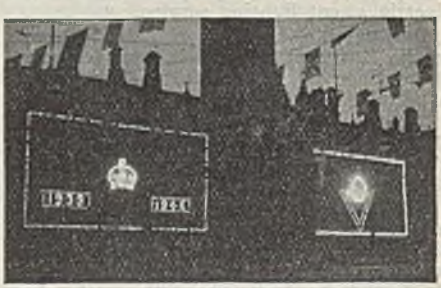
B.E.A.M.A. Contract price Adjustment Formulæ.—For the purposes of calculating variations in (a) rates of pay, the rate of pay for adult male labour at April 25 shall be deemed to be 95s.; (b) costs of material, the index figure for intermediate products last published by the Board of Trade on May 19 is 181.0 and is the figure for the month of April, 1945.

Production and Engineering.—The May issue of the bulletin of the Ministries of Labour and Production, has among its features articles on the flow packing system, coil winding under quality control, hinged form dies, the use of propane or coal gas for cutting steel and iron, release and resettlement, and simplified working drawings.

Selling Prices of Raw Mica.—In order to bring its selling prices of mica more closely into line with its current purchase costs, the Ministry of Supply has increased as from May 30, the prices at which mica is sold by its agents, Mica Distributors, Ltd., for U.K. consumption. The prices of all mica, except splittings and scrap (for grinding), have been raised by 50 per cent. on recent levels; the prices of mica splitting have been raised by 33⅓ per cent.; prices of scrap (for grinding) remain unchanged.

Bradford's "VE" Illuminations.—Last autumn the electricity department made a start on the design of some simple, but topical, illumination devices for VE-Day. Because of the necessity for conserving fuel, labour and materials, it was only possible to cover features of special interest, so the Town Hall and the department's power station, main showrooms and head offices were selected for the purpose. The Town Hall scheme, including the head of Mr. Churchill, with a big cigar, formed the major attraction. It comprised about 900 lamps, and the two wings each measured approximately 60 ft. by 30 ft. By the floodlighting of the Cathedral, Royal Infirmary and Cenotaph, some pleasing results were obtained. At the Cathedral twelve 1 000 W units, and at the Royal Infirmary fourteen such units, were employed.

B.E.S.T.E.C. Inauguration.—A reception to inaugurate the British Engineers' Small Tools and Equipment Co., Ltd., was held at Claridges Hotel, London, on May



"VE" illuminations at Bradford Town Hall

25. Mr. H. H. Harley (chairman of the company) received the guests, who included trade counsellors and representatives of trade delegations from overseas, and later gave an address of welcome. Mr. H. P. Potts (vice-chairman) outlined the aims and objects of the organisation, and said in B.E.S.T.E.C. they believed they had an instrument to secure the right selection of overseas agents and to support and supervise their efforts; a medium which would provide for its members close contact with overseas and home Government departments with overseas buyers, with current legislation affecting overseas business, import duties, exchange restrictions, and so on, and to conduct specialised market research. There would also be interchange of information among members. Mr. D. H. Lyal, Director of the Department of Overseas Trade, said they welcomed B.E.S.T.E.C. and any other combination of British manufacturers to develop trade connections all over the world. They believed that as the result of such combination there would be greater strength, greater penetration into overseas markets and consequently a much higher appreciation of what the United Kingdom could do. Overseas sales organisations should be examined for weak links. Mr. Phillip Scott, organiser of the British Export Trade Research Organisation, said they hoped to be able to co-operate with B.E.S.T.E.C. and any other organisation which had for its object the improvement and maintenance of British overseas trade.

Company News

MARSHALL SONS.—Intm. div. 3¾% (same).

AERONAUTICAL AND GENERAL INSTRUMENTS LTD.—Intm. div. 6½% (same).

CAWNPORE ELECTRIC SUPPLY CORPORATION.—Second intm. div. on ord. 3%.

GENERAL ELECTRIC CO. LTD.—Permission to deal in £2 000 000 4¼% "C" pref. stk. has been granted.

BRITISH THERMOSTAT CO. LTD.—Fin. on ord. 11% (same), mkg. 18½% (same). Net pft. to Jan. 31, £36 486 (£34 799).

LONDON ELECTRIC WIRE CO. AND SMITHS LTD.—Fin. div. on ord. 5½%, mkg. 7½% for yr. (same). Intm. 2% in respect of current yr.

CALGARY POWER (Montreal)—Net income 1944 $455 354 ($432 586). Prefd. div. $354 000 (same), surplus $495 749 ($394 395).

ALTRINCHAM ELECTRIC SUPPLY CO., LTD.—Accts. for 1944 show net pft. £25 701 (£25 450). To fin. on ord. £4 000 and defd. £4 000, fwd. £15 583.

NEWALL ENGINEERING CO. LTD.—Fin. div. on ord. 20%, mkg. 30% (intm. 5% before reorganisation and 30% after). Pft. to Mar. 31, £34 578 (£30 481).

ELECTRICAL FINANCE AND SECURITIES (assoc. with British Electric Traction).—Fin. 6% (same), and bonus 3½% (same). mkg. 13½% (same). Pft. 1944 £74 027 (£68 184). Fwd. £76 905 (£64 003).

STEWARTS AND LLOYDS, LTD.—After chargg. E.P.T. and inc.-tax, war damage, deb. int. and redemptn., net pft. for 1944, £1 989 836, £390 761 increase. Dirs.' fees take £15 000 (same), benefit fund and pensions £131 133 (£129 409) and deprecn. £624 612 (£638 609), and net credit blce. £1 219 091, £203 034 increase. Carry-fwd., £254 299.

EVER READY CO. (GT. BRITAIN), LTD.—Earngs. for yr. to Mar. 31 last show decrease of £72 631 at £747 745. Dirs.' remuneratn. takes £28 350 (£28 320), written off buildgs., plant, etc., £130 460 (£170 243). Net blce. £588 935 (£621 813). Transfer to res. £145 800 (£178 247). Staff fund receives £14 000 (same) and donatns. £2 208 (£2 036). Divs. on pref. and ord. £424 161 (same). Carry-fwd. £106 284 (£103 518).

LAURENCE SCOTT AND ELECTROMOTORS LTD.—Tradg. pft. 1944 (after E.P.T.) £139 310 (£142 362). To deprecn. £26 182 (£28 369), dirs.' fees £1 200 (same), war damage £1 896 (£3 289), lvg. net pft. £110 032 (£109 504). To pref. redemptn. res. £6 600 (£6 688), pref. div. £4 113 (£4 256) net, "A" and "B" ord. div. 12½% £25 062 (same), tax 1945-46 £56 000 (£54 000), pensions £5 000 (same), staff annuity £2 500 (same), to reserves £10 600 (£10 608), fwd. £7 029 (£6 871).

EDMUNDSONS ELECTRICITY CORPORATION LTD.—The report of the directors for the yr. ended Dec. 31, 1944, includes the following statistics: Total consumers connected at end of yr. 504 433 (496 989); units sold to domestic and commercial consumers, average per consumer, 1 000 (813); average price per unit sold, all purposes, 1.08d. (1.04d.), domestic and commercial, 1.94d. (2.12d.); average cost of coal per ton, 37s. (33s. 9d.); installed capacity of generating stations 586 000 kW (551 000 kW); mains laid at end of yr., 14 477 miles (14 155 miles). Units generated at the corporation's own power stations numbered 2 554 millions (2 361 millions), while units purchased from outside sources totalled 857 millions (675 millions). The total of the maximum loads to meet the requirements of the corporation's own consumers was 612 000 kW (567 000 kW) and the load connected to mains, 2 395 000 kW (2 233 000 kW). For the yr. ended Dec. 31, 1944, the gross rev. from the sale of current was

(Continued on page 500)

Metal Prices

		Monday, May 28. Price.	Inc.	Dec.
Copper—				
Best Selected (nom.)	per ton	£60 10 0	—	—
Electro Wirebars	,,	£62 0 0	—	—
H.C. Wires, basis	per lb.	9 7/16d.	—	—
Sheet	,,	11 1/16d.	—	—
Phosphor Bronze—				
Wire(Telephone)basis	,,	1s. 0 7/16d.		—
Brass (60/40)—				
Rod, basis	,,	—	—	—
Sheet ,,	,,	—	—	—
Wire ,,	,,	11d.	—	—
Iron and Steel—				
Pig Iron (E. Coast Hematite No. 1)	per ton	£7 13 6	—	—
Galvanised Steel Wire (Cable Armouring) basis 0.104 in.	,,	£28 5 0	—	—
Mild Steel Tape (Cable Armouring) basis 0.04 in.	,,	£20 0 0	—	—
Galvanised Steel Wire No. 8 S.W.G.	,,	£26 0 0	—	—
Lead Pig—				
English	,,	£26 10 0	—	—
Foreign or Colonial	,,	£25 0 0	—	—
Tin—				
Ingot (minimum of 99.9% purity)	,,	£303 10 0	—	—
Wire, basis	per lb.	3s. 10d.	—	—
Aluminium Ingots	per ton	£85 0 0	—	—
Spelter	,,	£25 15 0	—	—
Mercury (spot) Warehouse	per bott.	£69 15 0	—	—

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

£11 358 823 (£10 015 564), appropriation for taxation, £1 076 612 (£1 222 729), con. net pft., £758 553 (£709 895), increases in balances carried fwd. by subsids. £109 024 (£58 041); net pft., £535 151 (£541 374).

At the annual meeting to be held on June 8, the following figures for the year ended Mar. 31, 1945, will be submitted for approval:—Net pft., after providg. for taxatn., deb. and loan int. and deb. stks. redemptn., £538 065 (£545 892), amt. brot. fwd. from previous yr. £178 633 (£176 582), amt. available for appropriatn. £716 698 (£722 454). The appropriatns. made and those now recommended are: divs. on pref. stks. £118 821 (£118 821), trans. to gen. res. £20 000 (£20 000), intm. divs. on ord. stk. 2½%, £168 750 (£168 750), fin. divs. on ord. stk. 3½% £236 250 (£236 250), leavg. £172 877 (£178 633) to be carried fwd.

British Electric Traction Co., Ltd.—Fin. div. on defd. ord. 30% less tax, mkg. 45% for yr. (same). Rev. for yr. ended Mar. 31, £779 608 (£767 962). After deducting gen. exes., etc., and deb. int., and providg. £317 791 (£312 677) for inc.-tax, there remains for appropriatn. £323 737 (£316 441). Dirs. also recommend div. of 5% on 6% particg. pref., mkg. 8% (same) for yr., and 4% on 8%. prefd.

Superheater Co., Ltd.—Net pfts. for 1944, £128 031, £16 426 increase. Balce. includes £6 987 (nil) div. from subsidy. Pref. redemptn. takes £5 752 (£5 357), pref. res. £3 500 (£2 975), future taxation £72 500 (£70 500), war contingcs. £2 802 (nil), patent rights £2 500 (nil), developmt. £3 000 (nil), publicity £3 000 (nil), pref. divd. £7 624 (£7 822), intm. 12½% on ord., £8 203 (same). Fin. ord. divd. 27½%, mkg. 40%, less tax (25%, mkg. 37½%). Carrd. fwd. £18 930 (£17 828).

Commercial Information

Satisfaction

Parkinson, Polson and Co. Ltd., Eastbourne, motor engineers, and electricians.—Sat'ns. May 7, £7 500, reg. Feb. 15, £1 000, reg. Nov. 16, 1936, and £500, reg. Sept. 27, 1944.

Order on Application for Discharge

Trew, Donald A. M., 36, Binley Avenue, Binley, Coventry, lately carrying on business at 59, Primrose Hill Street, Coventry, under name of Trew Electrical Service, electrical dealer. Date of order April 16, 1945. Bankrupt's discharge granted subject to his consenting to judgment being entered against him by the Official Receiver for £75.

Applications for Discharge

Bridges, Sidney Walter, 37, Melgund Road, Highbury, N.5, and lately carry on business as British and American Radio Service Co., 10 and 11, Field Place, St. John Street, Clerkenwell, E.C.1, and 219, Pentonville Road, N.1, all London, radio and electrical dealers. Date of hearing, June 7, 1945, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Kennedy, Percy Sherbon (trading as Martin and Company), 102, High Street, Stoke Newington, London, electrical engineer. Date of hearing, June 7, 1945, 11 a.m., Bankruptcy Buildings, Carey Street, London, W.C.2.

Drury, James Denvir, 23, Strathmore Drive, Great Crosby, near Liverpool, and lately carrying on business under the style of "Mersey Electrics," and "Drury Brothers," at 64, Brasenose Road, Bootle, electrical engineer. Date of hearing, June 27, 1945, 10.30 a.m., The Court House, Hunter Street, Liverpool 3.

Notice of Dividend

Electrical Utilities Ltd., Rosedale Works, Rosedale Road, Richmond, Surrey. First dividend 4s. per £, payable June 22, 1945, at 10-11, Park Place, St. James's Street, London, S.W.1.

Coming Events

Monday, June 4.

Institution of Electronics.—Royal Society of Arts, John Street, Adelphi, London, W.C.2. Lecture, "Principles of Triode Design," J. H. Fremlin. *5.30 p.m.*

Tuesday, June 5.

I.E.E., Radio Section.—Waldorf Hotel, London, W.C.2. Informal luncheon. *12.30* for *1 p.m.*—I.E.E., N.W. Centre.—Manchester. Annual meeting. "The Place of Radiant, Dielectric and Eddy-Current Heating in the Process Heating Field," L. J. C. Connell, O. W. Humphreys and J. L. Rycroft. *6 p.m.*

I.E.E., Scottish Centre.—Glasgow. Post-War Planning Committee's report on Part-Time Education, introduced by D. B. Hoseason. *6.15 p.m.*

Wednesday, June 6.

I.E.E., Scottish Centre.—Edinburgh. Post-War Planning Committee's report on Part-Time Education, introduced by D. B. Hoseason. *6 p.m.*

Thursday, June 7.

A.M.E. and M.E., S. Wales Branch.—Control Room, Roath Power Station. Visit to power station, *3 p.m.*; annual meeting, *5 p.m.*

Saturday, June 9.

Institute of Economic Engineering.—Waldorf Hotel, London, W.C.2. Discussion, "Co-ordination in Factory Administration," opened by P. M. Garnier. *2.30 p.m.*

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, June 1, 1945.