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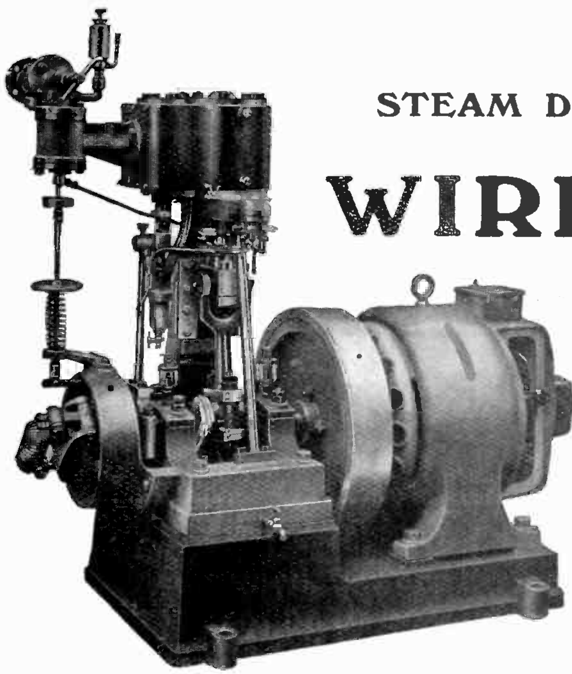

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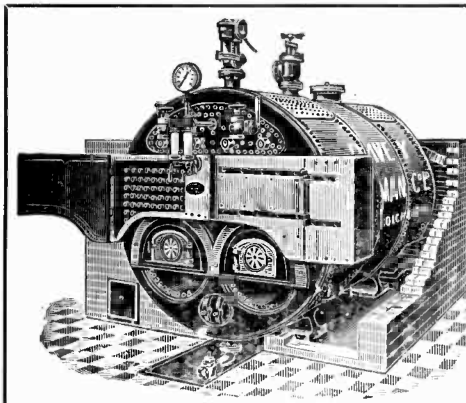

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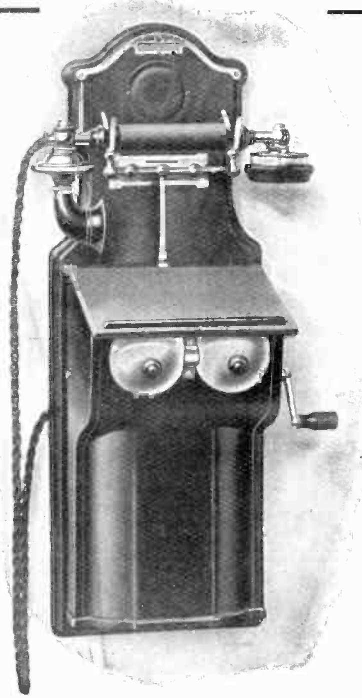

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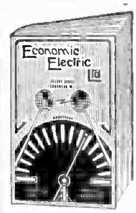

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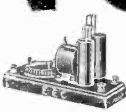

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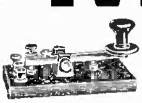

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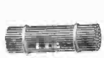

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Many of the original drawings, from which the illustrations in this and back numbers are reproduced, are for sale. Terms on application.

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MARCONIGRAM

WORLD WIDE WIRELESS

CONTINENT TO CONTINENT — SHORE TO SHIP — SHIP TO SHIP

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MARCONI WIRELESS TELEGRAPH COMPANY
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The White House,
Washington, November 15, 1916.

His Imperial Majesty the Emperor of Japan at Tokio.

The Government and people of the United States of America send greetings to your Imperial Majesty and to the people of Japan and rejoice in this triumph of science which enables the voice of America from the far West to cross the silent spaces of the world and speak to Japan in the far East hailing the dawn of a new day. May this wonderful event confirm the unbroken friendship of our two nations and give assurance of a never ending interchange of messages of good will. May the day soon come when the voice of peace, carried by these silent messengers, shall go into all the world and its words to the end of the world.

Woodrow Wilson.

Send the following message "VIA MARCONI", subject to the terms on back hereof, which are hereby agreed to.

MESSAGE OF THE EMPEROR OF JAPAN TO PRESIDENT WILSON

It affords me much pleasure that the first use of the installation of wireless telegraphy between Japan and the United States has been to transmit your cordial message. In return I send this expression of my thanks for the good wishes exhibited toward me and my people, and of the hearty desire entertained throughout Japan for the continued prosperity and welfare of the United States.

Photos: Dr. Wilson (Underwood & Underwood); Emperor of Japan (Exclusive News Agency).

Bridging the Pacific

Opening of the United States-Japan Wireless Service.

AT half past four in the morning, San Francisco time, on Wednesday, November 15th, an interchange of messages between President Wilson and the Emperor of Japan marked the opening of the new Transpacific Wireless Service, inaugurated by the Marconi Company. Whilst in Europe the greatest war in history was raging with unabated fury, here in America and Japan messages of peace and goodwill, of congratulation and hope, passed backwards and forwards across the world's greatest wireless span. After the two rulers had exchanged the messages reproduced at the head of this article the Governor of Hawaii sent salutations to the Premier of Japan and received a reply couched in the friendliest terms; the Mayors of Honolulu and Tokio exchanged courtesies; the President of the San Francisco Chamber of Commerce and Baron Shibuzawa of the Japanese Chamber of Commerce sent friendly greetings to each other; the editors of American newspapers exchanged fraternal messages with the editors of the leading newspapers in Japan; diplomats exchanged compliments; messages from Senatore Marconi and his American associates passed over the circuit and a host of congratulatory messages of all sorts poured through the connecting link at Honolulu.

But for the war, far more attention would have been paid in this country to this latest triumph of electricity and ether wave communication, for the distance between the San Francisco station and the corresponding installation at Funabashi is no less than 4,200 miles. The whole of the distance is covered with but a single relay, a high power station at Honolulu forming the connecting link. Direct communication between San Francisco and Japan has several times been accomplished and when conditions are good the relaying of messages at Honolulu will be unnecessary.

Behind the announcement that the wireless service established between the United States and Japan by the Marconi Wireless Telegraph Company of America was inaugurated on November 15th lies a story of overcoming seemingly insurmountable difficulties; of the accomplishment of engineering feats that apparently defied the most skilled efforts; of the battling with nature in remote climes and finally the resultant triumph—the forging of another link in the world-wide radio chain and the unlocking of other gates to the commercial world of the Orient.

The history of the United States—Japan service began about four years ago when the idea of encircling the world with radio stations was evolved.

The execution of the plan having been decided upon, the far-reaching machinery of the Marconi system was immediately set into motion. The American Marconi Company was called upon to build the following units: Trans-Atlantic stations at New Brunswick and Belmar on the New Jersey coast to send and receive messages to and from corresponding stations in Great Britain; sending and receiving stations respectively at Bolinas and Marshall, California, linking the Pacific coast with the Hawaiian stations, Kahuku and Koko Head; two similar stations in Manila, the Philippine Islands, and receiving and transmitting stations at Marion and Chatham, Massachusetts, to connect in Norway with Stavanger and Naerbo.

One of the first difficulties that came up in connection with the construction of the stations was that of transportation of materials. Practically all of the structural steel and machinery for the Kahuku and Koko Head stations was conveyed by steamship from New York to the Port of Mexico, across the Isthmus of Tehuantepec, and thence by boat to Honolulu, the trip occupying about five or six weeks. The cement and lumber were shipped from California.

Koko Head, which was planned originally as the receiving station in Hawaii, and will be used as the demands of the service require it, is about ten miles east of Honolulu. There were two ways to transport the material to this point; either by carting it by road, a plan which had many drawbacks because of the condition of the thoroughfare, or by transporting it by boat and unloading it on the beach. A trial of the latter plan was decided upon, and a consignment of steel was loaded on a small steamer commanded by a Hawaiian who had earned a reputation for skill in manœuvring his craft in and out of the numerous difficult landings. A barge and a launch accompanied the steamer, for the latter could not be navigated over a bar on the route to Koko Head, and it was planned to unload the material on the barge and have the latter towed ashore by the small steam-propelled boat. All went well until the launch with the barge in tow tried to shoot through the breakers. The first line of rollers was passed in safety, but a short distance farther on two large combers submerged the barge and it sank. Thus ended the attempt to effect transportation by the sea.

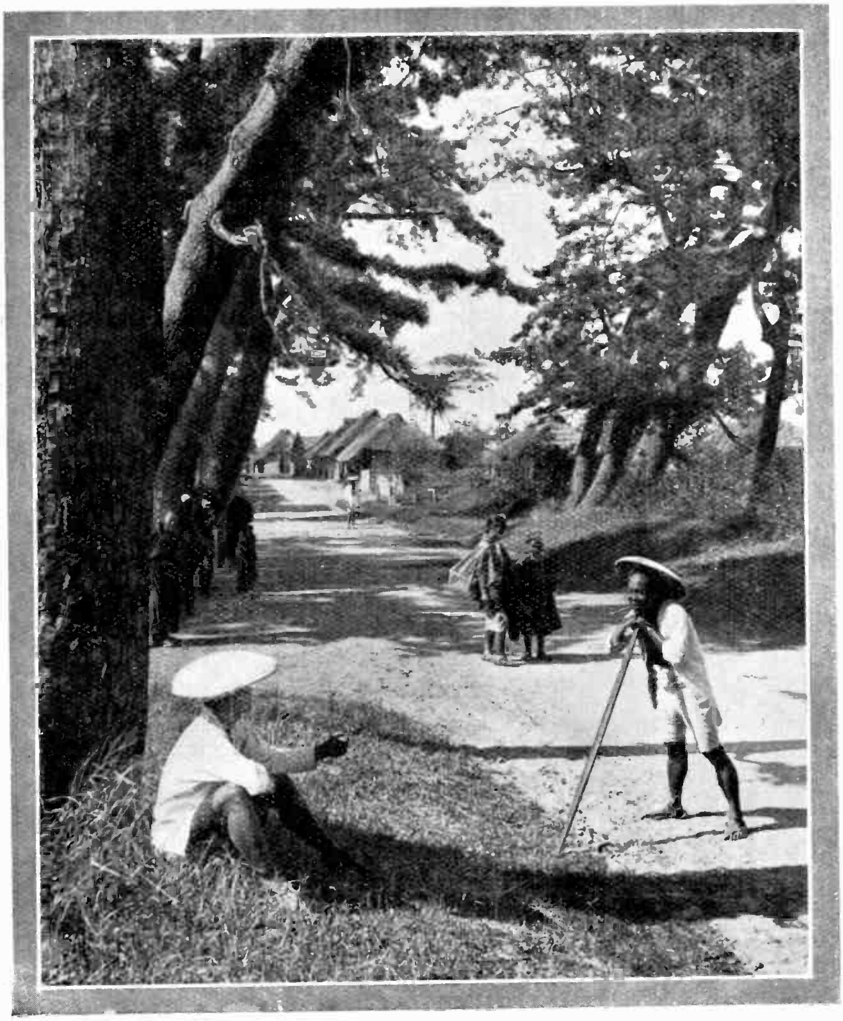


Photo: Underwood & Underwood.

ON THE TOKIO ROAD, NEAR THE FUNABASHI STATION.

Meanwhile the experiment of conveying the material by road was being tried. The caravan, laden until the wheels of the wagons creaked and groaned, started from Honolulu soon after midnight and ran into a tropical rainfall, after it had proceeded only a few miles. The road, which was built of red clay mud, softened and became so slippery that the wagons could not be driven in a straight line, the rear wheels slipping off to one side wherever the surface of the thoroughfare sloped. As a result, material fell from the vehicles, parts of harness broke, wheels were put out of commission, and it was finally necessary to shift most of the loads, double up on the teams and bring the material piecemeal to the site of the station. Notwithstanding this discouraging experiment, the trucking was continued by means of the road route, although the horse-drawn vehicles were discarded and automobiles substituted.

Koko Head, located on the Island of Oahu, the third in size of the Hawaiian group, is known as the dryest point on the island. The land is undeveloped and is used only for cattle grazing, even the latter getting little nourishment from the scanty surface growths. In fact they frequently perish because of the lack of fresh water. The inadequate water supply threatened to cause considerable hardship among the engineers and station builders. It was found easy to obtain well water, but it ran about forty grains of salt to the gallon, which destroyed its value for drinking purposes, and after scouring the hills in search of a supply it was decided to distill all water.

From the operating house as a centre, the San Francisco aerial extends south-westward, carried on five 330-foot masts to an anchorage. The Japan aerial extends from the operating house almost due east. The first two masts are of the standard sectional type, 430 feet in height, the first being on level ground and the second on a hillside. From the latter point the aerial makes a span of more than 2,000 feet to the top edge of Koko Head, an extinct volcano at an elevation of 1,194 feet above the sea level; here there was not room enough to erect a sectional mast, only about forty square feet being available for a self-supporting structural tower, 150 feet in height. The tail end anchorage is far down on the inside of the crater. The balancing aerial, which is employed in both sets of antennæ, is on self-supporting towers, each of which is 100 feet in height. The difficulty in erecting these masts was largely due to the fact that two of them and the anchorage were located in a pond and it was necessary to sink caissons in order to lay the foundations.

The problems of construction at Kahuku, which is now being employed both as a sending and receiving station, were not as great as those at Koko Head, although the former is the largest wireless station in the world. From the power house the San Francisco transmitting aerial extends southwestward, supported by twelve masts, each of which is, 325 feet in height; the Japanese aerial extends to the south-east supported by twelve masts, each being 475 feet in height. The subsoil at the station is made up of porous coral rock, and consequently considerable difficulty was experienced in putting down foundations for the power house and masts. In all of the excavations for the mast anchorage foundations were built in the form of water-tight wooden cribs into which concrete was poured. Different sections of the site required different treatment, but generally the trouble was due to the presence of water in the subsoil, a factor, however, which added to the facility of operating the station.

THE STATION AT BOLINAS, CALIFORNIA, FROM WHICH THE MESSAGES ARE FLASHED TO HONOLULU AND JAPAN.

The task of constructing the Bolinas station involved taking into consideration the fact that most of the material for erection purposes—the mast sections and wire rope for the eight masts, each 325 feet in height, and the steel work and machinery—was manufactured in the Eastern part of the United States, and in order to transport it to Bolinas, which is about fifteen miles from San Francisco, it was sent from New York by boat to the Isthmus of Panama, across the Isthmus by rail and thence by water again to San Francisco. As there was no railroad transportation available from the latter city to Bolinas, it was necessary to ship a considerable part of the material by water route from San Francisco, unload it at the wharf at Bolinas Bay and haul it by motor trucks to the site of the station. A sand bar with a shallow opening through which the tide races obstructs Bolinas Bay, making it impossible for craft of considerable size to reach the wharf except during high tide. In addition to these handicaps there was the necessity for rushing the work in order to make all the progress possible during the season of comparatively few storms.

As was the case at Koko Head, much difficulty was met with in obtaining a water supply. This was due to the fact that the ground is full of cracks caused by earthquakes and that the salt water from the Pacific seeped in. The solution of this vexed question was found, however, by damming a creek and installing a small pumping plant and a tank.

At Marshall, the receiving station, twelve miles north of Bolinas on Tomales

Bay, there were perhaps fewer obstacles to be overcome than at the other stations.

The automatic sending and receiving apparatus plays an important part in wireless communication between the Occident and the Orient. The sending machine somewhat resembles a typewriter and will make possible the transmission of more than 100 words a minute. Under the automatic system, 10 or 100 messages can be filed at the same time at the office of the Marconi Company in Honolulu. They will be distributed among the necessary number of operators and the dots and dashes punched in a paper tape by a machine. This tape is fed into an automatic sender and the signals conveyed by land line to Kahuku where the dots and dashes actuate a high-power sending key, automatically energising the aerial instantaneously with the feeding of the tape in the station, thirty miles or more away. At the transmitting station the dots and dashes operate magnets of the high-power sending key in the main energy circuits and the signals are flashed to the points which the destination of the message calls for, either Marshall or Funabashi. If the message is destined for Marshall it will be received on a specially constructed dictaphone machine, each cylinder, as soon as it is filled with the dots and dashes, being handed to an operator who will transcribe it into a typewritten message by means of a dictaphone machine running at normal speed.

Such were the difficulties, the achievements and a few of the problems met with. After the stations had been completed there was a long period of tests and trials. The first results of these were marked by the opening of the service between Hawaii

Photo: Exclusive News Agency.

A SCENE ON THE CANAL AT TOKIO.

and the United States on September 24th, 1914. On February 2nd, 1915, the station in Ochiishi, Japan, it was announced by newspapers of that country, had received messages from the Kahuku station. Prior to picking up the signals of the Kahuku station Ochiishi was receiving messages from a steamship 1,100 miles off the Japanese coast. The Ochiishi operators declared that messages from Hawaii were clearer than those from the steamship, notwithstanding the fact that the distance was more than three times as great. This was only one indication of the great range of the Kahuku station, for while tests were being carried on with the station in Funabashi, near Tokio, Japan, which was selected as the Japanese unit to communicate with the Hawaiian stations, inquiries regarding the spark and wave-length of Kahuku were received from Porto Rico, the Falkland Islands, New Orleans and New Zealand, where the signals transmitted by Kahuku were easily read.

At ten o'clock in the morning, New York time, and midnight, Tokio time, of the day appointed for the opening of the service, the cumulative result of the three years of study and effort which Edward J. Nally, Vice-President and General Manager of the American Marconi Company, and the members of his staff had devoted to the task of establishing communication with Japan was signalised by an exchange of messages between notables in the United States and the former nation. As an illustration of the operation of the service, it can be stated that a message from President Wilson to the Emperor of Japan, at Tokio, began its radio flight at the Bolinas station, from which, with the speed of a lightning flash, it took an unerring course across the Pacific and was received at the Kahuku station, spanning a distance of 2,087 miles. Quickly it was copied at Kahuku, given a new impetus, and sent speeding across the space of 4,140 miles that it had to traverse before reaching Tokio. In a similar manner the reply of the Emperor was dispatched to President Wilson. The message was transmitted from Funabashi and relayed at Kahuku to Marshall, which station has direct communication with the Western Union Telegraph Company, over whose wires traffic is forwarded. In Japan connection is made with the Japanese Imperial Telegraph system to all points in the Orient.

All of the communications between the United States and the Hawaiian and Japanese stations are transmitted in English or French. The Funabashi station is controlled by the Japanese Government and has two staffs of operators, military and civil, being employed by the Department of Posts and Telegraphs for commercial business, as well as by the Government.

There will be two classes of service between San Francisco and Japan, a full-rate or expedited service at eighty cents per word, a reduction of forty-one cents per word from the existing cable rates, and a deferred half-rate service at forty cents per word, the lowest cable rate at present being $1.21 per word.

This linking of two nations by wireless is simple in the telling, and in time will doubtless be accepted as a part of the scheme of general conditions in communication. But the men who brought it about, who spent days and nights in determining the solutions of vexed questions, who conducted tests regardless of time and weather, who journeyed to distant parts of the world to blaze the initial path of the project—they will long remember the romance and the difficulties of the undertaking, even though it was all a part of the day's work.

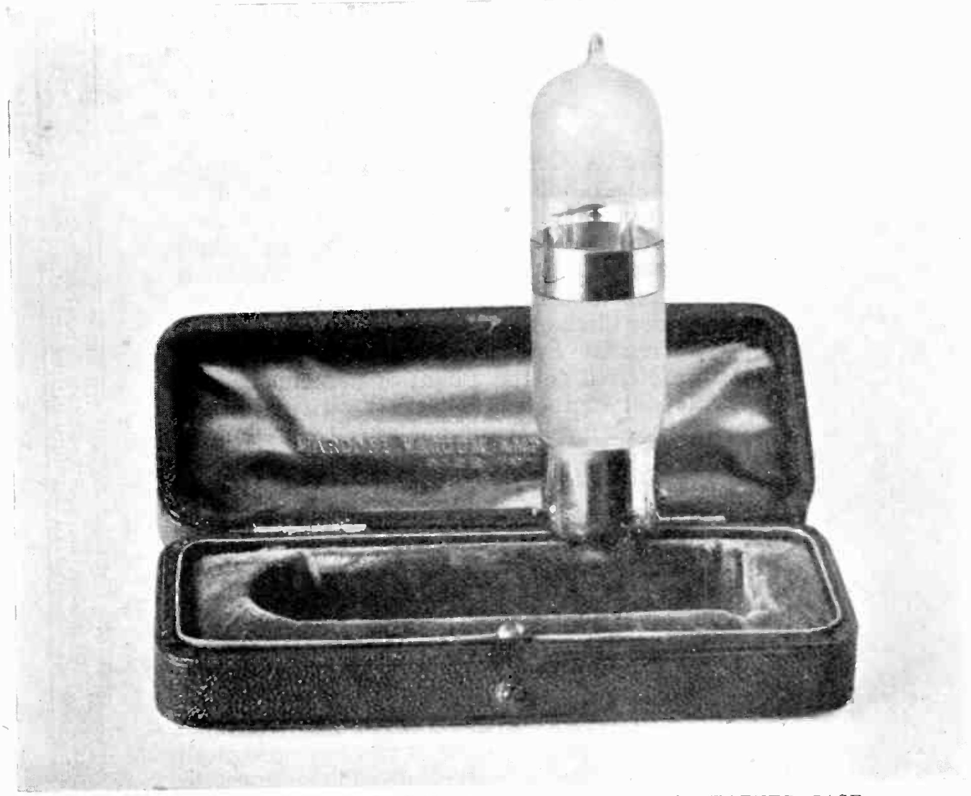
PERSONALITIES IN THE WIRELESS WORLD

MR. TSIANG TSENG-YI

THE Director General of the Chinese Telegraph Administration, Mr. Tsiang Tseng-Yi, is a native of the Haining District of the Chekiang Province. In 1904 he acquired the third degree of Literature at the Metropolitan Examination in Peking and was appointed as Junior Clerk of the Board of Revenues. Soon afterwards by special recommendation he transferred to the Board of Communications for the purpose of dealing with telegraph matters. The Chinese Telegraphs were then administered partly by a commercial company and partly by the Provincial Viceroys and Governors. Mr. Tsiang proposed that all the commercially and provincially owned telegraph lines should be nationalised and placed under the direct control of the Board of Communications. This proposal was soon put into operation, and by 1910 the work was completed. This nationalisation of the system met with strong opposition, but Mr. Tsiang made every endeavour to overcome the difficulties in carrying out the scheme.

Since 1910 the Chinese Government has been able to extend the telephone and wireless telegraph services, devoting a part of the telegraph revenues to this purpose. In 1911 Mr. Tsiang, in the capacity of the Commissioner of Telegraphs of the Board of Communications, caused two powerful radio stations to be established, one in Peking and the other at Nanking. Not long after these had been completed the Revolution broke out, a great deal of traffic regarding military matters being exchanged by these two stations, whereupon the importance of radiotelegraphy was realised by the Chinese people, who formerly had scarcely any idea of its possibilities. Since then the wireless service has been greatly improved and extended to such localities as Shanghai, Woosung, Foochow and Canton along the coasts, and Kalgan and Wuchang in the interior.

Mr. Tsiang has been over ten years in the telegraph service, holding the important positions of Commissioner of Telegraphs of the Yuchuanpu (1910–1911); Chief of the Financial Department of Telegraphs, Posts and Navigation (1913–1916), and Chief of the Telegraph Department and Director General of Telegraphs of the Ministry of Communications (1916 onwards). He is also Chairman of the Chinese Society of Electrical Science.



THE MARCONI VACUUM AMPERE GAUGE WITH ITS LEATHER CASE.

An Ingenious New Instrument

The Marconi Vacuum Ampere Gauge

WE are able to publish this month a description and photographs of a new instrument, of highly ingenious and interesting construction, which will prove to be of great value, not only in wireless telegraphy, but in all cases where an accurate means of measuring the electric current is required. The invention in question is the vacuum ampere gauge.

The demand for a small, sensitive, robust instrument suitable for use equally on alternating and continuous current circuits is not new, and inventors have made many attempts to satisfy it. It has remained, however, for the Marconi Company to produce just what is required, and a great demand for the new gauge is anticipated.

The instrument is designed primarily as a maximum current gauge to indicate the condition of syntony in wireless circuits, and may be employed as a substitute for a thermo-junction and galvanometer combination in the measurement of wave-lengths and decrement. The principle involved is that of the bifilar suspension, one pair of the filament ends being fixed, and the other pair attached to a pivoted arm, the rotation of which is controlled by a spring acting against the tension of the filaments. When a current passes through the filaments, heating them and causing them to elongate, the arm takes up a new position and the angular displacement as indicated on the scale is a measurement of the current.

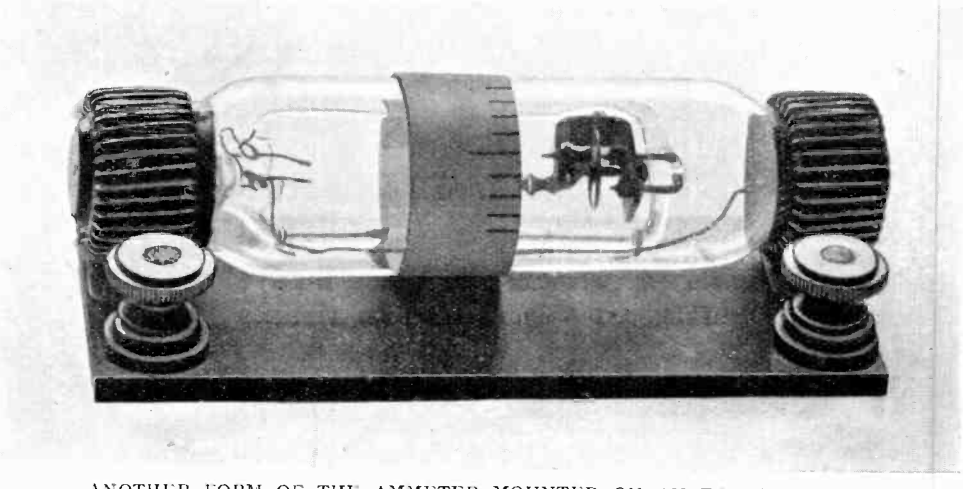
The movement is enclosed in a glass bulb exhausted of air. The sensitiveness is thus greatly increased, and the movement protected against damage and preserved from dust or corrosion.

The drawing on page 824 shows quite clearly the construction of the little instrument, which is made up in such a way as to resemble an electric lamp. In one form the bulb is attached to a brass cap with projecting pins identical with that used on standard lamp bulbs in this country, and the size of the instrument can be gauged by noticing this feature in the drawing. The screw type of lamp cap can also be supplied for use in countries where this type is standard. Other forms are capped at both ends, as shown in the photograph on this page.

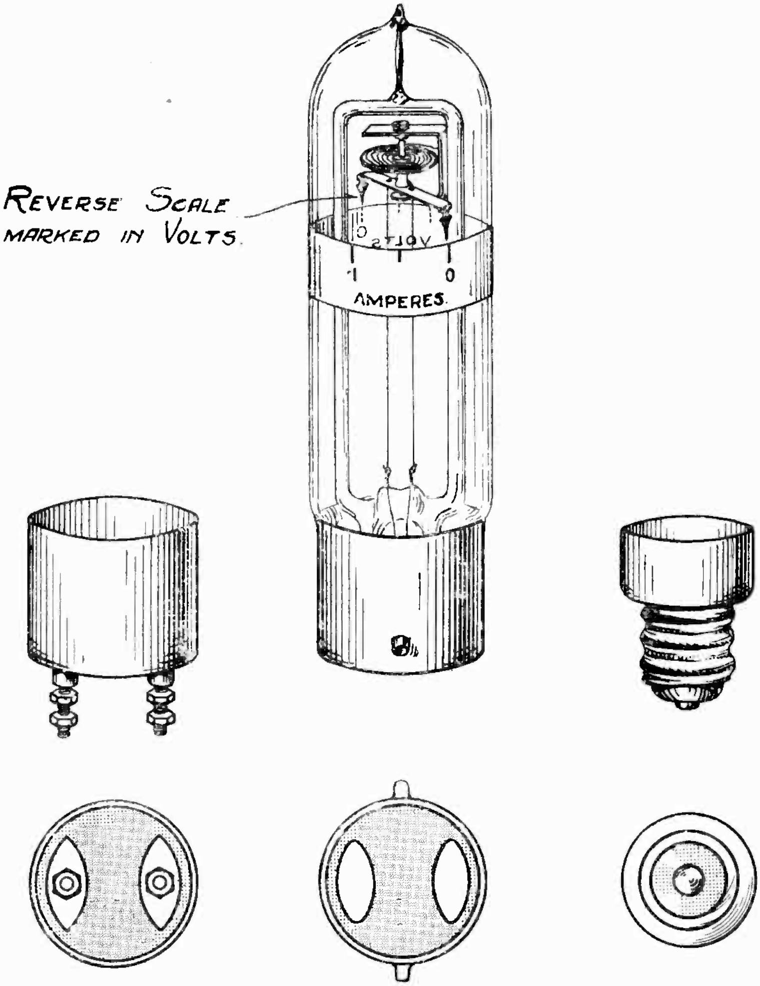
The variation in zero which is characteristic of hot wire instruments in general is negligible in this type of instrument, and the natural damping renders the movement especially dead-beat.

The instrument, suitably calibrated, may also be used as a low reading voltmeter or ammeter, or as a shunted ammeter. The normal resistance of the commercial type of vacuum instrument is approximately 12 ohms. The following readings give an idea of the general characteristics of high, and normal, resistance instruments :—

No. of Inst.	Res. Cold.	Full Scale.			Half Scale.			Smallest Measurable.			Overload Test.
	Ohms.	Amps.	Volts.	Watts.	Amps.	Volts.	Watts.	Amps.	Volts.	Watts.	Amps.
6	12·4	0·11	1·44	0·158	0·065	0·77	0·05	0·02	0·22	0·0044	0·125
7	30·2	0·035	1·25	0·043	0·025	0·77	0·0192	0·007	0·17	0·0012	0·06



ANOTHER FORM OF THE AMMETER MOUNTED ON AN EBONITE BASE.



FULL SIZE

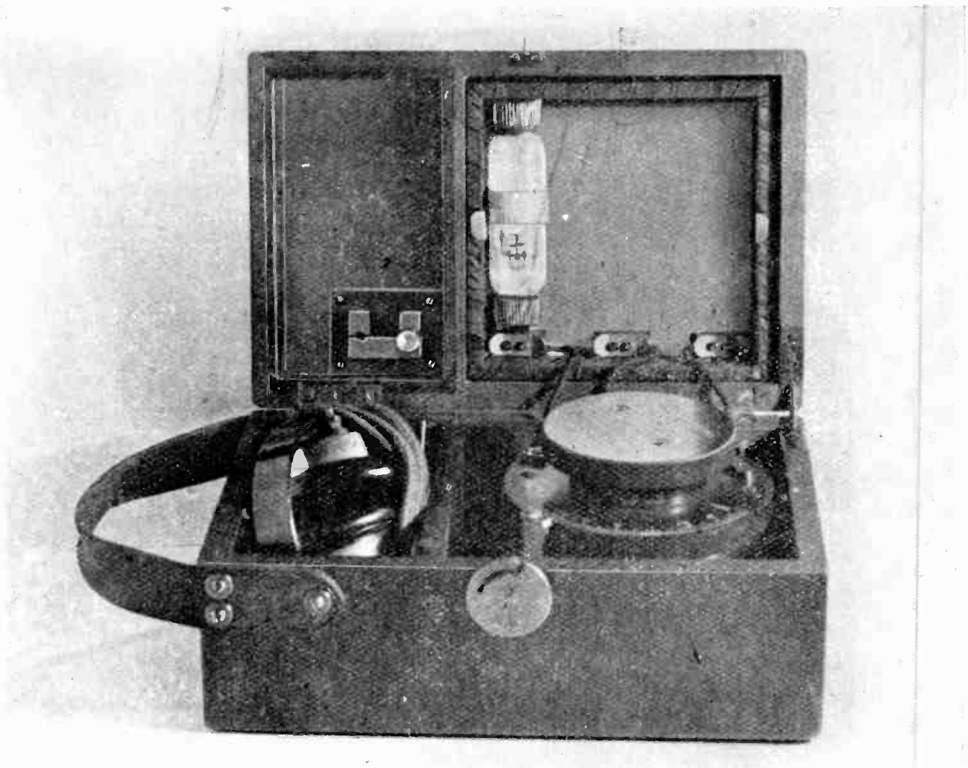
DIAGRAM SHOWING CONSTRUCTION OF THE NEW AMMETER, AND VARIOUS TERMINAL FITTINGS

The new instrument has been greatly admired for its neat appearance, which can be well judged from the photograph on page 822 showing one of the gauges standing upright in its silk-lined case.

Enclosing the working parts in a vacuum has enabled the Marconi Company to place on the market an instrument which should prove of great general utility on account of the fact that, at a reasonable cost, it is possible to provide the means of measuring direct and alternating currents of the order of ·01 amp., without sacrificing any robustness of construction. The small size makes it a matter of no particular difficulty to insert the instrument in a circuit where no previous provision has been made for a measuring instrument. For example, as a maximum current indicator for a wavemeter, the gauge can be inserted without appreciably altering the accuracy of the calibration, as the added inductance and capacity is negligible compared with the inductance and the capacity of the wavemeter itself.

The photograph below shows clearly how conveniently the gauge can be fitted to a wavemeter, the tube in this case being of the same type as that shown on page 823.

With a wavemeter using the new vacuum gauge the wave-length of the primary circuit of a 1½-kw. set can quite easily be read when the wavemeter is held with the plane of its inductance coils parallel to that of the primary of the oscillation



THE MARCONI VACUUM AMPERE GAUGE MOUNTED IN A WAVE-METER.

400-AMPERE TYPE MARCONI AMPERE GAUGE.

transformer at a distance of two to three feet. The noise of the spark, which often hinders the reading of a wavemeter by means of a crystal and telephones, in the case of the vacuum gauge gives no trouble, as the variable condenser has simply to be rotated until the pointer of the gauge gives the maximum reading. In this way circuits can be tuned rapidly as well as accurately.

In addition to the type of instrument already described, a range of ammeters has been designed for all capacities between 50 and 500 amperes. These instruments, while following the general design of the smaller gauges already described, differ from them considerably in detail. In the large meters the suspension filaments carry no current. The principal characteristics of this type are :—

Robust construction.

Accuracy.

Open scale at mid-position of pointer.

Zero error practically nil.

Watt loss about a third of that usually in commercial instruments of the same capacity.

Movement absolutely dead-beat.

A type of vacuum instrument for direct insertion in the aerial circuit is being developed, and we hope to publish a description in due course.

On this page we show a photograph of one of the large 400-ampere instruments, together with the smallest of the range. The photograph on the next page shows the cover removed and gives some indication of the general construction.

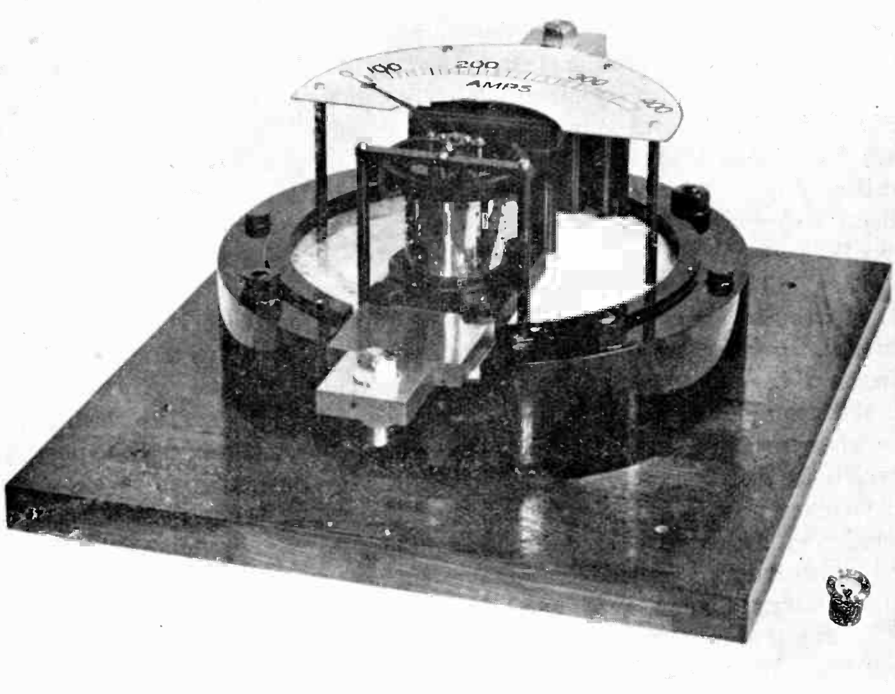
Readers who are acquainted with practical wireless work will realise that the two types of instruments described above are likely to prove of the greatest service, not only in radiotelegraphy, but in all practical application of electricity.

Some Wireless Speed Records

ALTHOUGH the service of the Marconi Wireless Telegraph Company of America between the United States and Japan was inaugurated only a short time ago, several speed records in sending and receiving messages have already been made by operators in the transpacific stations.

Operator "Paddy" Walsh, of Honolulu, recently sent to the Marconi receiving station in California, a distance of 2,372 miles, sixty-seven messages in one hour and twenty minutes. None of the messages was shorter than fifteen words, and some of them contained forty words. W. H. Barsby, operator at the receiving station, copied the messages without a break or an error.

Operators in the Marconi office in the heart of the business section of Honolulu are now, with the aid of repeaters, transmitting direct to both the United States and Japan. Automatic transmission and reception of messages at a speed of from 80 to 100 words a minute will be brought into use in the near future. Duplex transmission equipment has been provided, the tests made, and, when conditions warrant the step, transmission at that speed in two directions simultaneously will be employed.



400-AMPERE TYPE WITH COVER REMOVED.

(See opposite page.)

Digest of Wireless Literature

The Heaviside Layer.

In an interesting and informative paper contributed to the Proceedings of the Institute of Radio Engineers, Professor E. W. Marchant of the University of Liverpool dealt with the Heaviside Layer, and discussed to what extent this layer can explain the phenomena described by Mr. Fuller in a paper previously read before the American Institute of Electrical Engineers. It is within the knowledge of all radio operators, said Professor Marchant, that signals vary widely in strength, often in the course of a few minutes; and such variations can most easily be explained by reflection and refraction from moving masses of "cloud" or ionic fog. The surface wave theory developed by Sommerfield, while explaining transmission over long distances, round the curvature of the earth, does not explain these sudden changes. The fact that these changes occur more by night than by day provides further evidence that the reflection and refraction theory of which Dr. Eccles has been, in this country, the chief exponent, is the most likely one to explain observed phenomena.

The experiments described by Balsillie in which he found that dust storms occurring along the line of transmission affect signal strength, when the transmission is in the direction in which the wind is blowing, are of interest, as they indicate that the atmosphere immediately adjacent to the earth is a factor in the absorption of waves. The chief phenomena, however, which require further explanation are (*a*) the sudden variations in signal strength at night and (*b*) that comparatively small changes in wave-length may make relatively enormous changes in the strength of received signals. The experiments recently described by Mr. Fuller have added much exact information to that already available for the discussion of this subject, and it may be useful, therefore, to consider them in their bearing on the existence and probable nature of what in this country is generally called the "Heaviside Layer."

Though it is usually called by this name, Professor Fleming observed recently that it was Sir James Dewar who was one of the first to draw attention to its existence. In a lecture to the Royal Institution in 1902, when discussing the constitution of the atmosphere, Dewar pointed out that there were really two parts to it: the lower part in which atmospheric currents circulated, and in which the constituents were similar to those of the atmosphere at lower levels, and the upper part in which the distribution of gases was governed by their density. In two lectures delivered recently to the Royal Institution Professor Fleming has discussed the formation of this upper ionized layer and the causes which produce it. He points out that, in order to produce ionization in such a gas as oxygen by light radiation, it is necessary to have a wave length of the order of 1,500 to 1,800 angstrom units (10^{-7} mm.) that is, light which is far beyond the ultra violet end of the spectrum. If such light really produces any ionization, then it is to be expected that the ionization would be reduced at night, and therefore that signals might be expected to vary in strength at night if these ionized gases are the causes of signal variation. Professor Fleming suggests, however, that at heights of the order of 60 miles (100 km.), where the ordinary constituents of the atmosphere disappear and are replaced by hydrogen and helium and possibly other lighter gases, the most likely agency in producing ionization is the solar dust projected from the sun and transmitted to the earth through the agency of the pressure of light. This explanation of the production of an upper ionized layer of gas is verified by the fact that the time interval elapsing between the passage of a sun spot across the solar meridian and the corresponding magnetic storm as shown by Arrhenius is about 45 hours, a figure which agrees fairly closely with the time Professor Fleming calculates that a particle of 1,200 angstrom units diameter would take to pass from the sun to the earth. Whatever the cause which produces this layer, there is little doubt that such a layer exists, not necessarily in the form of a shell concentric with the earth, with fairly flat surfaces, but more likely in the form of large masses of gases in the upper regions of the atmosphere which act as reflectors and refractors for the waves that are used for the transmission of radio signals.

Other facts bearing on the presence of this layer have been dealt with by Dr. Eccles in a paper published by the Royal Society. It will not be necessary to reproduce the argument he uses to prove its existence; that may be assumed. It is the object of this paper to discuss to what extent the Heaviside Layer can explain the phenomena described by Mr. Fuller.

Dr. Marchant then went on to discuss the relation of Heaviside Layer to the phenomena described by Mr. Fuller.

* * * * * *

THE STUDY OF PURE SCIENCE.

In an illuminating address on Science and Industry, with Special Reference to the Work of the National Physical Laboratory, delivered to the Birmingham and Midland Institute, Dr. R. T. Glazebrook, the Director of the National Physical Laboratory, laid special emphasis upon the importance of research work in pure science. "Let us note then, in the first place," said Dr. Glazebrook, "we must have "scientific knowledge. That point I need not labour, but note also that to be "successful that knowledge must be pursued for its own sake. Each of the modern "practical applications of science had its foundations in purely scientific work, and "to quote Professor Gregory in his recent book discovery or the spirit and service "of science was not the result of deliberate intention to make something of service "to humanity. It is hardly necessary to illustrate this; let me, however, give one "classical example. The discovery of the laws of electromagnetic induction is due "to Faraday, and is described in his first three series of 'Experimental Researches,' "published in 1831–33. Oersted, Ampère and Arago had investigated some of the "phenomena connected with the magnetic force produced by an electric current, "and to Faraday it appeared clear that conversely it should be possible to produce "electricity from magnetism, as he put it. It is difficult to picture the world to-day "without electric power, and yet the whole development of electrical machinery, "as we know it, rests on the laws described in these brief scientific papers. Each "advance of knowledge brings its benefits to mankind, and in a general way Faraday "may have hoped to be a benefactor to his race by widening the sphere of knowledge, "but it was the desire to know the truth which led him on and to which we owe such "tremendous consequences.

"We must have the student of pure research, the genius who goes on his way "discovering new truths, irrespective of consequences, laying bare more and more of "nature's secrets and unravelling her mysteries.

"In England we have never lacked such men, our roll of great discoverers has "been a glorious one. Too frequently their lives have been hard and difficult, "prophets without honour they have lived; to-night it is not my task to speak of "them beyond urging the importance of giving every encouragement to such men by "supporting in the most generous spirit any among you here in your University or "elsewhere who are advancing the bounds of knowledge, searching for truth in some "of its difficult byways. The endowment of pure science is essential; without it "the attempt to apply science to industry fails."

* * * * * *

WIRELESS IN TRANSMISSION NETWORKS.

Communication between generating plants and sub-stations constituting a power distribution system is an essential for satisfactory operation. Moreover, the communication apparatus must give immediate and reliable service. Line telephones have been largely used for this purpose, and, when proper precautions against inductive interference are taken, give good results so long as the telephone wires remain in position. When the wires come down, however, the system becomes helpless, station engineers consequently grow nervous whenever winds are high or sleet storms appear. Several progressive power transmission men are now applying the radio systems to their own peculiar problems with notable success. Since the only structures which can be affected by storms are at the operating stations themselves, maintenance labour is localised and possible interruptions may be speedily ended. In installing wireless for emergency or regular service it must be borne in mind that first cost is a relatively unimportant item. The purpose of the service is to furnish insurance; consequently, if it is to be effective, the plants must be so chosen that they can supply uniformly satisfactory communication at all times. It will not do to "save" by installing inferior apparatus or stations too small to signal reliably over the required distances. Radiotelegraphy is finding new commercial uses almost daily, and the indications are that in its application to power station communication both the wireless and the transmission engineers will make material gains.—*Electrical World*.

* * * * * *

CABLE VERSUS WIRELESS.

Our contemporary, the *Telegraph and Telephone Age*, has been asked if in their opinion the wireless will ever supersede the cable. Dealing with the matter, the editor quotes a cable authority as stating: "The wireless will never supplant the "submarine cable as many people think." It must be borne in mind, says our contemporary, that the cable is a service connecting two points. The wireless is a universal service. It can reach the remotest points on the earth. The service that the wireless is doing for humanity alone, irrespective of its value in handling commercial business, is beyond estimate. The wireless reaches places where cable service is impossible. In some cases wireless has taken the place of the cable, Nassau, Bahamas, being an instance, the cable connecting that island being abandoned in favour of the wireless.

A wireless authority says :

" Several important technical problems in connection with long distance wireless " telegraphy still await solution, but the development of the art during the past few " years makes it altogether conservative to state that these problems are fast being " solved and that the most serious obstruction to perfect long distance wireless " communication, *i.e.*, ' Static,' will most probably be removed in the quite immediate " future.

" I think the answer to the question, therefore, is most positively in the affirma- " tive. To my mind the wireless will eventually supersede the cable because it is " natural and logical that it should do so. The only function that a cable performs " is to conduct electrical energy. When a natural medium exists for doing the " same thing, *i.e.*, conduct electrical energy, is it not superfluous to provide an " artificial means for doing the same thing, namely, laying a cable ?

" If nature provided a good road between New York and San Francisco, and we " wished to travel over this road, the only cause there could be for building another " road on the top of it in the form of an elevated structure would be when the natural " road was unable to handle all of the traffic. In transocean communication the " same will be true of the ether and cable roads.

" Moreover, with the advance of science, I am convinced that we shall eventually " be able to communicate across the Atlantic or across the Pacific with the use of " moderate power. By moderate I mean twenty-five to fifty kilowatts in the " antenna. When this is accomplished the cost of long distance wireless stations " will be insignificant as compared with the cost of laying the cables."

Indispensability

THE fact that wireless apparatus ought to form as essential a feature of sea-going vessels as life-boats, or any other part of their regular equipment, is being rapidly recognised in all quarters.

A short while ago, at an inquest held on Mr. Wm. Donaldson, the master of a merchant vessel, which was sunk with the loss of 17 hands, the jury requested the coroner to write to the authorities suggesting the advisability of installing wireless on all ocean-going vessels with the least possible delay. Towards the close of last year His Majesty's Government issued a proclamation in the *London Gazette*, announcing immediate steps for the compulsory fitting of radio apparatus on vessels of 3,000 tons and over ; the French Government almost immediately followed suit, whilst a recent regulation was issued by the Italian Government insisting on the fitting of wireless on all vessels carrying 50 or more persons on board.

The recommendation of the coroner's jury above referred to appears to indicate that wireless indispensability is being brought home to private citizens ; whilst the legislation enacted by one Government after another to enforce universal radio installation on sea-going vessels seems to show that official authorities have been as effectually impressed.

Wireless in Polar Exploration

THE interesting photograph, which we reproduce on the opposite page, shows Sir Ernest Shackleton's famous ship, the *Endurance,* in the process of sinking beneath the ice. The main and mizzen masts are smashed off at the level of the deck. The foremast is broken at the cross-trees and one mast with the sail still lashed on stands upright in the centre of the view. The hull has passed out of sight, and dogs and men can only watch the inevitable further stages of the ship's destruction. It should be explained that first the vessel was crushed by colliding pressures and then sank for a certain distance between the ice floes. Next, the floes coming together again, sheared off the masts and top deck and thrust the ship below the ice into the waters of the Weddell Sea.

How the vessel appeared before she met with disaster can be excellently judged from the photograph we reproduce on page 380 of our issue for September, 1915. In that issue will also be found some notes regarding the wireless installation and the arrangements which had been made to utilise it.

An Erroneous Report

EARLY in December last a telegram from Rome was published in a number of newspapers to the effect that Countess Helena Gleichen, of London, and Miss Nina Hollings, directresses of the British Wireless Telegraph Section, had been awarded the bronze medal. The announcement was couched in the following identical terms as regards both ladies :—" The Lady Directress of the British Wireless Telegraph " Section gave her useful and valuable work for wounded Italians on the Isonzo " front, hastening wherever she was summoned, even through zones bombarded by " artillery. On several occasions she was the object of enemy fire and showed " courage, intrepidity and contempt of peril, always fulfilling her part with zeal, " self-sacrifice and a deep feeling of philanthropy."

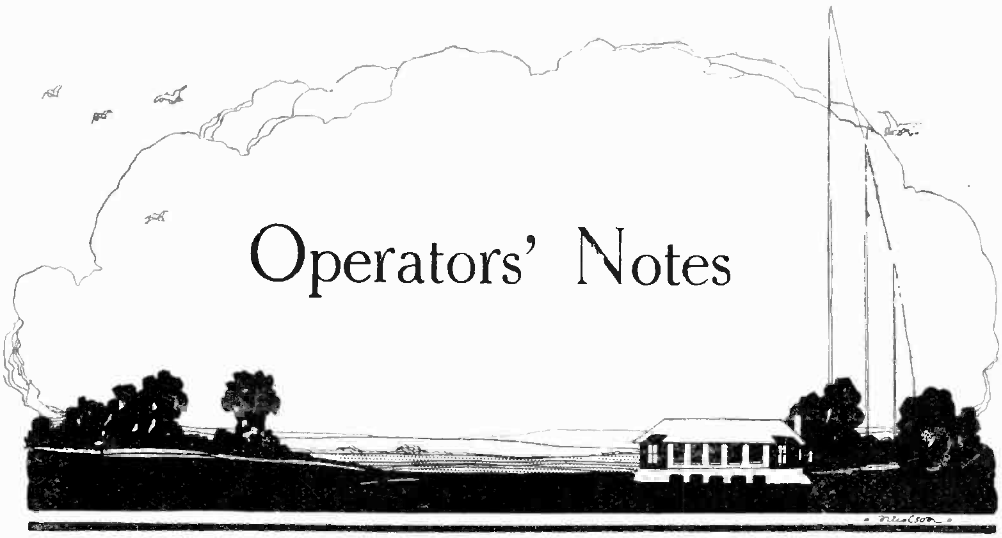
THE WIRELESS WORLD immediately caused enquiries to be made at the Italian War Office, and the following reply has now been received :—

" We beg to inform you that Countess Helena Gleichen and Mrs. Hollings are " members of the *Radiologic* section of the British Red Cross in our Army. Said " Radiologic section, which was a present of Countess Gleichen herself, is constituted " of an ambulance with Radiologic apparatus and of several automobiles for the " transportation of the staff, and is exclusively a unit of sanitary character. We " believe that the news reported by the English press has been taken from Bulletin " of Rewards No. 106 where has been printed in error that the two above-mentioned " ladies to whom has been awarded the Bronze Medal were Directresses of the " British Wireless Telegraph Section."

Although the two ladies in question have nothing to do with wireless telegraphy, they are doing a magnificent work, and we are sure our readers will be glad to hear of the Italian Government's award.

THE S.S. "ENDURANCE" SINKING IN THE ICE.

Photographed by Frank Hurley.



Operators' Notes

Some Notes on the Maintenance of Accumulators (II.)

By WILLIAM PLATT.

THE auxiliary resistance previously mentioned is connected in circuit by means of a two-way two-pole tumbler switch. When the switch is in charging position the resistance is connected in parallel with the lamps on marine switchboard. With the switch in discharge position the resistance is connected in series or directly across the accumulators, therefore when discharging cells through this resistance the rate of discharge is from 8 to 9 amperes.

DEVELOPMENT OF ACCUMULATORS.

The first accumulator was invented about the year 1801, but it was not until 1860 that Planté produced a practical cell. This was of remarkable efficiency compared with those produced by other experimenters who had endeavoured to develop a means of storing electrical energy. Planté's process consists of taking two lead plates, coiled closely round each other, but not touching at any point, and placing them in a solution composed of sulphuric acid and water. The outer ends of the plates are connected to a source of electrical supply and the cell then charged and discharged. A second charge is now given, but in the opposite direction, the cycle of charges being continued until the plates become possessed of a high degree of porosity. This process is spoken of as forming.

When the forming process is ended and the plates discharged there is a layer of active material on each plate. This active material can be regarded as $PbSO_4$, or lead sulphate, and we may show the result symbolically as follows :

	Positive Plate.	*Electrolyte.*	*Negative Plate.*
Discharged—	Lead sulphate	Water	Lead sulphate
	$PbSO_4$	$2H_2O$	$PbSO_4$

When the accumulator is charged the action that takes place is the dissociation of the lead sulphate and water molecules and a reunion of components, with the result that when the cell is fully charged the condition of the plates has changed as follows :

	Positive Plate.	*Electrolyte.*	*Negative Plate.*
Charged—	PbO_2	$2H_2SO_4$	Pb
	Lead peroxide	Sulphuric acid	Spongy lead

The positive plate is now a dark brown colour and the negative grey. In practice it would not be permissible to discharge a cell until the electrolyte is reduced to pure water as shown above, as this would result in the plates becoming coated with a layer of insoluble sulphate, Pb_2SO_4. (It may be mentioned here that there are two forms of lead sulphate, one soluble and the other insoluble. The latter is most injurious to the cell.) This will be explained later under the heading "Care of Cells." The process of forming accumulator plates is a long and tedious one, and in its place some manufacturers adopt the methods that were first used by Faure. His procedure consisted in making up lead grids containing a percentage of antimony, the latter being used for hardening and strengthening the lead. These grids were filled with a paste made up of lead and sulphuric acid, and by this means a greater depth of active material was obtained than by Planté's electro-chemical method, and the lengthy "forming" period considerably curtailed. Some manufacturers use both methods, the plates being first pasted and then formed by the electro-chemical process.

RATING OF ACCUMULATORS.

The ampere-hour capacity of an accumulator—*i.e.*, the number of hours at which it can be discharged at the rate of one ampere per hour—is governed in the first instance by the exposed area of the positive plates. The greater this area, the greater is the amount of active material which can be formed during the period of charging, and the greater the quantity of electro-chemical energy "stored." It is therefore correct to assume that there is a direct ratio between ampere-hour capacity and the superficial area of the positive plates. On the average a cell should give 5·75 to 6 amperes for each square foot of positive plate surface. There is also a fairly definite relation between the weight of both positive and negative plates combined and the ampere hour capacity of the accumulator, and this relation usually works out to about 4 amperes to each lb. weight. Manufacturers always fix the normal rates for charging and discharging, but if the ampere-hour capacity is known these rates can easily be calculated. Usually makers aim at producing cells which will perform 8 to 9 hours' work at the normal rate of discharge.

Suppose the combined weights in pounds of positive and negative groups of a cell to be 20, this figure should be multiplied by four to obtain the ampere-hour capacity. This gives 80, which, divided by eight (the number of hours at which a cell will usually work on a normal discharge) gives 10 ; therefore 10 amperes could be fixed as the normal rate of charging and discharging without damage to the cells. It is possible, and some manufacturers permit in their instructions, to discharge cells at rates much higher than the normal, but it is not to be recommended, as the ratio of output to input decreases rapidly in such cases, and the life of the cell is shortened. In general, provided a correspondingly low rate of charging is fixed, the lower the discharging rate the longer will be the life of an accumulator. The ratio of output to input should be as 10 to 11.

ELECTROLYTE.

What is known as accumulator acid should always be used. It is manufactured from Sicilian brimstone by the "lead chamber" process, and usually contains a small percentage of lead, but if this is not in excess it does no harm to the plates. Some acid is manufactured from iron pyrites by what is known as the contact process. This depends upon the principle of formation of sulphur trioxide when a mixture of sulphur dioxide and air is passed over heated platinised asbestos. Acid manufactured from iron pyrites frequently contains iron, which is most harmful to the plates. Pure acid can readily be distinguished from commercial acid by its appearance, the former being a heavy colourless oily liquid while the latter is a trifle brownish in appearance.

When mixing acid for accumulators care should be taken to use only a clean porcelain or glass container. Distilled water should first be poured into the container and the acid then slowly added. The water should never be added to the acid as the sudden heat generated by such an action would probably crack the container, and boiling acid would be thrown into the face of the person making the mixture. The specific gravity of accumulator acid is usually 1·215, and it will be found that approximately one part of pure acid to four of water is required to obtain such a solution. Acid has a strong corroding effect on the skin, and, if pure, is likely to cause a painful wound. It is also injurious to linen, cloth, etc., and a quantity of diluted ammonia or lime water should be kept handy to apply in case of splashing the hands or clothes, these solutions being very effective in neutralising the acid. Ammonia must not be allowed to get into the accumulators as it would injure them.

There is a direct ratio between the specific gravity of the electrolyte of an accumulator and the ampère-hour capacity, and readings of the specific gravity should therefore be frequently taken.

Erratum

IN the article by Lieutenant Bertram Hoyle, entitled "The Accurate Calculation of Inductance," which appeared in our December issue, an error crept in, which, although obvious to anyone using the table, should, we think, be pointed out. In the tabulated values for $\frac{d}{D}$ obviously $\frac{d}{D}$ cannot be greater than unity. The table should therefore run :—

$$\left.\begin{array}{l}1.00\\0.99\\0.98\end{array}\right\}\text{ instead of }\left\{\begin{array}{l}1.00\\1.99\\1.98\end{array}\right.$$

as printed.

Messages by Wire

The Telegraph Methods of the British Post Office

MR. HERBERT'S book *—the standard work on the telegraph system of the British Post Office—is so well known and widely esteemed that any word of praise from us would be superfluous. The third edition, just to hand, brings the volume thoroughly up to date, and, as would be imagined from the progress which has been made since the book last appeared, the additions and alterations have been considerable. Nearly 1,000 pages with 630 illustrations now go to make up this comprehensive treatise, which is as clearly written and illustrated as could be desired.

Very wisely the author opens the book with an Introduction detailing the fundamental principles of magnetism and electricity, and treating Ohm's law and the electrical units in a careful manner. Chapter I. deals with primary cells, extensively used in the Post Office as a source of current. It may be remarked that, as the result of Mr. J. G. Lucas's researches, his modified Leclanché cell has now replaced all other forms of primary wet cells in the Post Office Telegraph Service. Accordingly we are not surprised to find that much of the matter in the previous editions relating to Daniell and other cells has been deleted. The popular "dry cell," now so useful to the general public in the millions of pocket flash-lamps, is clearly explained, and a tabulated comparison of cells of various types makes interesting reading.

Chapter II. is of great importance, being devoted to the calculations in connection with circuits and conductors. This chapter is subdivided into four parts, the first dealing with the Arrangement of Cells, the second with Joint Resistance and Division of Current, the third with the Resistance of Wires of Varying Dimensions, and the fourth with Electro-Magnets. Unlike many technical writers, Mr. Herbert has not given much place to mathematics, for he says: "After anxious "and careful consideration in the light of an extensive teaching experience, I have "deemed it best to avoid the use of mathematics, and I am satisfied that the more "elementary method adopted will make the work accessible to the far larger and "wider circle of readers who most need the information I have sought to convey."

In the third chapter we come to the Measurement of Current, the many forms of galvanometer in use being fully described. Students of electricity will find the pages devoted to the Tangent Galvanometer of particular value, the great merit of this instrument lying in the fact that its indications bear a definite and simple relation to the current flowing through its coils, the current being directly proportional to the tangent of the angle of deflection.

In further chapters measurement of E.M.F., battery testing, and the measurement of resistance are considered. In Chapter VI. the author deals with single current systems and relays, and here we find descriptions of the various types of sounder and single-current keys, which are used in this form of telegraphy. Nothing could be clearer to the student than Mr. Herbert's descriptions in this chapter. They are indeed typical of the clear and lucid style of the whole book.

* *Telegraphy.* By T. E. Herbert, A.M.I.E.E. London: Whittaker and Co. 9s. net.

Capacity, condensers and double-current sounder are next described. The double-current system has several advantages over the single-current, greater speed of working being the most prominent. The subsequent chapter is given up to the Differential Duplex Telegraph, and is immediately followed by a clear description of the quadruplex. Quadruplex working consists in the simultaneous transmission of two messages in each direction over a single wire connecting two stations. It is accomplished by taking advantage of the fact that currents may differ from each other in direction and strength.

Automatic systems of telegraphy take a prominent place in the Post Office system, and enable enormous quantities of traffic to be handled in a minimum of time. The generic term "automatic system" is usually employed to denote all the systems in which the signals are transmitted by mechanical means as opposed to those in which the signals are sent by a manually operated key. The speed at which most circuits can be worked by a machine transmitter is far greater than that at which even the most highly expert telegraphist can operate a key. Further, the speed is constantly maintained and the signals are more accurately formed than is possible with hand-working.

The Wheatstone automatic system, which is described in Chapter X., is that most widely used. The apparatus comprises three separate and distinct parts. Firstly, the perforator, which is employed to prepare the tape (known professionally as "slip") controlling the signals sent out. Secondly, the transmitter, which sends out the signals in accordance with the perforations on the slip. Thirdly,the receiver, which is a very sensitive form of polarised direct writer. The perforation of the slip can be carried out in many ways, the simplest consisting of passing the unperforated tape through the Wheatstone perforator, which is purely mechanical in action. It consists of five steel punches operated in suitable combination by three keys, one of which gives dots, another dashes, and the third spacing. In the ordinary form of Wheatstone perforator, the operator himself provides the power to punch the holes, but pneumatic devices are also in use, and enable from one to eight slips to be simultaneously punched, a tap on the keys releasing compressed air, which forces the punches through the paper.

One of the most interesting sections of the book is that devoted to the various types of perforators, several of which operate with a keyboard resembling that of a typewriter. In one form of Wheatstone receiver, the received signals operate a second perforator, which punches tape identical with that passing through the machine at the transmitting end. This second perforating slip is then run through a machine device which translates the dots and dashes into a clear typewritten message. It will be seen that in this way it is possible to transmit and receive messages without any knowledge whatever of the Morse code.

Space will not permit us to deal at any length with the remaining sections of the book, which covers various forms of printing telegraph, central battery systems, repeaters, testing devices, and many other equally importnat matters. The chapter on Secondary Cells, however, is worthy of special mention, the description of various types of accumulators being very clear and to the point. Chapters are also devoted to the consideration of Aerial Lines and Underground Lines respectively, this part of the work of the Post Office calling for special care and ingenuity. A word must also be given to the ten appendices, the first of which is devoted to the Molecular Theory of Magnetism, and others to Notes on Chemistry, The Siemen's High-Speed Automatic Printing Telegraph, and Superposing. Appendix G. consists of syllabuses of examinations set by the Post Office and the City and Guilds of London Institute.

Although the volume claims to be " a detailed exposition of the telegraph system " of the British Post Office," we do not find even a passing mention of radiotelegraphy, which certainly forms a part of this great organisation. This is more noticeable in that among the subjects dealt with in the examinations above referred to wireless telegraphy finds a place. Perhaps this omission will be remedied in a future edition.

Altogether the volume is excellent, and should be in the hands of all who desire to have an intelligent knowledge of the working of the telegraph system of the British Isles.

" Wireless in Jungleland "

An Insect which Eats through Lead

OUR article in the November issue entitled " Wireless *versus* Wire in Jungleland " has evidently aroused considerable interest, particularly amongst people who had previously entertained the impression that, once two places have been linked by a wire, uninterrupted telegraphic communication is assured. By way of further illustration of the disillusionment on this point, as set forth in the article referred to, we may say that our attention has been recently drawn to a further little animal pest, known as the " Cable-eating Bug." We extract the description thereof from our contemporary the *Telegraph and Telephone Age* :—

" The bug, which is so fond of eating the lead-sheathing of cables, has won " international fame with a pyrotechnic suddenness ! His methods of prosecuting " the business for which he was born have only recently been discovered. It appears " that he bores through the lead-sheathing of a cable by scraping the surface until " a small indentation has been made. Into this he inserts his teeth, and then starts " rocking his head from side to side while exerting all possible pressure downward.

" Up to the present, as far as the United States are concerned, the cases of " cable trouble which have been traced and found chargeable to the activities of " metal-destroying bugs are those reported from California and the southern States. " It is quite possible, however, that in other sections of the country cases of trouble " heretofore attributed to lightning discharges may in reality have been due to the " depredations of members of one or other of these highly interesting bug families."

Doubtless the universal use of wireless in the above-mentioned districts would result in the extermination of these " interesting specimens."

Administrative Notes

FRENCH WEST AFRICA.

THE coast station of Tabou, French West Africa, has now resumed working.

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ITALY.

The *Gazzetta Ufficiale* contains the text of a Decree (No. 1,587) relative to wireless installations on board merchant ships. Merchant vessels carrying 50 or more persons on board must, unless they are specially exempted, be provided with radiotelegraphic installations.

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JAPAN.

By letter of October 14th the Japanese Administration has informed the International Telegraphic Bureau that under date of October 9th His Excellency Baron Kenjiro Den has been named Minister of Communications, in the place of His Excellency M. Katsuto Minoura, who takes his resignation from the same date.

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LIBERIA (REPUBLIC OF).

The coast station of Monrovia (F.M.A.) has suspended working.

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PERU.

A wireless station has been erected at Cachendo, situated in Peru between Mollendo and Arequipa. The following particulars of the station have been received :

Name of Station.	Call Letters.	Wave Length (metres).	Approximate Range.	Service.	Hours of Service.
Cachendo	O A B	600, 3,500	Day, 600 Night, 1,800	Public	First 15 minutes of each hour

Coast Station Tax—14 *centavos per word*.—This coast tax is applicable to radio-telegrams worded in plain Spanish language ; for radio-telegrams in code, or worded in a language other than Spanish, the coast tax is doubled.

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PORTUGAL.

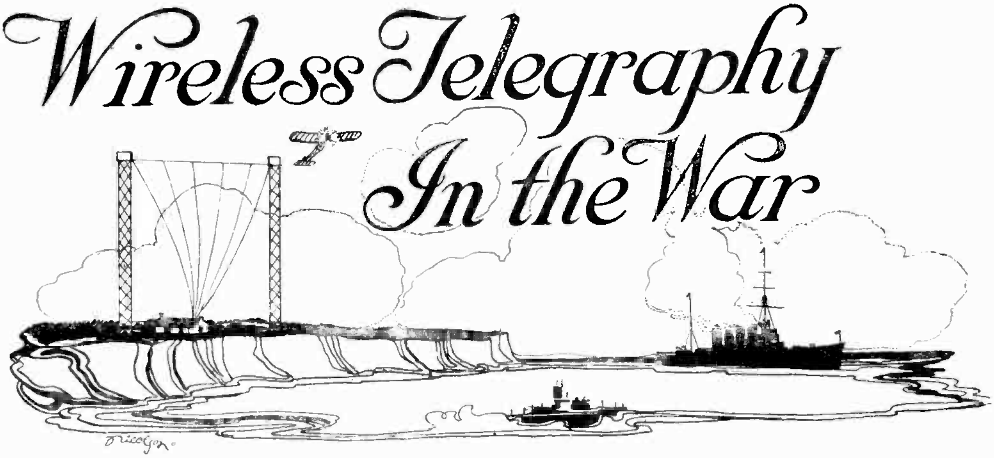
By telegram of November 1st the Portuguese Administration has informed the International Bureau that the legal time used previous to June 18th, 1916, is re-established in Portugal (Continental).

* * * * * *

TASMANIA.

By telegram of October 5th the Australian Administration has notified the Bureau that mean time in Tasmania is advanced by one hour from 2 o'clock on the first Sunday in October of each year till 2 o'clock on the last Sunday of March of the following year.

Wireless Telegraphy In the War



"CODES OF HONOUR" VIOLATED.

IN the early days of man, when—as Andrew Lang puts it in one of his most charming poems—

> Man had no tact,
> And could ne'er take a hint,
> Whilst his notions he backed
> With a hatchet of flint—

we may suppose the ancient proverb about "all being fair in love and war" to have been absolutely exact. But, in the many thousand years which have elapsed since those days, codes of honour have arisen which have tended to mitigate man's savagery, even when—as in war—an appeal is being made to the elemental passions. It constitutes one of the most saddening circumstances surrounding the present struggle that our German foe have deliberately set at naught these long-established codes of honour in war-time.

On various previous occasions we have made references to "wireless traps," such as attempts on the part of the captains of German war vessels to lure British transports and other vessels from the course appointed for them by radiating faked messages, which purported to emanate from friendly sources. Such a procedure would appear to be one of those *ruses de guerre* held traditionally to be perfectly permissible. But some of the more recent manifestations of German warship radio-activity stand upon a different plane altogether. For instance, in the earlier days of January a Dutch captain, on his return to Amsterdam from a long sea voyage, informed one of our Netherland contemporaries that, whilst he was in the Bay of Biscay, he received the wireless signal S O S, proceeded immediately to the spot indicated, *as in duty bound under International Regulations*, and found the signal to have originated with a German submarine, not in the least need of assistance. So far from displaying any shame for such conduct, the German submarine commander merely expressed his disappointment that the vessel which answered the call of humanity flew the Dutch, and not the British, flag. Now such a procedure is, if anything, worse than the conduct of infantry who lure an enemy into ambush by the display of a white flag. The London International Convention of 1912, ratified by Germany and issued in common with all the important Powers of the world, lays it down that signals of distress shall have priority over all others, and that it shall be the duty of every person receiving them immediately to take action to render the assistance called for.

Again, on the occasion of the sinking of the great hospital ship *Britannic*, to which we referred in our last issue ; according to one of the published accounts, we learn that wireless messages were received by vessels proceeding to the rescue, stating that no assistance was required. The source of this message has apparently not been ascertained with certainty ; but it is legitimate inference that the message came from enemy and not friendly aerials ; indeed, such conduct fits in only too well with the general trend of Teutonic conduct. The morality of the procedure needs no comment from us, and we are of the opinion that no more suitable epithet than "saddening" could be found for characterising such conduct on the part of enemies whose courage and skill might otherwise have aroused within us "the stern joy which warriors feel in foemen worthy of their steel."

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MISSED OPPORTUNITIES.

One very excellent way of learning what one owes to a certain instrument is to do without it for a while. We get a good insight into the utility of aeroplane wireless from an account recently sent home by a newspaper correspondent. It is concerned

Photo: Topical.

THE FRENCH DIRECTOR OF MILITARY TELEGRAPHS IN HIS MOTOR-CAR ON A TOUR OF INSPECTION.

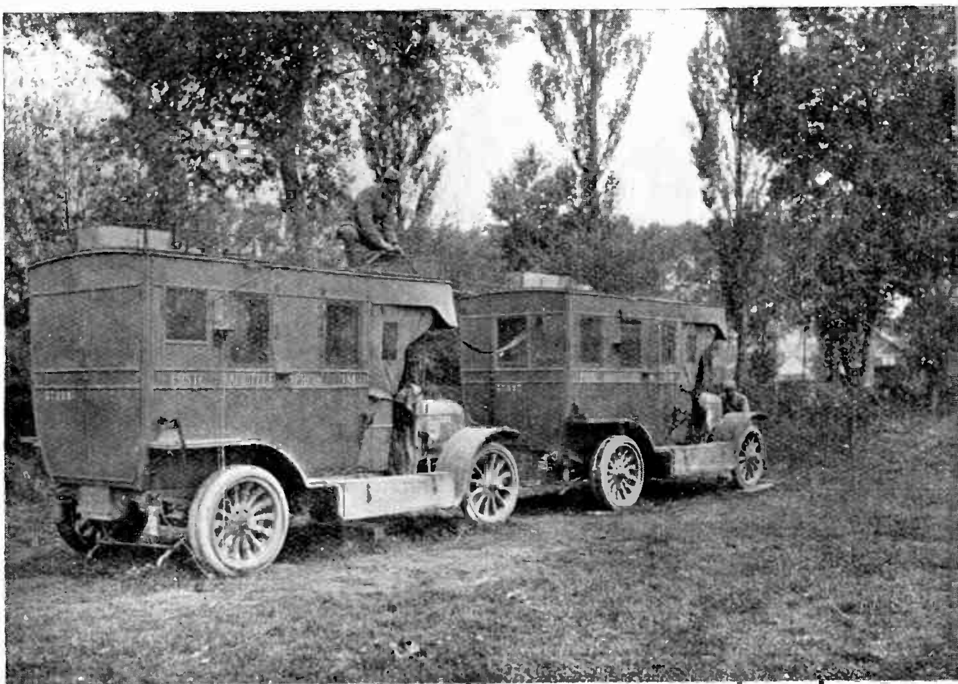

Photo: Topical.

FRENCH MILITARY WIRELESS SETS IN MOTOR-CARS.

with the adventures of a subaltern in the Flying Corps who was serving in Mesopotamia at a time when he was "monarch of all he surveyed" (*i.e.*, when his was the only plane available). He was scouting on a machine unfitted with radio apparatus, and—as soon as he went up—noticed how at a certain height he ceased to be troubled by the shimmering mirage which in hot climates confuses the human eye and judgment of distance so long as the observer is located on the earth level. From his vantage point in the sky everything was "clear as a bell."

> Yonder go our cavalry and the enemy's, nearing each other in the haze totally unawares! . . . What's ——'s brigade wheeling round for now? A mile further advance would turn the enemy's flank. . . . The Turks are leaving their front trenches; they're fully 3,000 strong: oh, if only I could get our gunners to shell them from across the river. . . . Now's the time; if only the cavalry would go for them! . . . What a chance they've missed!

Matters have been amended now, and the British air ascendancy in Mesopotamia is at present as complete as it is in France. The machines are of the latest pattern, and aeroplane wireless keeps the pilots and observers in the sky in close touch with the artillery commanders and army leaders beneath them. The erection of hangars has reduced the wastage of aircraft by giving protection against the alternate sun-baking and rain-drenching to which the machines were subjected in the earlier stages of the campaign.

The scraps of the flying man's remarks, from which we have just quoted, speak eloquently of missed opportunities which would not have been let slip had wireless been available. And may not this position of the hovering observer, chafing at being unable to communicate with his comrades below, give us some hint as to what perchance is happening in an unseen world? May it not be that those who have "passed over," crossing the "bourne from which no traveller returns," look down upon the scene below, unaffected by the mirage of earthly bonds, and longing for some means of communication whereby they may radiate timely warnings of "lost opportunities" to their loved ones still battling in this world of sense?

* * * * * *

WIRELESS DRAMA.

MR. ALFRED NOYES has been recently contributing to the Press a number of graphically written descriptions of matters at sea. Any of our readers who may have missed them would do well to turn up the accounts in the back files of their favourite newspapers. Amongst the most dramatic episodes narrated by him is the tale of the historic wireless operator of the *Anglo Californian* as told in the messages extracted from the records of the vessel on which he was working and that which was hurrying to her rescue. The *Anglo Californian*, homeward bound from Montreal with a cargo of horses, was chased and shelled by a submarine, and radiated wireless calls for assistance, which were answered by a man-of-war below the horizon. Just as the captain had determined, in view of the severe bombardment which he was enduring, to abandon his ship, a wireless message told him to hold on as long as possible, and he proceeded on his course. The hot shell-fire which followed killed the captain and eight hands, besides twenty horses, and readers will get some idea of heroic fortitude displayed by these British merchantmen when they remember that *they possessed no weapon wherewith to retaliate.* The wireless messages, reproduced textually by Mr. Noyes, describe how the *Anglo Californian's* course was altered in accordance with the directions transmitted from the warship. The latter was at length able to radiate the welcome news, "Can see your smoke. Hold "on. Funnel red and blue bands with yellow star." All the time the submarine was following hard astern, firing at the wireless aerials, the only means of defence the unfortunate vessel possessed. Every now and again the transport operator would send out a pathetic message like "For God's sake hurry up. Firing like "blazes." In one of his "calls" the telegraphist described to his brother operator on the warship how he was discharging his duty lying on the floor with broken glass all round him, "the place stinking with gunpowder." At last the British man-of-war came up, and the *Anglo Californian's* operator announced that "submarine has dived," and was asked to report her trail at intervals.

The name of the hero of this episode is Mr. J. F. Rea, who on the occasion above referred to carried out the "Marconi tradition" of fortitude in times of stress and danger which we are proud to think has now become universally recognised. The British Admiralty Board wrote to the owners of the *Anglo Californian*, paying a very high tribute to the officers and crew, and especially commending the behaviour of Mr. Rea, who was presented by them with a gold watch suitably inscribed, in recognition of his conduct. The drama so vividly described by Mr. Noyes lasted four hours.

War Notes

In our January issue (pages 763 to 765) we published a description of a wireless man's adventures with the force of General Smuts, and we have since seen a further communication on the same subject from a teacher formerly attached to the Hales Owen College, Manchester, now serving with the wireless Signalling Section of the British Forces in German East Africa. He, like our earlier correspondent, speaks feelingly of the hard work involved in hewing a track through pathless scrub, and emphasises the delight of his companions and himself "to see a railway line again, after eight "months' wandering about uncivilised Africa." He also tells the story of a German corporal, *ex* the wrecked German cruiser *Königsberg*, who went into a native kraal to get milk, was made prisoner by the natives while drinking it, and handed over to the British.

More about our African Forces.

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On page 841 will be found a reference to the violation of the old-time "Codes of Honour" by our present enemies, and we have given an example of how this violation has been brought "right home" to a German submarine on the occasion when a Dutch vessel answered a bogus call of distress. A similar instance occurred when the Italian steamer *Duca Degli Abruzzi* arrived at Genoa without having met any German submarine on the voyage, and learned that other vessels had received S O S messages purporting to have been sent out by herself. The infamy of such action on our enemy's part is beyond comment.

Bogus Wireless.

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It has become a commonplace amongst naval experts that through the agency of radio-telegraphy the British Fleet is able to maintain its blockade against Germany without hanging round the exits to German ports after the old traditional fashion. Some of the recent critics, in their desire to tilt at everything and everybody, would appear to have forgotten this, and have been talking as though the British Fleet is failing to pursue its traditional policy. Of course, such criticism only displays the out-of-date nature of their authors' knowledge. Wireless telegraphy has rendered the old-fashioned short-range blockade as unnecessary to-day as it used to be laborious, dangerous and (frequently) ineffective in times gone by.

"Times change."

* * * * * *

There are great differences between the conditions of to-day and a hundred years ago. These lie in the greater speed of ships, in the longer range of guns, in the menace of the torpedo as fired from ships, destroyers and submarines, in the menace of mines, the use of aircraft as scouts, and of wireless telegraphy.

The gallant First Sea Lord worked out the above dictum in some detail, but what it comes to, as far as the blockade is concerned, is that the necessity under modern conditions of remaining at a greater distance from the enemy's blockaded coast than in olden days is more than counterbalanced by the rapidity with which news can be radiated, and the speed of modern vessels.

What Says Sir John Jellicoe?

Wireless Signals in the Home

More Marconi Gramophone Records. Important New Arrangements

ELEVEN months have now elapsed since we first announced the publication of *Gramophone Records of Wireless Signals*, the success of which was immediate. No sooner had our descriptive article appeared than orders came in from all parts of the world. Young men studying to become wireless operators, boy scouts, signallers in the Army and Navy, wireless operators at sea, teachers in technical colleges—all hastened to obtain the new discs. It will not surprise our readers, therefore, to learn that the whole of the first large edition of these records is exhausted, and a second edition is now being prepared.

This month we have two important and interesting announcements to make. The first concerns a reduction in price, which has been made possible by the large sales, and the second is in reference to an entirely new series containing many novel features.

PRICE REDUCED.

From the 1st of February the Marconi Official Training Signals, issued as "His Master's Voice" gramophone records, will be obtainable from all accredited dealers in "His Master's Voice" discs at the price of 2s. 6d. per double-sided 10-inch record, or 15s. for the set of six. In countries other than the United Kingdom the price of records will be that charged for a standard 10-inch double-sided "His Master's Voice" record, and so long as our readers are within reach of an accredited dealer they will save the cost of postage—a large item in many cases. For the benefit of those readers in this country who have no agent in their town, the Wireless Press, Limited, will supply the discs at 2s. 6d. each, postage and packing 8d. extra. In the case of the whole series being ordered at once postage and packing will be free.

SIX NEW RECORDS.

We are also pleased to announce that the arrangements for the issue of a new series of six double-sided records have now been completed, and the new records will shortly be obtainable at the same price and in the same manner as that detailed above for the first series.

SOUNDER SIGNALS.

In response to a considerable demand we have prepared a double-sided record of "Sounder" signals for the purpose of giving instruction in the reception of signals on this type of receiver. As the Sounder is largely used in wireless stations on circuits which connect the landline telegraph with the radio station, all operators who anticipate appointment to installations on shore should obtain these discs, so that they may not have to plead ignorance of this form of reception. On one side of the record we find the Morse Code sent slowly and exactly as printed in the Postmaster-General's Handbook, and on the other side a simple press message at 10 and 12 words a minute. To those of our readers who are not acquainted with the first series (described fully in the March, 1916, issue of this magazine), we would state that by altering the speed regulator of the gramophone the speed of the signals can be very materially changed. Thus on most machines a record which when run at normal speeds would give signals of 10 words a minute, run at the slowest would give 5 or 6, and at the fastest at least 14 or 15 words per minute respectively. The flexibility of this method of receiving is thus at one demonstrated.

FOREIGN LANGUAGES.

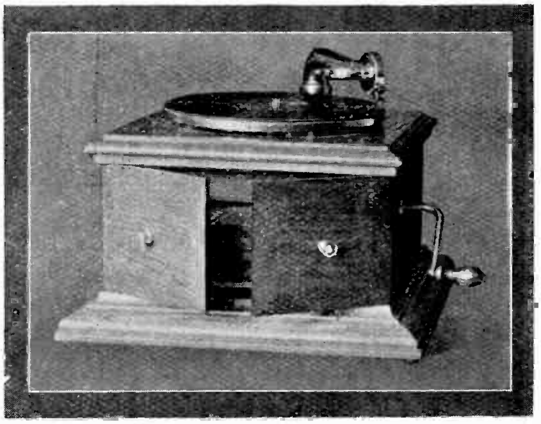
The second record contains on one side a press message in French at a good working speed and on the other a similar message in Italian. The third disc contains on one side Spanish and the other side Portuguese. The two records thus give instruction in the reception of signals in no less than four languages. The excellent practice afforded by the reception of the messages in foreign languages will be greatly appreciated by many of our readers who are anxious to avoid what may be termed "guesswork" reception—so easy when the messages are in plain English.

FIGURES AND FRACTIONS.

The fourth disc will be specially popular, containing on one side nothing but figures and fractions. At most wireless schools far too little practice is given in figure reception, and it is by no means unusual to find an applicant for employment in the Marconi Company able to receive excellently in plain language and code, but worse than indifferently in figures. Many experienced operators will welcome the opportunity of practising figure reception at a high speed, for, although the record run at its normal speed gives reception at 23 or 24 words per minute, it can be run at a speed of well over 30 words per minute.

A TEST FOR CONCENTRATION.

The other side of the fourth record will cause a great deal of amusement, and although we anticipate that it will be largely purchased by many people who have no desire to master the mysteries of the Morse Code, at the same time it will be extensively bought by wireless students of all stages of advancement. Briefly, it consists of a Poldhu Press Message with almost every conceivable interruption from extraneous noises. The record starts off with seven bells on the ship's bell, followed by the well-known preliminary V's of Poldhu, leading on to a typical bulletin of press from the famous "ZZ" station. Very few letters have been transmitted before the voices of men on deck are heard, and a raucous voice calls upon some person unknown to "bring the bosun here." The grating of boxes being dragged along the deck and the shrill note of a whistle then obtrude themselves


THE EXPERT TEACHER IN YOUR HOME.

upon the ear, and this interruption has hardly ceased before an inquiry from a passenger who has intruded himself into the cabin creates further exasperation: "Operator, can you send this message?" "He doesn't take the slightest notice of me!" and other similar remarks follow rapidly one upon the other, and among the medley of voices, whistles and bells the piping note of Poldhu still goes on. The object of the record is to give practice in concentration, and although on first hearing the new student will be inclined to think that it is impossible to receive in such a general "mix-up," he will find later that practically all the message can be transcribed without error. Frankly this is a difficult record—it is intended to be—but it will afford splendid practice.

In case the would-be operator feels discouraged on hearing this record, we would explain that conditions are very rarely as bad as this, and in any case the headpiece pressed closely to the ears cuts off a great deal of the outside noises. Nevertheless, on some ships conditions approximate those of this disc, and a number of senior operators who have had an opportunity of hearing this record state that the interruptions are very natural.

A Ship in Distress.

In the fifth disc we pass from the humorous to the dramatic. On starting the record we hear one ship telling another to "wait for a further message." Suddenly in the distance, on a high whistling note, the famous S O S call is heard, the cry of distress being immediately answered by two vessels. Of these the ship in peril selects one as being the nearer, and transmits to it the message giving its position. A suitable reply is sent, the different notes of the three ships working together and handling their traffic in a highly skilful and expeditious manner, giving a record which is unsurpassed for verisimilitude. On the second side of this record practice is given in the calling up of a coast station and the transmission of a "time rush." The coast station called promptly answers, and both ship and coast station send messages. The speed of transmission being comparatively high, this record is excellent for advanced practice.

More Jamming.

The last disc of the second series contains on one side messages from ship to shore properly numbered and timed, and on the other from shore to ship similarly sent. Transmission is effected at 26 or 27 words per minute, and both sides are severely "jammed" by French press. This jamming record is much more difficult than that of the first series, and affords exercise in both English and French.

Useful Hints.

We take this opportunity of reminding our readers that, whilst these records can be played on any disc gramophone using the needle method of reproduction, they cannot be played on gramophones using jewelled points or sapphires. Of these latter machines the Pathé is the best known. It is possible, however, to obtain from Messrs. Pathé Frères an adapter and needle sound box, enabling needle records to be played, and readers who have Pathé machines will have to obtain this before they can utilise the wireless records. As the cost of the change is only a few shillings, and as furthermore the two types of sound box are interchangeable, no possessor of a disc gramophone is now debarred from benefiting from this excellent means of instruction.

MODIFYING THE SOUND.

Great modification of sound is possible by the use of various kinds of needles. "His Master's Voice" gramophone needles, which we strongly recommended as specially designed for giving the best results with "His Master's Voice" records, are obtainable in three grades, *i.e.*, "Pianissimo," "Piano," and "Forte," the first giving very soft reproduction, the second medium, and the third loud. It is just as well to obtain all three grades of needle, so that practising in reading weak signals can be obtained where necessary. The loud needles should only be used for class work, the medium needles being most suited to work in the average room. Although the horn type of machine gives the greater strength of sound, the hornless models are equally suitable for home study; and, indeed, with a soft needle, and by opening or shutting the modifying doors, the student can obtain all the practice he desires in the transcription of weak signals without moving his position in relation to the gramophone or altering the needle on the machine.

It should be unnecessary to remind users of gramophone needles that the point must be changed after every record. Not only does the reproduction suffer when a needle is used more than once, but the surface of the record is injured and its life considerably lessened. A velvet pad, such as is sold by hatters for polishing silk hats, will be found very useful for dusting the records before playing, and if dirt is removed in this way before each reproduction the very best results will be obtained.

THE USE OF TELEPHONE RECEIVERS.

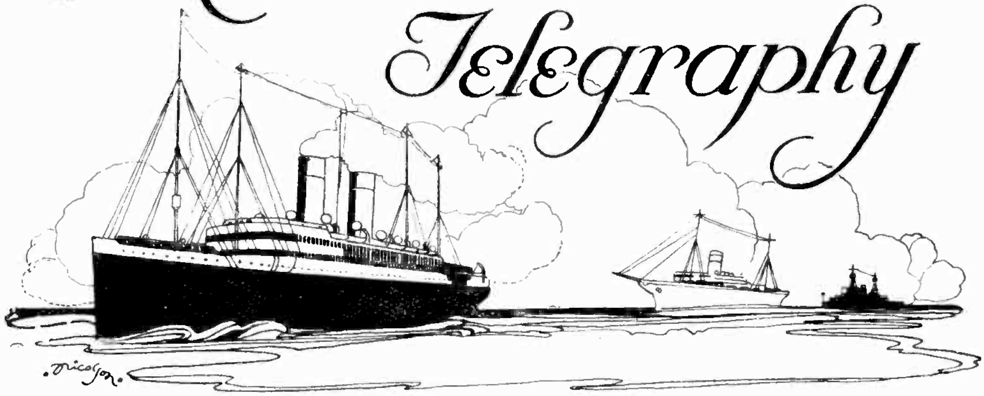
In our November issue we printed a note regarding a new use for the Marconi records, in which we described the methods used by J. Mr. H. Morris for reproducing the wireless signals from the gramophone records into the standard telephone headpieces. Those of our readers who wish to practise reception with the telephone receivers should refer back to this note, which gives all the necessary information.

It is anticipated that the new records will be on the market by March 1st.

King Constantine and Wireless

NEWSPAPER readers have long been acquainted with the fact that the Central Powers have been cut off from the rest of the world, as far as cable communication is concerned, ever since the beginning of the war. It is in consequence of this cable isolation that we have become so familiar with the "German Wireless" items which figure prominently every day in our Press. Nevertheless, every now and again we are reminded by some picturesque incident of the disabilities suffered in consequence by our enemies. Only the other day, when King Constantine of Greece perpetrated his treacherous stroke against the Allies' landing party, was direct touch with Berlin regained by him through his retaking possession of the Greek wireless installations. He lost no time in utilising his opportunities, and the Greek man-of-war, the *Hydra* (now under the control of the Entente), speedily detected the fact that wireless messages were passing between Tino and the German authorities. In addition to wireless, other methods of interchanging messages have been employed. A German aeroplane has played the part of postman at Athens, whilst Zeppelins have been employed to drop mail bags at Larissa.

Maritime Wireless Telegraphy



Fishing for Men.

THE radiation at sea of wireless messages has often been picturesquely spoken of as a " net " whose meshes are formed by the criss-crossing of the various streamers of ether waves. An apt illustration of what this metaphorical term is intended to convey was recently furnished on the occasion of the wreck of the Spanish steamer *Pio Nono*. This was a vessel of 6,500 tons register, *en route* from New Orleans to Barcelona. In the earlier part of December, 1916, she encountered a series of heavy storms, culminating in a hurricane with heavy cross-seas. After having been for some time subjected to this severe buffeting she became waterlogged, and it was thought best to abandon her. The crew and officers, numbering between 60 and 70, were divided between the four boats which were successfully launched, and although they did their best to keep in company, darkness and weather proved too much for them so that the little craft speedily drifted apart. We owe our knowledge of what next occurred to Dr. José de Belda, the ship's doctor, who with his ten companions were, fortunately for themselves, not many hours in their boat before a rescuer arrived. As it was, several of the men were found to be in a state of collapse when they were carried into safety on board their " Ark of Refuge." The rescuing vessel, as soon as the captain learned that there were three other boatloads in peril, set to work to search for them, but without success. They then started radiating wireless messages calling upon anyone who received them to aid in the search.

As the disaster occurred on one of the main routes of ocean travel, the *Pio Nono* having foundered about 300 miles south-east of Madeira, the tale was soon taken up first by one vessel and then by another, until the neighbouring ether was swept by a " wireless net " straining to rescue the unfortunate Spaniards from the perils of the deep. Eventually a radio message arrived from a ship bound for Las Palmas, announcing that she had succeeded in rescuing yet another boatload. Of the remaining two boats, however, no trace could be found, and all hope seems to have been abandoned. Thus only 22, or less than half the personnel, escaped.

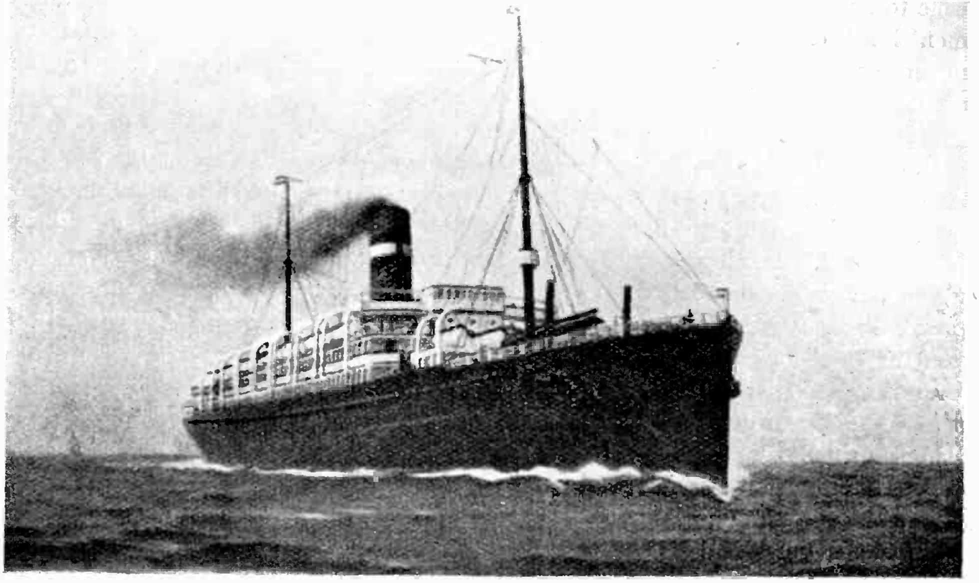
The mental picture called up in such a sweeping of the sea by the " wireless net " constitutes a striking fulfilment (though in a slightly different sense) of the famous prophecy of the Divine Founder of Christianity, "Ye shall become fishers of men."

WIRELESS—WITH DISCRETION.

Cautionary wireless messages to and from ships on the High Seas have proved of the greatest utility all through the present war. So deep was the impression made upon the American mind of the piratical raid of the *U53* in October, 1916, its depredations, and the large number of possible victims saved from its "frightfulness" by wireless warnings, that their magazines still occupy themselves with the subject, and the *Wireless Age* for December contains a dramatic personal narrative contributed by the wireless operator on board the s.s. *Stephano*, one of the earliest victims. Incidentally, our American contemporary characterises the journalistic side of the matter as a "wireless triumph," pointing out that—thanks to this means of communication—the American papers were able to print full details of the disasters in their late editions published on the same day.

Warnings against the commerce-raider, whose list of victims recently figured in the British daily Press, were issued in good time by the Naval Authorities, and doubtless these warnings have proved effective in many cases.

In a recent award for salvage, however, made in the Admiralty Court towards the latter part of January, we have an illustration of the "Other Side of the Shield." Wireless, like everything else, often requires to be used with discretion, or the messages which are intended to help may aid the enemy to destroy. A case in point was furnished in a recent award by Sir Samuel Evans of £8,500 salvage to the Norwegian tank steamer *Caloric* for services rendered to the Japanese liner *Tansan Maru* in the North Atlantic. The latter *en route* for England broke her propeller shaft, and—on meeting the *Caloric*, also bound for England—requested her to send



THE S.S. RIJNDAM, WHOSE "WIRELESS" ADVENTURES HAVE BEEN DESCRIBED IN OUR PAGES ON SEVERAL OCCASIONS.

a wireless message giving the position of the *Tansan Maru*, and asking for tugs. The Norwegian master, however, judged it imprudent to send such a message lest it might attract the attention of enemy submarines, and towed the *Tansan Maru* all the way to Berehaven, a matter of 621 miles.

TWO DRAMATIC RESCUES FROM FIRE AND FOG.

Fire at sea, with the destructive element in possession of the upper hand! Can any situation be more awfully critical for unhappy voyagers? When the ss. *Congress*, one of the largest units of the Pacific Steamship Company's fleet, was found to be on fire in the neighbourhood of Coos Bay, Oregon, with the flames making rapid headway, and no ship in sight, the 233 passengers and 175 members of the crew who constituted her personnel found themselves in a predicament that might well have cowed the stoutest heart. Captain Cousins, who was in command, ordered the vessel to be headed for the nearest point on the coast, and instructed the wireless operator, Mr. R. H. Brower, to send out the SOS message. As soon as the telegraphist proceeded to the execution of his duty, however, tests showed that the fire had cut off the power of the main set, and the auxiliary equipment had to be used in order to flash the appeal. The Marconi station at Eureka was the first to answer, although the naval installation at Cape Blanco came in only five minutes later. Ten miles off Coos Bay Bar, when the decks of the *Congress* were scorching, those on board half-choked by smoke, and the vessel plainly in imminent danger of being completely enveloped in flames, everyone, passengers and crew alike, took to the boats. It was indeed fortunate that rescue craft were already on the scene; for, hardly had the personnel of the unhappy vessel left her, than she flared up like a torch, the flames spreading from stem to stern, as if to impress the occupants of the lifeboats with the awful fate from which they had so narrowly escaped. On this occasion, as on others which we have from time to time reported, the immense importance of having an auxiliary power equipment has been strikingly exemplified. The same accident which brings the danger not infrequently severs the connection between the ship's dynamos, which form the ordinary source of power, and the wireless apparatus.

As far as navigation is concerned, seamen have few bugbears more fully fraught with dread than fog, which stifles sound and sight alike in its chill embrace. The American s.s. *Bay State* was feeling her way through a dense mist when she suddenly found herself "piled up" on the ledges off McKenny's Point, Cape Elizabeth (Maine). The force of impact tore a great rent in the ship's bottom, through which the water poured in torrents into her hold. So rapidly did the inundation proceed, that it was of the utmost importance to summon aid quickly, especially in view of the fact that the unhappy vessel contained as many as 250 passengers. Unfortunately, the same shock that ripped her plates had inflicted damage upon the wireless set, throwing the top off the condenser case, besides breaking the tabs off the plates. Fortunately, Mr. A. R. Gardner, the Marconi operator, was able to effect repairs with but little delay, and despite all his disadvantages succeeded in getting into communication with the Cape Elizabeth radio station within three minutes of the accident. A revenue cutter and tugs were quickly on the scene, but their efforts to haul the *Bay State* off into deep water proved ineffectual, and the stranded vessel's inmates had to be transferred by rope ladders into small boats and thence to the rescue vessels.

Notes of the Month

In Defence of Wireless Students.

We desire to express to our contemporaries in Aberdeen our appreciation of the recent opening of their columns to the defence of wireless students against a thoughtless charge of lack of patriotism levelled against the latter at a recent sitting of the Aberdeen City Tribunal. Mr. Kingsley Bell, writing from the Scottish Wireless College, points out that it would be as unfair to dub wireless students "unpatriotic" as it would be to apply the same epithet to the munition workers. The part played by wireless telegraphy in the present war has been all important, and has affected every department of military activities. Now wireless apparatus without operators would be as useless as big guns without artillerists. There appears to be, amongst a number of mistaken enthusiasts, an idea that only men who spend half their time wading in the mud of Flanders are acting patriotically towards the country so dear to us all.

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Cherchez la Femme.

Sailor-men, perhaps because they spend so large a part of their lives cut off from intercourse with the fairer sex, are characterised by more than their share of chivalry. *Cherchez la femme* is a proverb which has hitherto been meaningless at sea, as far, at all events, as British men-of-war are concerned; now we learn from our contemporary, the *Daily Sketch*, that this immunity is threatened! It appears that a lady recently applied for the position of wireless telegraphist on board a British Dreadnought, stating that she was attending a school, hoped soon to be proficient, and would be willing to undertake the duty without pay. The gallant officer, to whose lot it fell to answer the missive, wrote courteously, pointing out that under the imperfect conditions at present ruling, wireless operating on His Majesty's ships of war was carried out by men only; but he added that, in the future, such positions might *possibly* be thrown open to ladies. His fair correspondent thanked him, asking that in such an event he would not forget her, and added the characteristic reminder that she, at a recent ball, enjoyed the pleasure of twice "taking the floor" with him.

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Training in Radiotelegraphy.

Last month we referred to the projected establishment of a new wireless school at Rutherford College, Newcastle-on-Tyne, and the preliminary steps which had been taken in the matter. We are now able to report further progress. Councillor George Lunn (the Lord Mayor of Newcastle) at a recent meeting of the local education authorities, announced that the local shipowners had contributed £2,000 towards the installation and had thereby practically covered the cost.

This municipal action at Newcastle is typical of other activities in a similar direction which are going on at other great provincial centres. The Birmingham Education Committee, for instance, some time ago, at the request of the local representative of the Royal Naval Volunteer Reserve, arranged a course for recruits awaiting drafts for wireless duties. Classes started at the end of last June, being held on every week-night (Saturdays excepted) at a fee of 5s. per month.

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THE PLACE OF WIRELESS IN AN IMPERIAL SCHEME.

There have been recently printed, for the benefit of general readers, addresses delivered by various eminent public men at the series of Conferences arranged by the Empire Parliamentary Committee of the House of Commons, during last year's official visit to this country of Representatives of the various Dominion Parliaments. These addresses include contributions by Earl Grey, Viscount Milner, Lord Islington, Sir George Foster and Lord Sydenham.

Owing to Lord Milner's recent inclusion in the Inner Council of the nation, the paper contributed by him under the title of "The Constitutional Position" has attracted considerable and well-deserved attention from the general Press. His lordship therein outlines a scheme which several eminent publicists characterise as an excellent basis for discussion.

Readers of THE WIRELESS WORLD take a double interest in the forthcoming developments of the grand Imperialistic idea. Firstly because, as loyal Englishmen, we are all of us deeply concerned in the close-welding of the Empire which this war has done so much to hasten; and secondly, because we realise the importance of the part that wireless must inevitably play in the practical working out of any such project as that outlined by Lord Milner. Increase in cheap and speedy means of communication between the various parts of the Empire is an essential condition of progress towards the goal. The present is not a suitable time for dealing at any length with the Imperial wireless chain, at one time so fruitful a source of debate, but we *do* feel it not inopportune to remind our readers of the idea promulgated by the late Sir John Henniker Heaton, that telegrams ought to be interchangeable between all parts of the British Empire at the cost of 1d. per word, with a minimum of 1s. Such a reform would do more to bind the various units of the British Empire more closely together than any number of Conferences, and its consummation could only be brought within range of "Practical Politics" by wireless. His realisation of this fact was largely responsible for the great postal reformer's enthusiastic interest in the development of radiotelegraphy. The "Life of Sir John Henniker Heaton," which we reviewed at length in our issue of October last (pages 524 to 526), contains a number of future reforms projected by the distinguished subject of the biography, and possesses, on that account, a living interest quite apart from its fascinating account of a notable personality.

The Wireless Man

EDITORIAL NOTE.—*The following graphic description of the life of a wireless operator at the Front will help to bring home to our readers the perils that are daily faced by the ever-increasing army of radiotelegraphists attached to the British Forces. It comes to us straight from the trenches, and is no "armchair" essay on imagined perils. The incidents so vividly described actually took place not very long ago.*

BATTALION headquarters are located in the cellars of a row of ruined blackened cottages just behind the supports. The ruins are gaunt, grim—hideous almost. To the casual observer they are merely a line of blasted dwellings left in the wake of a retreating and spiteful army—with not a living soul within miles. If we made a more minute inspection perhaps we would observe shaftways leading to the cellars, and we would also perceive that the said cellars were illuminated brilliantly, yet cunningly, by electrics. Here the brains of the battalion holding the few hundred odd yards of line out in front are located.

We pause before a thin wire which seems to rise out of the earth and disappear into the clouds. On making a further examination we trace a spidery system of wires, cleverly hung from the tottering gables and blasted trees. A few yards off you decide it would be invisible almost. You peer down the shaftway into the cellar of a one-time café, and are bewildered to see a figure in khaki, with headgear adjusted, and a vague glittering heap of apparatus before him, neatly arranged on an impromptu table consisting of two battered horse-hair chairs and a few planks. Another dim figure, with his gumboots protruding from the folds of an army blanket, is huddled up in the corner—asleep. Such is the battalion wireless station.

The operator seems to be listening intently. His swiftly-moving fingers make adjustments ceaselessly. His pad and pencil are occasionally used, then laid aside.

Outside the dusk is deepening and soon the first Very light soars up with a trail of sparks, flares up and hangs for a few seconds, dancing and shimmering and throwing the ruins and the drab landscape into ivory on ebony relief. It fades and falls gently into the wilderness of No Man's Land. A machine-gun coughs in an uncertain fashion for a second—then silence. There is a vague feeling of uneasiness in the air. The day has not been marked by any "strafing" of note, yet there's the feeling that precedes a typhoon in the air to-night. There's the usual low mumbling of artillery somewhere away to the south, but the guns immediately in our area are quiet.

Rats begin to rustle about—plump, easy-going beasts, which amble slowly off when disturbed.

The faint roll of wheeled transport can plainly be heard coming down wind from the German side, and you conjure up cameos of grey-clad drivers and hurrying teams straining to turn the cross-roads on which the English shrapnel may begin to burst any instant. There will be working parties too, and there's bound to be despatch riders and transports, all hurrying on their various errands.

Your browsings are suddenly interrupted by the sight of three coloured rockets which flash up suddenly out in front. Next second there is a soft roll as of a gong beaten swiftly and quietly. Next instant pandemonium. "Gas!" "gas!" the word flies from cellar to cellar, from mouth to mouth.

Our artillery crashes out in a tremendous roll, and the gaunt landscape shimmers under stabs of violet, crimson and emerald fire. Within fifteen seconds they've laid a mathematically correct barrage immediately behind the first straggling line of field-grays. Another curtain of white-hot metal descends on the German communication trenches, supports, and gun emplacements. The artillery are now registering hits on all these targets; they've been "saving up" for an occasion such as this.

However, the German artillery is active, too. Our front line and its surroundings are being ploughed by H.E. "stuff" of heavy calibre. Black sixty-pound "Woolly Bears" are bursting everywhere. Bursting over places, perhaps, you've never seen a shell burst on before. Sulphury, yellow shrapnel is exploding almost overhead. And everywhere the Krupp speciality—the 5.9 delayed action "krump" —is sending scorched earth, acrid fumes, and whining splinters aloft with its peculiar "end of the world" roar. The tinier and even more awful "whizz bang" is arriving in showers with its fast, almost musical whine.

Suddenly a khaki-clad figure, with a gas helmet drawn over its head, staggers up the shaftway from the cellar—the wireless man—his aerials have "gone west" under the awful bombardment. Under his arm he carries a coil of wire, and a rope halliard is wrapped around his waist. He hurries about in the inferno—a ghostly figure—and presently locates the break, swiftly fixes it, and hauls the repaired spider's web into position again. He turns and swarms along the ruined wall towards the shaftway. Suddenly there is a vivid flash, a violent concussion, and an ear-splitting detonation, and a whole piece of wall and a dark sack-like object ascend in slow curves and a second later thud to earth again. You don't see the wireless man—he's lying on the other side of the ruin—shapeless and blackened. The second figure, whom last you saw asleep, rushes out and again makes good the damaged aerial. He makes the cellar in safety and continues to deal with his traffic, which is heavy—most of the land lines having been smashed early in the attack.

Two hours later the ground ceases to rock and gradually things go back to normal. The attack has failed dismally and the Very lights show grey-clad figures sprawling in the rank grass in all varieties of grotesque attitudes—where our machine-guns and shrapnel "got them."

Next day your eye chances on the official summary, and you learn that the Germans, under cover of dusk, launched gas on a front of a thousand yards, but their attack broke down under our barrage and machine-gun fire. If the casualty list interests you, you might notice that Sapper So-and-So, of the R.E., had joined the great majority. And you'd never think these two everyday announcements would be connected with each other in any way, would you?

PERIKON.

Wave-Lengths Calculations

By P. BAILLIE.

THE travelling of an electric disturbance along a metal wire, ruled by the well-known "telegraphists' equation," can be simply considered in a few particular cases.

Let us assume the resistance of the wire to be negligible compared with its distributed capacity C_1 and distributed inductance L_1 (per unit length).

Consider the case of an earthed single wire aerial, of length l, having a localised inductance (self-induction coil) L_B in series at the lower part (Fig. 1) and oscillating freely with its proper period T. The disturbances travel along the conductor with a speed v given by $v = \frac{1}{\sqrt{L_1 C_1}}$, and it is easily shown that

$$\frac{v\,T}{2\pi} \operatorname{cotg} \frac{2\pi l}{v\,T} = \frac{L_B}{L_1} \qquad (1)$$

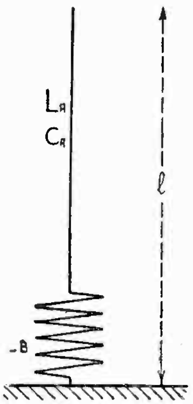


FIG. 1.

This antenna radiates Hertzian waves which travel through ether with a speed of 3×10^{10} centimetres per second. The wave-length λ of the radiated oscillations is then $\lambda = 3 \times 10^8 \times T$ metres.

Equation (1) can be written

$$\frac{1}{\theta} \operatorname{cotg} \theta = \frac{L_B}{l\,L_1} \qquad (2)$$

where $\theta = \frac{2\pi l}{v\,T}$. Then $\lambda = \frac{6\pi\,10^8\, l\sqrt{L_1 C_1}}{\theta}$

or $\lambda = \frac{6\pi\,10^8 \sqrt{l\,L_1 \times l\,C_1}}{\theta}$ metres.

Now $l\,L_1$ and $l\,C_1$ are respectively the total inductance L_A and capacity C_A of the antenna (not including self-induction coil). Hence

$$\lambda = \frac{6\pi\,10^8 \sqrt{L_A C_A}}{\theta} \text{ metres ; } \theta \text{ being given by } \frac{1}{\theta} \operatorname{cotg} \theta = \frac{L_B}{L_A} \qquad (3)$$

This last transcendental equation possesses an infinite number of solutions. For instance, when $\frac{L_B}{L_A} = 1$, solutions of equation (4) are $\theta_1 = 0{\cdot}8596$ radian ; $\theta_2 = 3{\cdot}42$ rad. ; $\theta_3 = 6{\cdot}437$ rad., the corresponding wave-lengths being $\lambda_1 = 1{,}000$ metres ; $\lambda_2 = 251$ m. ; $\lambda_3 = 134$ m., etc.

The first solution corresponds to the "fundamental oscillation." It is that one we are concerned with, the others not being of any practical interest.

The following table gives fundamental solutions of equation (4) for different values of $\frac{L_B}{L_A}$ and λ can be calculated from above formula.

Solutions of $cotg = \frac{L_B}{L_A} \cdot \theta$

$\frac{L_B}{L_A}$	θ rad.	$\frac{L_B}{L_A}$	θ rad.	$\frac{L_B}{L_A}$	θ rad.	$\frac{L_B}{L_A}$	θ rad.
0	$\frac{\pi}{2}$=1·57			27	0·1912	48	0·1437
0·05	1·498	7	0·3709	28	0·1877	49	0·1420
0·1	1·431	8	0·3491	29	0·1844	50	0·1407
0·2	1·314	9	0·3294	30	0·1814	52	0·1381
0·3	1·223	10	0·3133	31	0·1784	54	0·1356
0·4	1·145	11	0·2968	32	0·1755	55	0·1344
0·5	1·076	12	0·2843	33	0·1729	56	0·1331
0·6	1·021	13	0·2738	34	0·1703	58	0·1309
0·7	0·9730	14	0·2643	35	0·1680	60	0·1288
0·8	0·9303	15	0·2552	36	0·1658	62	0·1268
0·9	0·8932	16	0·2471	37	0·1633	64	0·1248
0	0·8596	17	0·2398	38	0·1612	65	0·1237
1·5	0·7374	18	0·2332	39	0·1592	66	0·1228
2	0·6532	19	0·2273	40	0·1574	68	0·1209
2·5	0·5948	20	0·2216	41	0·1555	70	0·1191
3	0·5467	21	0·2163	42	0·1536	75	0·1151
3·5	0·5101	22	0·2114	43	0·1518	80	0·1117
4	0·4774	23	0·2069	44	0·1500	85	0·1082
4·5	0·4547	24	0·2027	45	0·1482	90	0·1051
5	0·4329	25	0·1984	46	0·1468	95	0·1024
6	0·3980	26	0·1948	47	0·1451	100	0·0998

Consider now the same aerial but having a localised capacity (condenser) C instead of coil L_B (Fig. 2). The period T of the natural oscillations is then given by

$$1+\frac{C_1}{C} \cdot \frac{vT}{2\pi}\, tg\, \frac{2\pi l}{vT}=0$$

or

$$1+\frac{lC_1}{C} \cdot \frac{vT}{2\pi l}\, tg\, \frac{2\pi l}{vT}=0$$

the wave velocity along the conductor being $v=\frac{1}{\sqrt{L_1C_1}}$.

The wave-length of radiated oscillations is still given by

$$\lambda=\frac{6\pi\, 10^8\sqrt{L_AC_A}}{\theta},$$

but θ is a solution of

$$1+\frac{C_A}{C} \cdot \frac{tg\,\theta}{\theta}=0. \qquad (5)$$

We still have an infinite number of solutions for any given value of $\frac{C_A}{C}$; the fundamental are given below:—

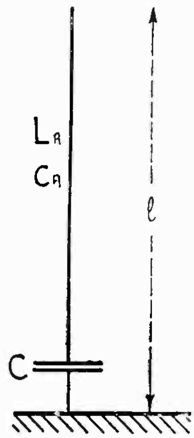


FIG. 2.

$\frac{C}{C_A}$	θ rad.	$\frac{C}{C_A}$	θ rad.	$\frac{C}{C_A}$	θ rad.	$\frac{C}{C_A}$	θ rad.
0	π=3·141592	0·3	2·4958	1	2·0282	10	1·6321
0·05	3·0020	0·4	2·3801	1·5	1·9070	20	1·6020
0·1	2·8701	0·5	2·2903	2	1·8365	50	1·5833
0·2	2·6562	0·75	2·1300	5	1·6886	100	1·5772

Solutions of $\frac{tg\,\theta}{\theta}=-\left(\frac{C}{C_A}\right)$

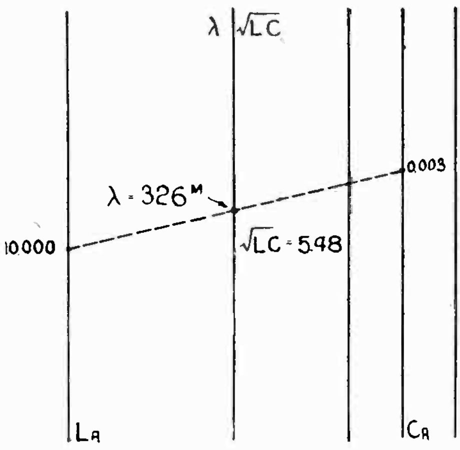


FIG. 3.

In formula (3) θ must be expressed in radians and L_A and C_A in homogeneous units. If L_A is expressed in centimetres and C_A in microfarads the formula is

$$\lambda = \frac{6\pi\sqrt{10}\sqrt{L_A C_A}}{\theta} \text{ metres.}$$

Results of Tables I. and II. have been combined with formula (3) in the accompanying abac. It gives, too, the wave-length of oscillating circuits according to Thomson formula. The use is as follows :—

Closed oscillatory circuits. Suppose one wants the wave-length of a closed circuit, the condenser having a capacity of 0·003 mfd. and the self-induction being 10000 cm. (10 mhys.).

Draw a straight line (Fig. 3) from point 10,000 of scale L_A to point 0·003 of scale C_A. At the meeting of this line with middle scale you read the wave-length $\lambda = 326$ m., or the oscillation constant $\sqrt{L_A C_A} = 5{\cdot}48$.

Antennæ.—Suppose the wave-length is needed of an antenna having a proper capacity $C_A = 0{\cdot}0008$ mfd., and a proper self-inductance $L_A = 48000$ cm.

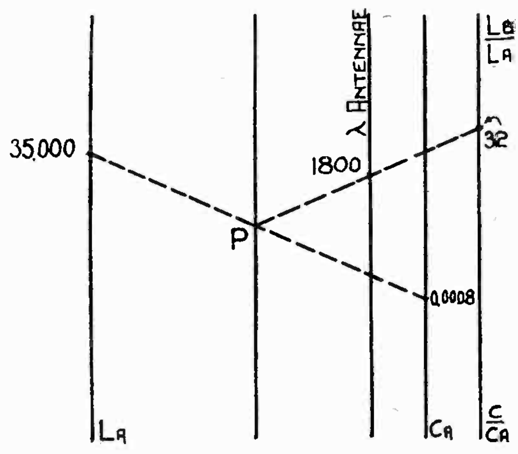


FIG. 5.

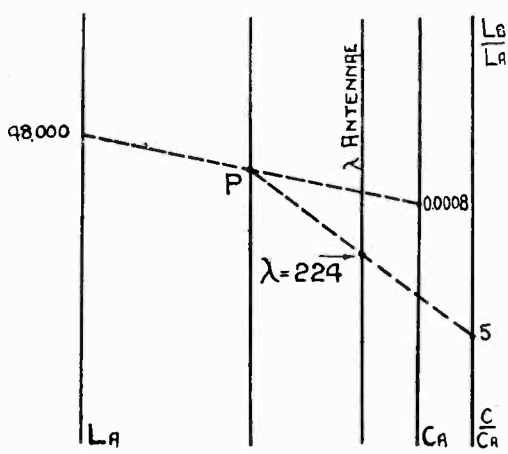
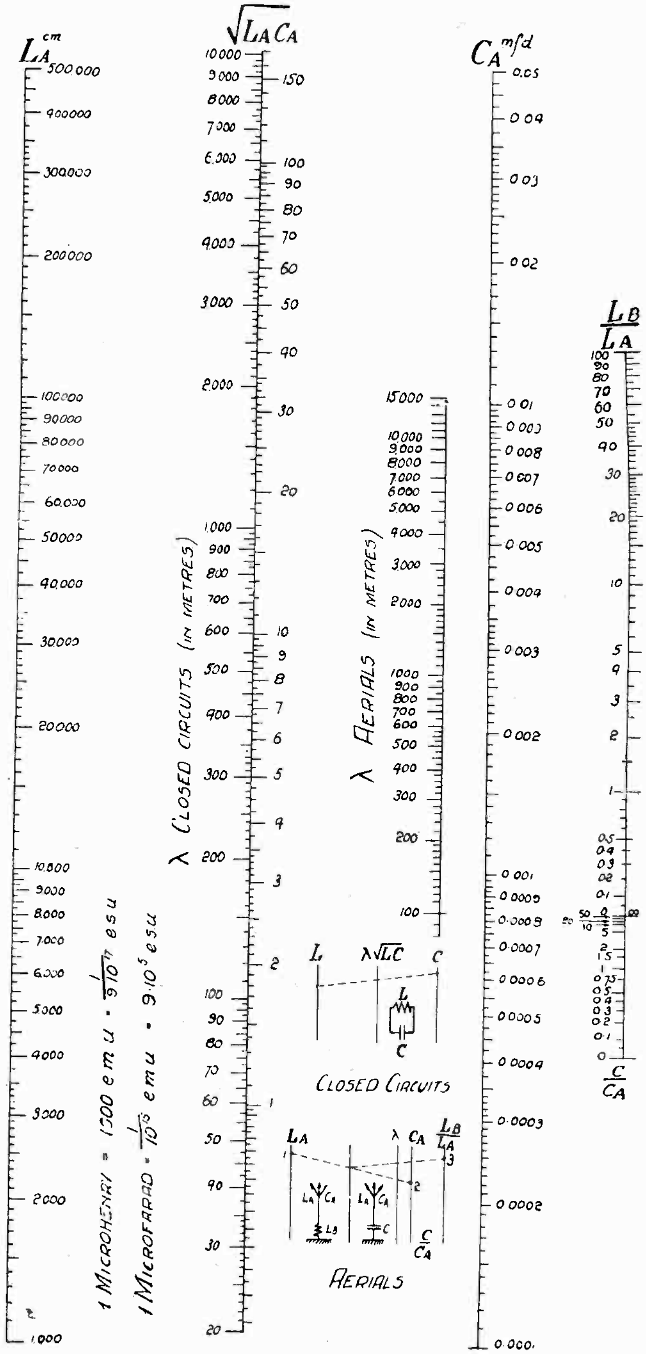


FIG. 4.

Suppose there is put in series with this antenna a condenser C having a capacity $C = 0{\cdot}004$ mfd.

$$\text{Then } \frac{C}{C_A} = \frac{0{\cdot}004}{0{\cdot}0008} = 5.$$

Draw a straight line (Fig. 4) from point 48000 of scale L_A to point 0·0008 of scale C_A. It meets the middle scale at P. Now draw a straight line from P to point $\frac{C}{C_A} = 5$ of right hand scale. The required wave-length is read at the meeting with scale "λ antennæ." Here $\lambda = 224$.



L_A cm
$\sqrt{L_A C_A}$
C_A mfd
$\frac{L_B}{L_A}$
$\frac{C}{C_A}$
λ Closed circuits (in metres)
λ Aerials (in metres)
1 Microhenry = 1000 e m u = $\frac{1}{9 \cdot 10^{17}}$ e s u
1 Microfarad = $\frac{1}{10^{15}}$ e m u = $9 \cdot 10^5$ e s u
Closed Circuits
Aerials

The use is the same when instead of a condenser there is a self-induction coil L_B, but $\frac{C}{C_A}$ must be changed into $\frac{L_B}{L_A}$.

If an antenna has only distributed self-inductance and capacity take $\frac{L_B}{L_A}=0$, since $L_B=0$.

Reciprocal problems can be solved in the same way. Suppose it is required to find the self-induction L_B to be added in series with an antenna of $C_A=0{\cdot}0008$ mfds. and $L_A=35000$ cm. to give it a natural wave-length of 1800 metres.

Find as above the oscillation constant $\sqrt{L_A C_A}$ (point P, Fig. 5). Draw a straight line from P to point 1800 of " λ antennæ " scale. It meets scale $\frac{L_B}{L_A}$ at point 32. Then $L_B=32\times L_A=1120$ microhenrys.

It must be noticed that numbers of scale L_A or of scale C_A may be multiplied or divided by 100, 10000, etc..... ; numbers of λ scales are then to be multiplied or divided by 10, 100, etc..... Numbers of scales L_A and C_A may *simultaneously* be multiplied or divided by 10, 100, etc..... ; numbers of λ scales are then to be multiplied or divided by 10, 100, etc.....

A Novel American Receiving Device

OUR photograph shows an ingenious instrument recently produced in America and called the "Detectometer." It consists of a crystal detector and stand with an indicator at the back. The crystal is held in a small cup and an adjustable point in a spring holder presses on it from above. The two terminals for connection with the receiving tuner are seen on the front.

From the brief descriptions of this instrument which have so far been published, it would appear that the indicator at the back is a very sensitive form of milliampere-meter which gives a reading when signals are being received. Such an instrument might be made to act as a calling device by a slight modification.

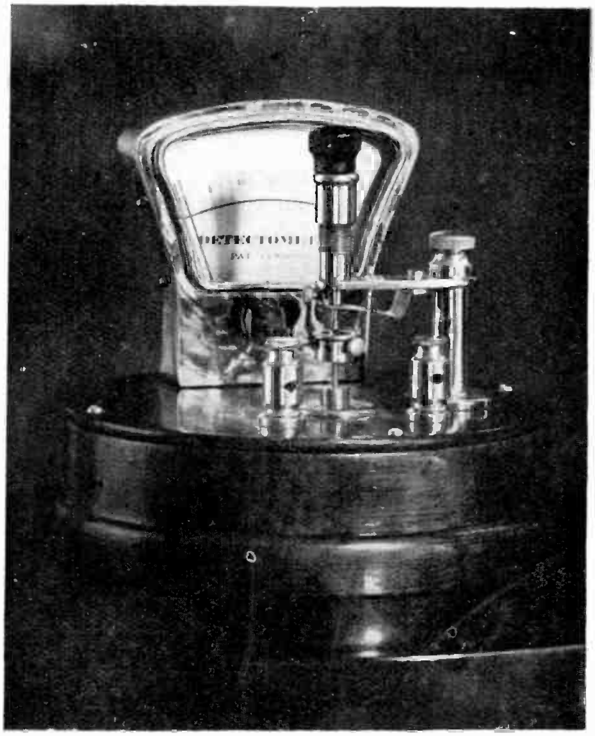
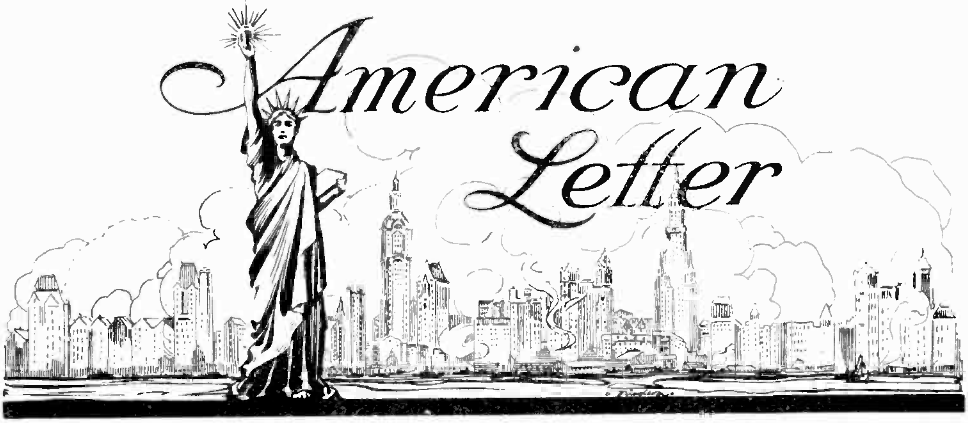


Photo: Frank C. Perkins.



I HAVE previously referred to the Radio Legislation which is proposed by United States Government Officials, but we had no definite information on this subject until about the middle of November, when a draft of a bill entitled " An Act to Regulate Radio Communication " was placed in the hands of interested parties by Manager Todd, Chairman of the Inter-Departmental Committee on Radio Legislation. Representatives of commercial companies and others were invited to be present in Washington on November 22nd, 1916, where the Government Committee met those who came and discussed informally the provisions of the proposed bill and its effects. Commercial interests were represented by their executive heads and, as Secretary, I represented the Institute of Radio Engineers.

Professor Kennelly, President of the Institute, and Professor Goldsmith, Editor of *Publications*, addressed communications to the Government Committee protesting against the proposed bill.

Commander Todd summarised the bill interpreting the salient features of the proposed bill. Among other things, Commander Todd said that while this bill does not provide for the taking over by the Government of commercial radio stations at present, nevertheless " it sounds the note of Government ownership." The Marconi Company filed a written protest against the bill. Other commercial representatives asked questions without definitely committing themselves. Dr. Rose discussed the bill and strongly supported it, adding that, in his opinion, none of the provisions of the proposed bill would in any way stifle the development of the radio art. Commander Todd stated that the bill is the result of the Inter-Departmental Committee's efforts, ranging over a period of one year. He stated also that in view of the protests made, by certain interests, the Committee would again consider the bill and that certain changes might be made which would strengthen it. He advised that when the modifications are made, the bill will be forwarded for approval by each Department concerned, and thereafter it is expected that the bill in its final form will be presented at the next session of Congress, and the Commander added that the bill would go to Congress with the support of the administration.

An interesting paper on " The Classification and Elimination of Strays " was presented at the last meeting of the Institute of Radio Engineers held on December

6th, 1916. The paper was written by Dr. C. J. de Groot, head of the Radio Service in Holland, Dutch East Indies. The paper was read by Professor Goldsmith and discussed by Messrs. Weagant, Armstrong and Alexanderson. A summary of the paper is given below :

Following a general discussion of radio *v.* submarine cable telegraphy, the work of the Radio Division of the Dutch East Indian Service is described.

A chain of stations installed for this Service are considered ; their location, equipment and operation being described in considerable detail. The failure of the original contractor to furnish stations covering the requisite distances (which would have required six to eight times the actual available power) is critically considered.

The choice of station location and certain details ; *e.g.*, precautions against earthquakes, are then treated.

A description of the origin and nature of strays and their classification is given ; together with a number of methods for their elimination. In this connection, the Eccles theory of a tropical thunder-storm origin of all strays is disproven.

Strays fall into three classes, the origin, character, and mode of elimination of which are as follows :—

Type 1.—Strays originating in near-by thunder-storms of short range, of periodic electrical character, audible as sudden and loud widely separated clicks, and eliminated by radio or audio frequency compensation circuits.

Type 2.—Strays associated with low-lying rain clouds of very short range, of intermittent unidirectional electric character, audible as a constant hissing sound, and eliminated by the Dieckmann electrostatic shielding cage.

Type 3.—The most common or night strays, originating in cosmic bombardment of the Heaviside layer of audible range of several hundred miles (with the receivers used), audible as a continuous rattling noise, and eliminated by the Dieckmann cage.

The daily and seasonal variation of strays is considered in great detail, and a number of interesting conclusions are drawn.

DAVID SARNOFF.

Editorial Note : Professor Kennelly's letter to which Mr. Sarnoff refers reads as follows :—

DEPARTMENTAL COMMITTEE ON RADIO LEGISLATION, WASHINGTON, D.C

CAMBRIDGE, November 17, 1916.

GENTLEMEN,—I am informed that new legislation is proposed, looking towards the invasion of the existing commercial field of radio communication in the United States by a certain department or departments of the Government, and that a hearing is proposed in the near future, at very short notice after the preparation and promulgation of the said proposed legislation.

The views of the Board of Directors of the Institute of Radio Engineers have recently been expressed officially upon this question, and I beg to state my endorsement of those views, which will doubtless be presented to your notice.

I am not commercially interested, either directly or indirectly, in any radio communication system, plant, company or organisation, so that I am not actuated by any financial considerations in urging my point of view before your committee. I am deeply interested, however, in the active development of the science and art of radio communication in America as a scientist, a teacher, an operator, a telegraphist and a U.S. citizen.

Although in the past the commercial field of radio communication has unfortunately been exploited by certain unscrupulous promoters, to the detriment of all interests involved, nevertheless, a large aggregate amount of capital, and the savings of U.S. citizens, has been honestly invested in it. I submit that it is the duty and interest of the Government to protect that investment and the American enterprise that goes with it.

If the Navy Department, or any other department of the Government, is allowed to compete in times of peace with existing industrial shore stations in the hands of American citizens, such competition is likely to degenerate into the confiscation of private property, because the Government now claims the right to regulate radio communication, under the terms of the London Convention, and it needs no argument to show that, with the Government in competition and at the same time construing the terms of regulation of their competitors, the competitors might quite easily, and very probably would, be regulated out of existence, and their properties confiscated at scrap valuation prices by the Government. I do not, of course, say that such injustice is the intention of any department of the Government, but I do say that any legislation which permits any branch of the Government to compete commercially with existing stations for messages in times of peace is likely to lead to the injustice above mentioned.

In times of war or national peril it is of course the duty of every citizen to sustain and co-operate with the Government in the general commandeering of all electric communication, radio or otherwise; but in times of peace such commandeering of private enterprises by the Government is not only fatal to the private interests, but also fatal to the Government interests. This is shown by the fact that in those countries of Europe where the telephone system is owned and operated entirely by the Government, the telephone communication of the country is in a relatively backward state by comparison either with the United States or with countries in which the telephone is not owned and operated by the Government. Statistics on this point are so ample and accessible that I need not refer to them here. In order, therefore, that the highest development of radio communication shall constantly be obtainable for the support of the Government in time of need, it is very desirable that inventions and improvements should be open to the public and to public competition. If the radio system is a Government institution, nearly all incentive for improvement and most of the inventive and scientific effort for development will cease. There will be no market for private enterprise. I therefore urgently contend that, for the present, there should be no legislation increasing the already great powers of the Government in the radio-communication field.

Yours respectfully,

(Signed) A. E. KENNELLY,

Professor of Electrical Engineering at Harvard University and Massachusetts Institute of Technology.

Among the Operators

S.S. "CONCH."

IT is our sad duty to record this month the death of two members of the Marconi Company's operating staff, Messrs. D. Brewster and H. E. Holmes, both of the s.s. *Conch*, which was sunk by the enemy in December.


OPERATOR D. BREWSTER.

Mr. Douglas Brewster, the operator in charge, was 26 years of age in July last. Prior to taking up the profession of wireless telegraphy he was employed in an architect's office in his native town of Nottingham, and left that firm to study wireless at the East London Wireless Telegraph College. Obtaining his first-class certificate at this place, he entered the Marconi Company's London School in September, 1914, and shortly afterwards was appointed to the s.s. *Ascania*, from which he transferred to the *Conch* in April, 1915. He remained on board the *Conch* from that time until the ill-fated vessel was torpedoed. Deep sympathy is felt for the late Mr. Brewster's relatives in their sad bereavement.

Mr. Harry Ernest Holmes, junior operator, hailed from Dulwich, and was 18 years of age. After receiving his education in that town he obtained employment on the Marconi Company's clerical staff, and attended evening classes at the Marconi House School. Receiving his appointment to the operating staff in October, 1915, he made his first trip on a Russian vessel, the wireless installation of which was controlled by the Société Anonyme International Télégraphie Sans Fil. Later he returned to the English company, and was appointed to the *Conch* in March, 1916. The late Mr. Holmes's friends and fellow-workers at Marconi House will join with us in offering our sincerest sympathy to Mr. Holmes's relatives in their great loss.


OPERATOR H. E. HOLMES.

* * * * *

S.S. "IVERNIA."

The torpedoing of H.M. Transport *Ivernia* will be fresh in the memory of all our readers. The two operators on this ship

OPERATOR R. H. NASH.

were Messrs. R. H. Nash and N. W. Campbell. Fortunately both of these gentlemen were among the rescued. Mr. Robert Hawker Nash, senior operator, who is 23 years of age, was born at Barton, in Lancashire. On completing his education in Manchester he entered the Liverpool Wireless Training College, where he obtained his Postmaster-General's certificate, and in January, 1913, entered the Marconi House School. Shortly afterwards he was appointed to the staff and proceeded to sea on the s.s. *Cornishman*, from which ship he transferred in the following year to the *Herefordshire*. Later he served on the s.s. *Canning* and *Persic*, and was appointed to the s.s. *Ivernia* in August, 1915. He remained on this vessel until she was sunk.

The junior operator, Mr. Norman William Campbell, was born in Cardiff in 1894. He was educated at Monmouth, and on leaving school took up a commercial appointment, in which he served three years. He received his preliminary wireless training at the South Wales Wireless College, and entered the Marconi House School in May, 1915. At the end of the following month he was appointed to the staff, and took duty on the s.s. *Sagamore*. Mr. Campbell transferred to the *Ivernia* in August, 1915, and remained on her until she was sunk.

We are pleased to say that both men were safely rescued, and so far as we know at present are none the worse for their experience.

* * * * * *

S.S. "CALEDONIA."

The loss of the liner *Caledonia* in December last was fully reported in the Press at the time. Two operators were carried, Messrs. J. A. Kelly and D. D. Cochrane. Mr. Kelly, the senior, was born in County Limerick in 1894, and on completing his general education took a course in wireless at the Northern Wireless School, Dublin. In September, 1913, he entered the Marconi House School, and in May of the following year was appointed to the staff. His first trip was on the s.s. *Cartagena*, and afterwards he served on a number of vessels, receiving his appointment to the *Caledonia* in March of last year. Mr. David Duncan Cochrane, the junior operator, is 20 years of age, and was born in Glasgow. After completing his education in that city he served for a few years in

OPERATOR N. W. CAMPBELL.

various business appointments, later leaving this work to study wireless at the North British Wireless Schools in Glasgow. In May, 1916, he entered the Marconi House School, and three months later was appointed to the staff, the s.s. *Caledonia* being his first ship. We are very glad to say that both men were safely rescued.

OPERATOR J. KELLY.

* * * * *

S.S "RUSSIAN."

The s.s. *Russian* carried two men, Messrs. C. C. Faraker and H. Jones. Mr. Cyril C. Faraker is 22 years of age, and lives at Brockley when at home. He received his education at Lowestoft and the Regent Street Polytechnic, and after leaving the latter institution studied to become a wireless operator. He received his Postmaster-General's first-class certificate at the British School of Telegraphy, and entered the Marconi House School in May, 1915. He was appointed to the staff almost immediately, and first went to sea on the s.s. *Saxon*, later transferring to the s.s. *Bornu*. He then served on several other ships, and was appointed to the *Russian* a year ago.

The second operator, Mr. Harry Jones, of Cardiff, will be twenty-one this month. After leaving school he entered his father's business, but left to study wireless at the South Wales Wireless School in Cardiff. In January of last year he entered the Marconi House School, and after a short stay was appointed to the staff, his first ship being the s.s. *El Cordobes*. From this vessel he was transferred to the *Russian* shortly afterwards, and remained on board until she was sunk.

OPERATOR D. COCHRANE.

We are pleased to announce that both operators were saved, although Mr. Jones suffered considerably from exposure. He had to cling on to a lifeboat for no less than six hours, and of 39 men he was one of 10 surviving. We trust he will make a speedy recovery.

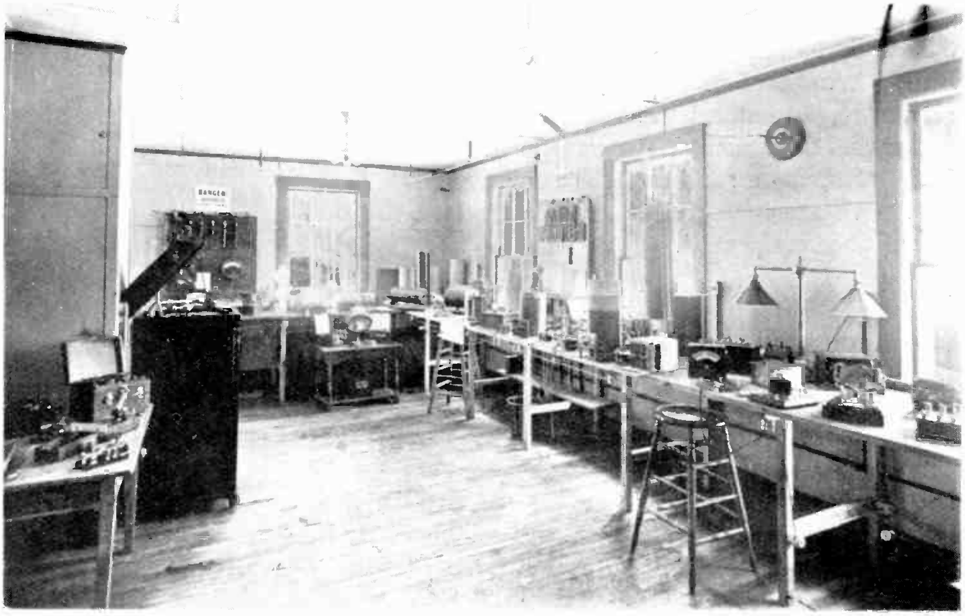


Photo: Frank C. Perkins.

INTERIOR OF THE RADIO RESEARCH LABORATORY AT TUFT'S COLLEGE, MASS.

An American Wireless Laboratory

Radio Research in Massachusetts

By FRANK C. PERKINS.

THE accompanying illustrations show the wireless equipment of the American Radio Research Laboratory at Tuft's College, Mass. In these photographs may be seen the electrical instruments in the wireless laboratory as well as the antenna machine-shop and one of the experimental rooms.

It is of interest to note that the American Radio and Research Laboratory had its beginning in the Tuft's Wireless Society founded at Tuft's College, 1910, and under the guidance of its president, Mr. H. J. Power, and its secretary, Mr. J. A. Prentiss, the society made rapid progress in the field of space telegraphy.

It was while associated with the wireless society that the promoters first realised the need of systematic research work in the development of radio-telegraphy and telephony. In order to undertake the solution of the existent problems of the science a new plant has been erected consisting of a 304-foot steel tower and a cement laboratory building. The tower supports an aerial of the umbrella type made up of 6,500 feet of phosphor-bronze wire, the whole being insulated to stand a working strain of 20,000 volts. An extremely good ground connection is obtained from 12,000 feet of copper wire buried in radial trenches over the entire tract of land.

It will be seen that facilities are thus provided for practical experimenting and

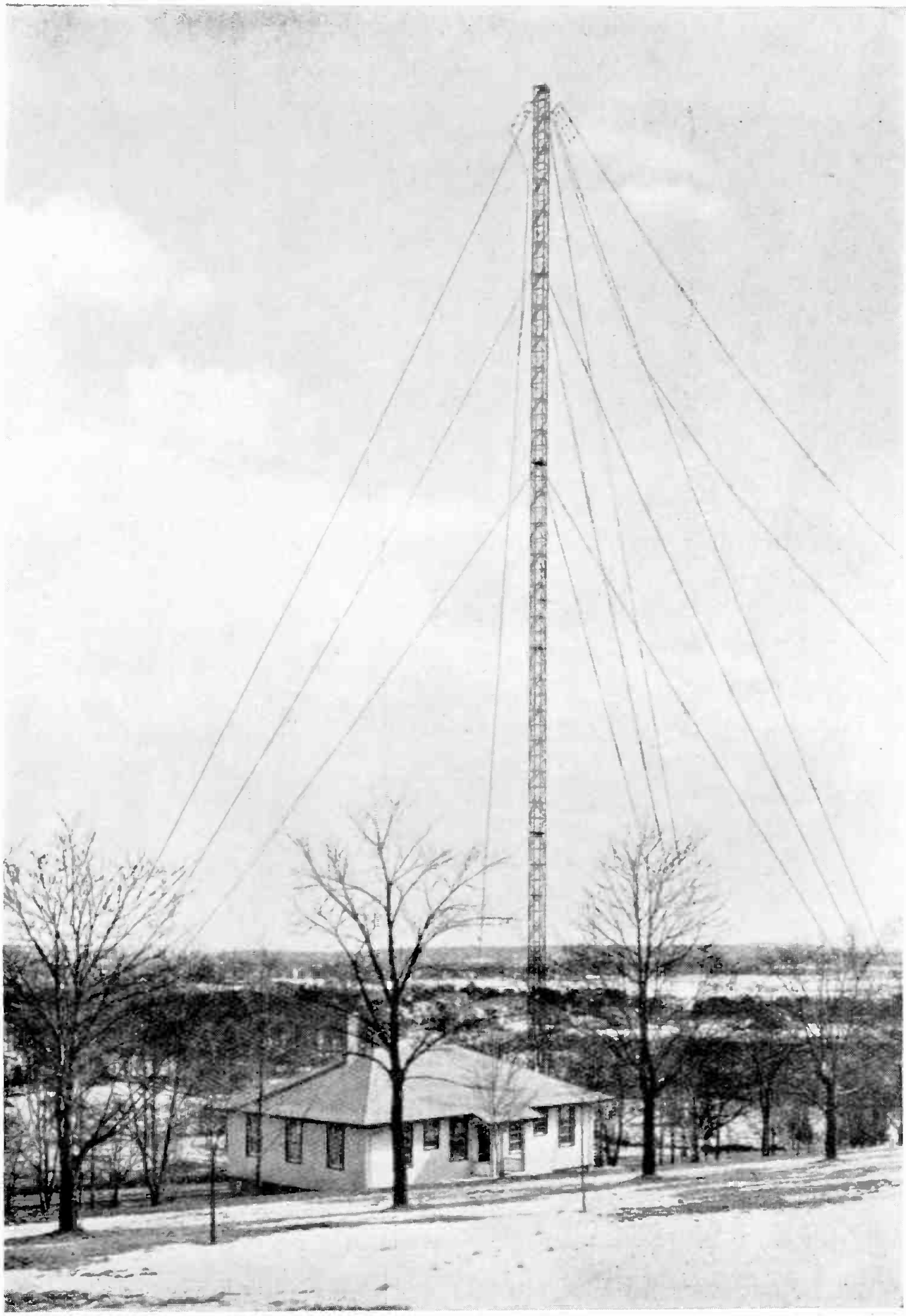


Photo: Frank C. Perkins.

THE AMERICAN RADIO RESEARCH LABORATORY AT TUFT'S COLLEGE, MASS.

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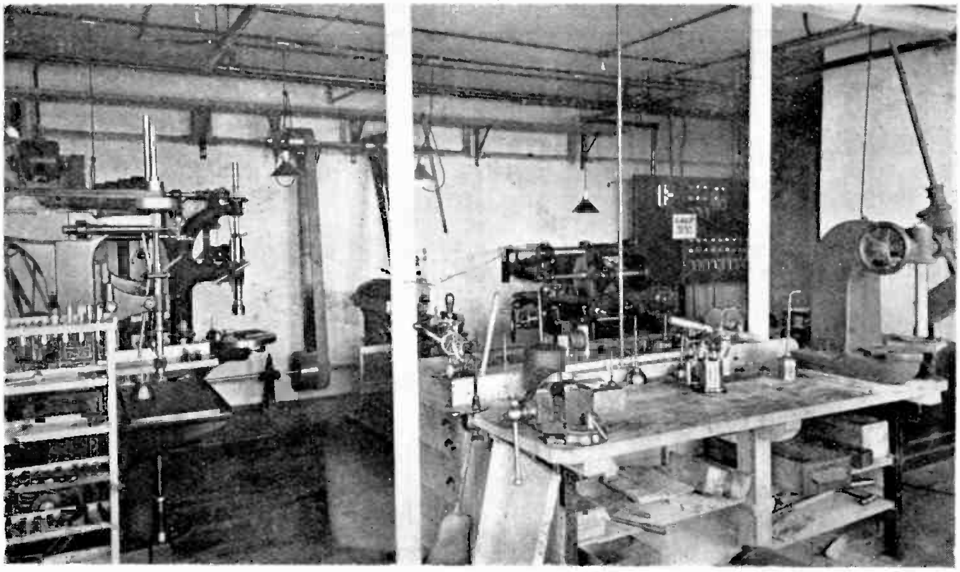


Photo: Frank C. Perkins.

INTERIOR OF THE WORKSHOP, TUFT'S COLLEGE RADIO LABORATORY.

testing of apparatus. The building is supported on a foundation as heavy as that of a five-storey building, giving great rigidity, enabling the performance of very accurate work. The building combines a research laboratory equipped with the latest type of precision meters and galvanometers with a finely-appointed machine shop furnished with machinery and tools of every kind and description.

Instructional Articles

Important Announcement.

WITH the present issue the series of Instructional Articles on Mathematics comes to a close after running through eighteen numbers of our magazine. These articles have proved exceedingly popular, and a large number of appreciative letters have been received from readers, who found in the lessons a clear explanation of many of the points of difficulty which had arisen in their wireless studies. We are now pleased to be able to announce that in due course these articles will be reprinted in amplified form as one of the standard text-books in the excellent student series of which *The Elementary Principles of Wireless Telegraphy*, *Handbook of Technical Instruction for Wireless Telegraphists*, and *The Wireless Transmission of Photographs* have already been published. Further announcements on this subject will be made at a later date.

A new series of Instructional Articles will be announced next month.

Foreign and Colonial Notes

COLUMBIA.

IT is reported that the two Marconi outfits purchased by the Columbian Government some time ago will be delivered soon. It is intended to establish these two stations at Arauca and Orocue. The former is situated on the Arauca River, where it forms the boundary between Columbia and Venezuela, and the latter is on the Meta River, some 200 miles east of Bogota.

* * * * * *

NEW ZEALAND.

Wireless weather forecasts, which were discontinued at the commencement of the war, says the Secretary of the Marine Department, have been resumed during the year, and are sent out through the radio stations at Awanui, Wellington, and Awarua on the usual reporting nights, and at other times when deemed necessary. A daily wireless weather report was authorised from the Chatham Islands wireless station and commenced on April 8th, 1915; it has been maintained without a single break. Part of this message is also transmitted by cable to the Commonwealth Weather Bureau for research purposes. Forecasts are also occasionally transmitted to the Chatham Islands, for which a small charge is made by the Post Office, but usually the Wellington forecast suffices. Macquarie Island radio station was closed on October 14th, 1915. Since it was opened by Sir Douglas Mawson it has done very good work indeed and is one of the most notable researches in meteorology of the day. Since Sir Douglas Mawson sold the establishment to the Australian Government the New Zealand Government has contributed £500 per annum towards its upkeep, mainly the research into Antarctic conditions, and to link up with the Imperial Antarctic Expedition still in the South. It has also proved a valuable aid in forecasting in dealing with westerly storm areas. Some valuable records from the island were lost in the s.s. *Endeavour*, but there is much scope for research work upon the records which remain. The records were not entirely lost, for they had been partly transmitted by wireless before the originals were removed.—*Evening Post, Wellington.*

* * * * * *

NORWAY.

It is stated that a harbour is being constructed and a wireless telegraph station is being built in connection with the State coal mining operations which have been commenced in the newly discovered mines on Bjeerneoen (Bear Island), between Spitsbergen and the northern point of Norway.

* * * * * *

PORTO RICO.

The wireless station at Ensenada, Porto Rico, gives notice that it will not accept messages which refer in any manner whatever to movements of any class of merchant ships belonging to belligerent countries, or sailing under belligerent flags, and that messages referring to merchant ships of other than belligerent countries will not be accepted unless the nationality is stated.—*Telegraph and Telephone Age.*

SOLOMON ISLANDS.

Wireless communication from Australia has been opened with Tulagi (inland near the coast of the Island Florida in the Solomon Group) and with Ocean Island (Gilbert Islands). This is another step forward in linking up all the islands in the Pacific with the mainland and soon the romantic isolation of this part of the world will be completely swept away.

* * * * * *

UNITED STATES.

The Government has put a Navy officer on duty in the wireless station of the *New York Herald* at the Battery in New York City, with instructions to prevent the use of that station for sending unneutral messages to vessels at sea. This action resulted from the interception by the Brooklyn Navy Yard of a message sent out by the *Herald* wireless station to ships at sea reporting that the German submarine *U* 53 was operating off the Nantucket Lightship.—*Telegraph and Telephone Age.*

* * * * * *

The Drainage Board, Sanitary District of Chicago, has authorised an expenditure not to exceed $4,000 for the installation of wireless telephones at the generating station at Lockport and the receiving station in Chicago. The energy from Lockport is transmitted to Chicago, 32 miles distant, over a twin-circuit transmission line of steel towers at 44,000 volts. At certain seasons of the year lightning is extremely severe, putting the telephone system out of commission. It is to overcome this difficulty—namely, to permit communication between the two stations when most needed—that wireless telephones are to be installed.—*Electrical World.*

* * * * * *

According to the *Electrical Experimenter*, in order to facilitate the technical work of determining the exact latitude and longitude of the City of Oakland's new observatory, which must be known as a base for all future observations, Mr. G. V. Tudhope was requested to provide radio apparatus so that the time signals from the United States radio station at Mare Island, some 25 miles distant, could be received and used as an aid in these and other observations.

The large dome of the observatory is constructed of sheet metal and made to revolve upon an iron track, about 45 feet above the ground, by flexible steel cables driven by an electric motor on the first floor. Having noted that the dome, motor and steel cables were sufficiently insulated from the ground by the plaster boarded frame walls and wooden floors, and not wishing to mar the scenic beauty of the observatory and its surroundings by the erection of a radio mast, the metal dome of the observatory was used as the antenna. An ordinary two-slide tuning coil with silicon detector, small condenser, and 2,000 ohm receivers, were connected in the regular way to the steel cables leading in from the dome and to a 1-inch galvanised iron pipe driven about 8 feet into the ground, with the result that the radio time signals came in sufficiently clear and loud enough to be heard 2 feet from the receiver.

Professor Charles Burckhalter, Director of the Observatory, is an ardent advocate of radio receiving sets as permanent fixtures in all places where astronomical observations are made.

UNIFORM SUIT

BRIDGE COAT

MESS SUIT

PATROL SUIT

Remarkable long-distance transmission by amateurs appears to be common in the State of Wisconsin, says the *Scientific American*. Recently E. H. Hartnell, an amateur of Salem, was able to work 75 miles either day or night with a 3-inch spark coil consuming 24 watts. Previous to this time the amateurs of California were looked upon as having a monopoly on long-distance transmission and reception with ordinary apparatus.

* * * * * *

Completion of San Diego station marks the welding of the third link in a chain of five wireless stations for the United States Navy, extending from Washington, D.C., to Cavite, P.I., *via* the Canal Zone, Panama. The new station has three towers each 600 feet high, and it is to operate in conjunction with the two stations already in service at Washington and Panama, and with the proposed station at Pearl Harbour, Honolulu. The latter, when realised, will connect the Philippines with the United States.

* * * * * *

President Wilson was steaming up New York Bay in the yacht *Mayflower* when he received confirmation of his re-election. It reached him in the form of a congratulatory wireless message from his secretary, Joseph P. Tumulty, who was in Long Branch, N.J.

Mr. Tumulty had told the President he would not congratulate him until it was definitely known that he was elected. When the result was no longer in doubt, he sent the news by wireless.

* * * * * *

R. R. Buck, navy radio operator on the Diamond Shoal lightship, was taken suddenly ill recently and sent out a wireless call for help. The destroyer *Cushing* was sent from the Norfolk navy yard with a physician and a substitute operator.—*Telegraph and Telephone Age*.

* * * * * *

On Saturday night, December 2nd, the Statue of Liberty was permanently flood-lighted at a wireless signal from President Wilson, who had come to New York for the ceremonies.—*Electrical World*.

* * * * * *

WEST AFRICA.

A wireless station has been erected on Cape Juby, on the African coast. It will be available for ships in distress. It is about 100 miles from the station on Teneriffe island.

R.M.S.P. Pocket Diary

THE Royal Mail Steam Packet Company, of London, have again issued their customary Pocket Diary.

This year it contains four photogravures from paintings by Charles Dixon, R.I., of the company's vessels in the service of the Government from the Crimean War of 1854 to the present conflict.

Instructional Article

NEW SERIES (No. 18).

The following series, of which the article below forms the eighteenth part, is designed to provide wireless telegraphists, amateurs, and technical students generally, with clear and precise instruction in technical mathematics, in order that they may be enabled to read and understand the more advanced technical articles which appear from time to time

110. In a given circle to draw any number of circles touching one another and also touching the containing circle.

First divide the circumference of the given circle (Fig. 100) into as many equal parts as there are to be contained circles (in this case three). This can be done by using the construction of Fig. 95. Let *A*, *B* and *C* be the points of division, and let *O* be the centre of the circle.

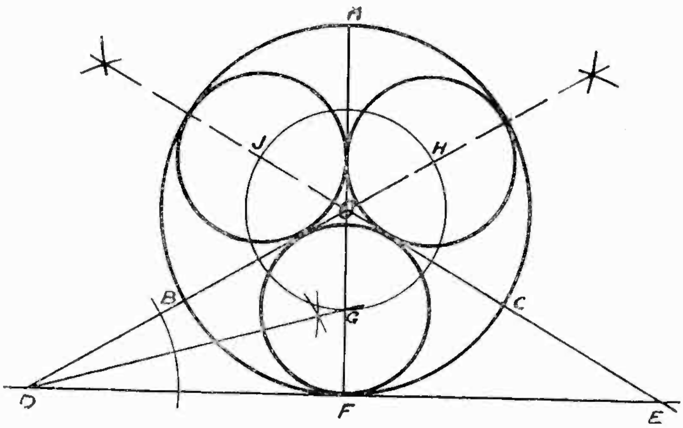


FIG. 100.

Draw the three radii, *OA*, *OB* and *OC*.

Bisect the angle *BOC* with the radius *OF*, and at *F* draw a tangent to the circle (which *must* be at right angles to *OF*), this tangent cutting *OB*, produced, and *OC*, produced at *D* and *E* respectively.

The problem now resolves itself into inscribing a circle in the triangle *ODE*, and then reproducing this circle in each of the other sectors of the big circle—*AOB* and *AOC*.

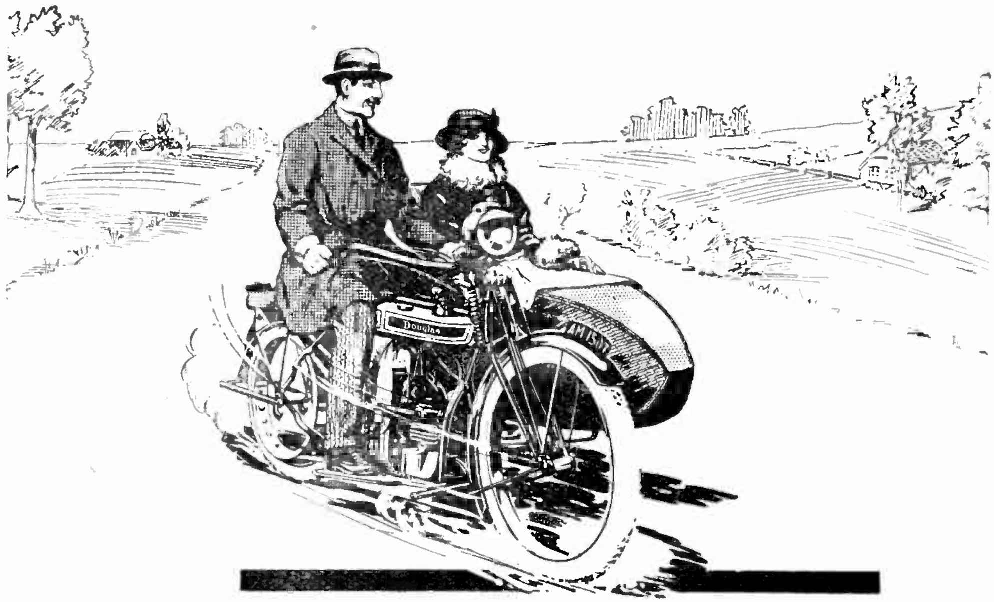
Therefore bisect the angle *ODE* with the line *DG*, cutting *OF* at *G*. Then *G* will be the centre and *GF* the radius of the first of the required circles.

To obtain the centres of the other circles draw a circle *GHJ*, with centre *O*, and radius *OG*, and bisect the angles *AOB* and *AOC* with the lines *OJ* and *OH*. Then *J* and *H* will be the centres of the other circles, the radii being, of course, the same as that of the first circle.

111. About a given circle to draw six equal circles touching one another and the given circle.

This is a very simple problem.

From centre *O* of the given circle (Fig. 101), draw any convenient radius *OA*. Produce *OA* to *B*, making *AB* equal to *OA*. With centre *O* and radius *OB* draw a second circle.



Divide the circumference of this outer circle into six equal parts, and from each point of division draw a circle with a radius equal to OA.

Fig. 100 and Fig. 101 show the cross-section of cables consisting, respectively, of three strands and seven strands.

It will be noticed that in seven-stranded cable there will be the same central strand along the whole length of the cable, the other six strands being coiled side by side round it. As the outer strands have a twist, we see that the central strand will be shorter than the others, all the latter being of equal length (for a straight length of cable).

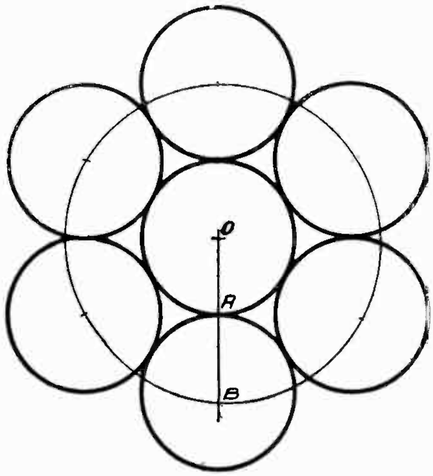
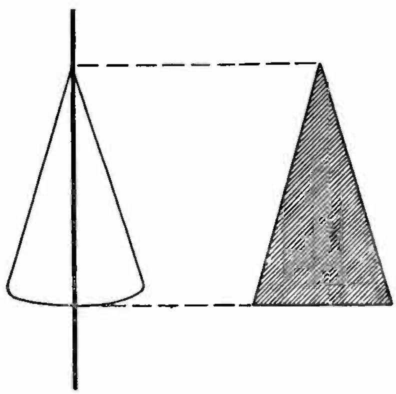
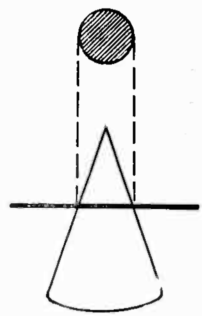


FIG. 101.

Another point is this : if the frequency is high enough (as in wireless) the current will not penetrate into the inner conductor at all, and so the central strand is just so much waste copper. Copper being expensive, it will be cheaper to wind the six outer strands (or any other number) round some non-conducting core, the latter being made of any cheap — and suitable — material.



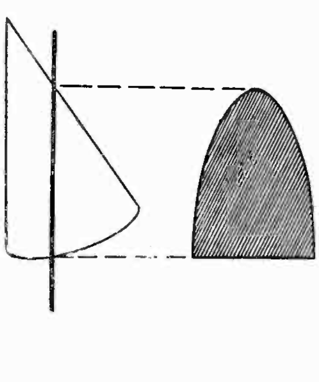


CONIC SECTIONS.

112. By the term conic section we mean the sectional shape obtained when a cone is cut by a plane. Five general forms are obtained in this manner :—

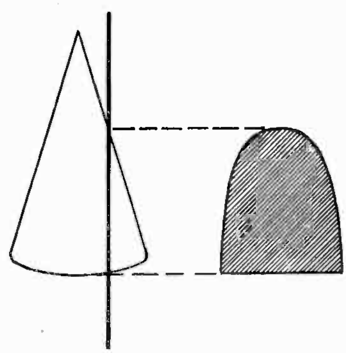
(1) *A Triangle,* when the plane cuts the cone along its axis.

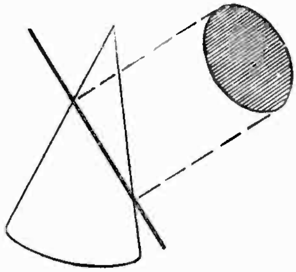
(2) *A Circle,* when the plane cuts the cone perpendicular to its axis.



(3) *A Parabola,* when the plane cuts the cone parallel to one side.

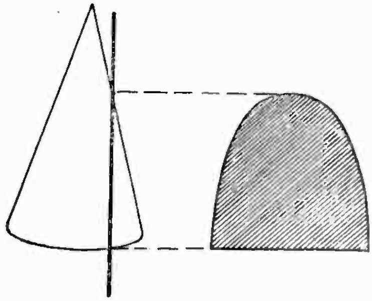
(4) *A Hyperbola,* when the plane cuts the cone either perpendicular to its base or else





inclined to the axis at a smaller angle than the side of the cone.

(5) *An Ellipse*, when the plane cuts the cone obliquely, and without cutting the base.



The complete study of these latter curves would carry us far beyond the scope of these articles, and so all that will be given here will be a few methods for drawing them.

113. *Parabola.*—In Fig. 102 is shown the construction of a parabola on the base *AB*, and with the axis *CD*.

First complete the rectangle, *ABEF*. Then divide both *AC* and *AF* into the *same number* of equal parts—in this case six—numbering the points of division from *A*, as shown.

Through each point of division on *AC* erect perpendiculars, and join *D* to each point of division along *AF*. The points of intersection of correspondingly numbered lines will be points on the required parabola, and a fair curve drawn through them will give one half of the parabola. The other half is obtained in the same way.

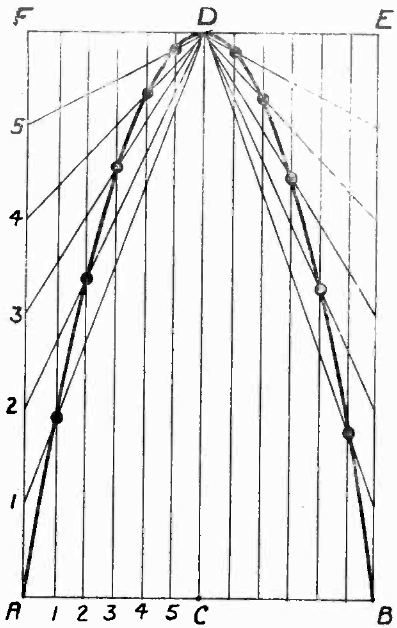


FIG. 102.

114. *Hyperbola.* — The most useful form of this curve is the *rectangular hyperbola*, the construction of which is shown in Fig. 103.

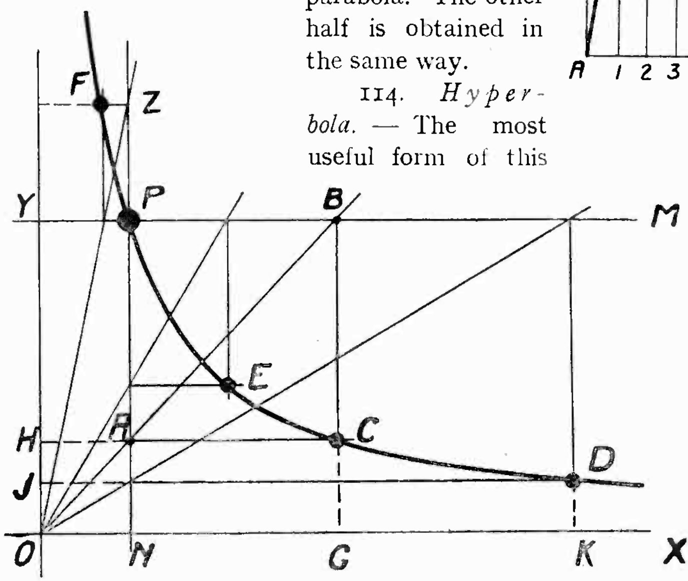


FIG. 103.

In this figure, *OX* and *OY* are the two perpendicular containing axes, and *P* is a known point on the hyperbola. Through *P* draw *ZN* parallel to *OY* and *YM* parallel to *OX*.

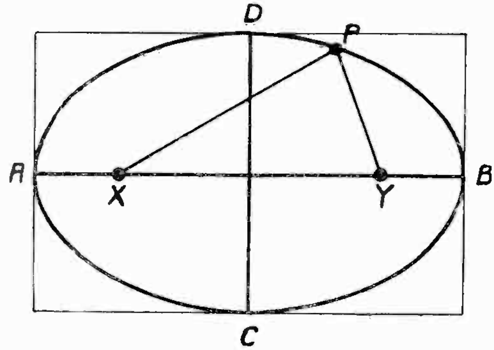


FIG. 104.

Then from O draw any line, OB, cutting ZN at A and YM at B. A perpendicular from B cuts a horizontal from A at C, where C is a second point on the hyperbola. In the same way the points D, E and F are found, and when we have sufficient points it only remains to draw a fair curve through them, as shown.

This curve has two simple properties—

(*a*) It is *tangential* to OX and OY—*i.e.*, if extended in both directions it will gradually approach, but never cut, these lines.

(*b*) If we take any point on the hyperbola, and complete a rectangle by using parts of OX and OY as two sides, O and the point taken being opposite corners; then, wherever we take this point, the area of this rectangle has the same value. Referring to Fig. 103, we can write—

$$OH \times OG = OY \times ON = OJ \times OK = \ldots$$

115. *Ellipse.*—An ellipse has two unequal diameters—AB and CD (Fig. 104)—perpendicular to one another. The longer diameter, AB, is known as the *major axis*, and the shorter diameter, CD, as the *minor axis*.

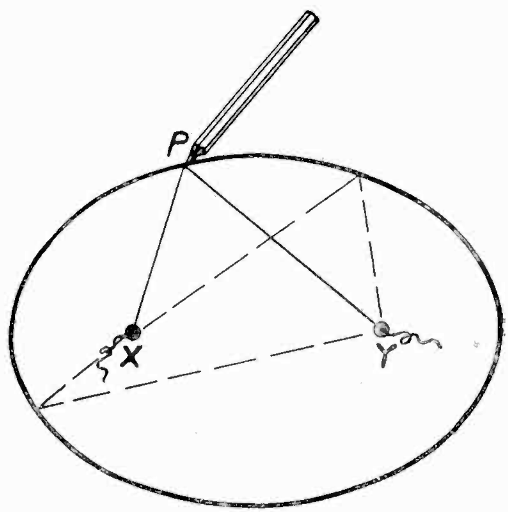


FIG. 105.

There are two points—X and Y—on the major axis, known as the *foci* of an ellipse. These are such that if any point, P, be taken on the circumference of the ellipse, then the sum of the radii, $PX + PY$, will be a constant quantity for any position of P.

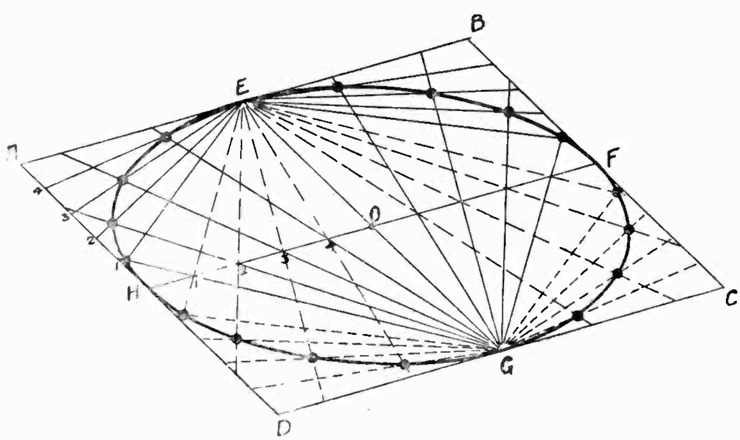


FIG. 106.

This property gives us the simplest method of drawing an ellipse: select two foci, *X* and *Y* (Fig. 105), and fasten a piece of string, *XPY*, of convenient length to pins at *X* and *Y*. Place the point of a pencil in the loop so formed and move it round, keeping the string taut. The pencil will trace out an ellipse.

Another method is similar to that used for a parabola.

In Fig. 106 we have a parallelogram, *ABCD*; this can be a rectangle if required. Each side of the parallelogram is bisected, and the points *E*, *F*, *G* and *H* so obtained are joined across as shown, thus subdividing the parallelogram into four equal parallelograms. Let *O* be the centre of the figure. *OH* and *HA* are divided into the same number of equal parts (in this case four), and the points of sub-division are numbered from *H* in each case.

E is joined to each point along *HA*, and *G* to each point along *HO*. The latter lines are produced to cut the former, and the points where correspondingly numbered lines cut will be points on the required ellipse.

In the same way the remaining parts of the ellipse can be constructed.

EDITORIAL NOTE.—*This concludes the present series of Instructional Articles. An announcement regarding a new series will appear next month.*

Wireless in the Tropics

With the Rhodesians in German East Africa

Photo: Topical.

This photograph shows a field wireless outfit with mast, aerial, and receiving and transmitting apparatus. This outfit was of long range and enabled the column to keep in touch with Brigadier General Northey in command of the southern forces.

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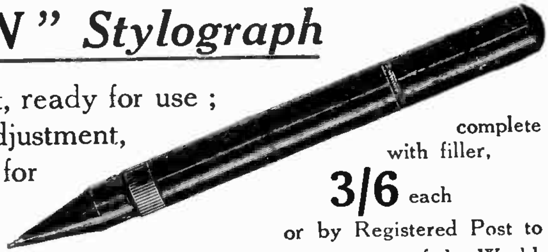

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Arrangements have recently been made whereby special facilities are now available for obtaining practical instruction at a small cost for Officers in H.M. Forces desirous of becoming acquainted with Wireless and Field Signalling Apparatus; also for giving Morse Sounder and Buzzer practice either during the day time or evening to those wishing to learn or to improve their knowledge of the Morse Code.

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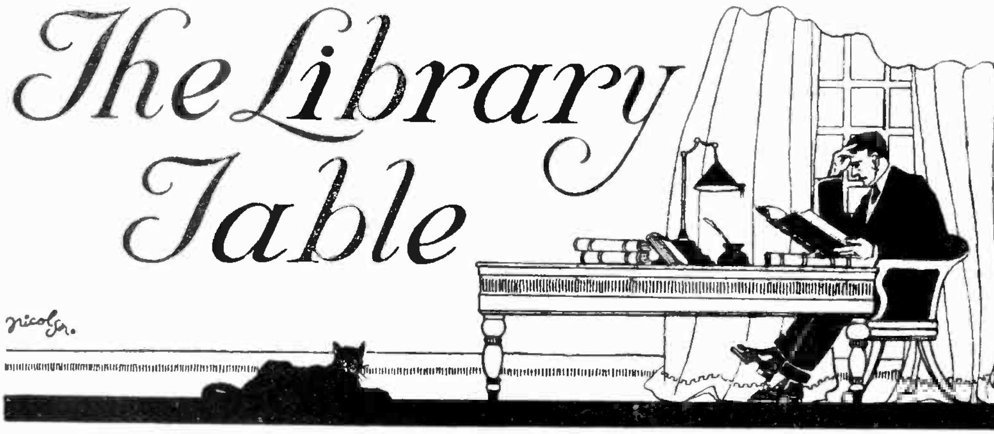

" AN OUTLINE OF THEOSOPHY." By C. W. Leadbeater. London : The Theosophical Publishing Society. 1916.

The doctrine of Theosophy contains some beautiful truths, some spurious science and a fair quantity of utter nonsense. Perhaps we shall not be far wrong if we define it as an attempt to gather together the main points of all religions and creeds (not excluding spiritualism) and then to apply to them some of the American ideas of efficiency. In an attempt to explain everything it makes little appeal to the average man, who consciously or unconsciously feels that if the system of the universe is brought within his own limited comprehension it must be a very poor thing indeed. This little book explains as well as any we have seen the faith of the Theosophists, and in perusing it very carefully we are only confirmed in our previous ideas. It is crammed full of definite assertions with nothing to back up, and when the author seems to have a doubt as to whether his readers will believe them, he makes such statements as that found on page 36, when, in referring to certain points, he says : " Once more we must repeat that all this is by no means " metaphysical speculation or pious opinion, but definite scientific fact thoroughly " well known experimentally to those who have studied Theosophy." This statement is made in connection with the previous paragraph, which contains the following assertion : " It might be said that there exist around us a series of worlds one " within the other (by interpenetration) and that man possesses a body for each of " these worlds, by means of which he may observe it and live in it." If this is a " definite scientific fact thoroughly well known experimentally " to Mr. Leadbeater and his fellow Theosophists, it is rather strange that some kind of convincing evidence on the point is not included in this book.

There is a great deal of talk in the little volume regarding " vibrations." Thus, on page 10 we find the following extraordinary statement : " The whole scheme will " be found fully explained in other theosophical works ; for the moment let it " suffice to say that it is entirely a question of vibration. All information which " reaches a man from the world without reaches a man by means of vibration of " some sort, whether it be through the senses of sight, hearing or touch. Consequently if a man is able to make himself sensitive to additional vibrations, he will " acquire additional information, and he will become what is commonly called a " clairvoyant."

On page 38 we find some more pseudo-scientific announcements: "Recollect "that all matter is in essence the same. Astral matter does not differ in its nature "from physical matter, any more than ice differs in its nature from steam. It is "simply the same thing in a different condition. Physical matter may become "astral or astral may become mental, if only it be sufficiently sub-divided, and "caused to vibrate with the proper degree of rapidity." And again, a little farther on: "The appointed method for the evolution of the man's latent qualities seems "to be by learning to vibrate in response to impacts from without." Mr. Leadbeater and his fellow-disciples may be vibrating at a very high frequency quite comfortably, but we think most people would require a far more forcible shaking up than this book would give them before they abandoned their present ideas of life and hereafter.

* * * * * *

"SPONS' ELECTRICAL POCKET BOOK." By Walter H. Molesworth, M.I.E.E., M.I.M.E. London: E. & F. N. Spon, Ltd. 6s. net.

This collection of general electrical information, formulæ and tables for practical engineers, brought together in the form of an excellent pocket book by Mr. Walter H. Molesworth, will be welcomed wherever the need for such information is felt. Great care has been exercised in the selection of the material, and the author has wisely confined himself to those subjects which can be adequately dealt with within the confines of a handy book. For this reason we find no reference to telegraphy, telephony, and special branches of electricity, and many of the lengthy mathematical tables which add so much to the bulk of many so-called pocket-books will here be sought in vain.

It must not be thought, however, that the book suffers through the omission of these points. Quite the reverse is the case. With adequate space to deal with matters of importance the author is able to produce a volume which can be truly termed indispensable.

The many illustrations which elucidate the text are clearly drawn and excellently reproduced. As an example, nothing could be clearer than the manner in which details of electric railways, and the methods of support of catenary wires are explained in the section devoted to railways. The illustrations of electric locomotives of various types are particularly praiseworthy. Electric traction occupies a considerable portion of the bcok, and the matter relating thereto is thoroughly up to date.

The wireless man will turn with interest to the section devoted to alternating current circuits, generators, motors, etc., and will find the notes on transformers not without value. Altogether this book is well written and excellently produced. We have no doubt that it will rapidly find its place on the bookshelves of all practical engineers.

* * * * * *

"THE ELEMENTS OF ENGINEERING DRAWING." By E. Rowarth, A.M.I.E.E London: Methuen & Co., Ltd. 3s. net.

This book will be found very useful to students who are taking preliminary engineering courses in junior technical institutes. It should also appeal to operators who wish to learn how to draw their apparatus—and any improvements which may occur to them—in the best and clearest fashion. Commencing with a few notes on equipment, the author explains certain geometrical constructions which

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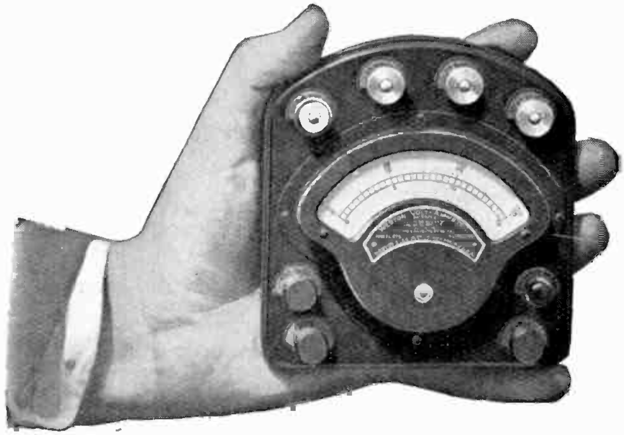

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it is necessary that the student should understand before proceeding to more advanced work. In this section of the book the left-hand page of every opening is utilised for illustrations. Section 2 is given up to the study of orthographic projection and section 3 to a detailed consideration of the manner of drawing nuts, bolts, etc. Too much attention cannot be given to details of this sort, for, as the author says, unless they are carefully drawn with a moderate degree of accuracy the appearance of a drawing will be offensive to the eye of an engineer. In section 4 the more difficult work is described.

By carefully following out the instructions given in this book the student should make very good progress in what is certainly one of the most important branches of engineering study. There appears to be no superfluous matter and a great deal of real technical information is condensed in a small space. It should be mentioned that the exceptionally thick paper on which the book is printed makes it appear to contain much more matter than is actually the case.

* * * * * *

"THE COCONUT PLANTER." By D. Egerton Jones. London: Cassell & Co., Ltd. 6s.

When, in a novel, we find the heroine under the erroneous impression that she is a widow, and when, furthermore, she sets off from Australia to a Pacific Island on a steamer where at least one of the officers is handsome and fascinating, we know that something is sure to happen.

Sunny Shale, who is supposed to tell the story in the book before us, is a vivacious, excitable girl who had secretly married a wireless operator just prior to his departure for a distant wireless station in the Pacific. In this case, it seems, absence did not make the heart grow fonder, for Terry, the operator in question, wrote fewer and fewer letters to his wife as time went on, until at last the correspondence ceased entirely and a laconic message soon afterwards announces his death.

We should spoil the interest of the story for our readers if we were to tell how, thinking her husband was dead, the girl set forth from Australia to earn her living as a coconut planter on one of the islands in the Pacific and how, later, she suddenly became aware that her husband was still alive.

The characters in the book are clearly drawn and there is plenty of excitement for all who love a breezy, modern novel. Wireless crops up here and there, and several of the passages referring to this form of communication indicate that the author, unlike so many novelists, is not unacquainted with its technique. As a means of whiling away the hours off watch, or some idle time in port, this book can be confidently recommended.

Share Market Report

LONDON, *January 15th*, 1917.

Business has been very quiet in the Share Market during the past month, but there has been a considerable demand for all the issues by small investors.

Prices as we go to press are: Marconi Ordinary, £2 13s. 9d.; Marconi Preference, £2 5s.; Marconi International Marine, £1 19s. 6d.; American Marconi, 15s. 6d.; Canadian Marconi, 9s.; Spanish and General Wireless Trust, 9s. 6d.

Personal Notes

Mr. N. M. MacLachlan, whose biography and portrait appeared in our December issue, has now obtained the degree of Doctor of Science.

* * * * * *

We learn from the *London Gazette* that the King has been pleased to give orders for the publication of the names of Wireless Telegraph Operator R. C. Older and Wireless Telegraph Operator John Rea, in the *London Gazette*, as having received an expression of commendation for their services. We heartily congratulate these gentlemen on the honour they have received. Some notes regarding Messrs. Older and Rea have already appeared in our pages. Mr. Older was referred to "Among the Operators" for June last, and the story of Mr. Rea's adventure appeared in our issue for August, 1915.

* * * * * *

Members of Marconi's Wireless Telegraph Company, Limited, will deeply regret to learn that Mr. Arthur E. Johns died on December 17th, after a comparatively short illness. He was compelled to give up his duties in the Anti-Aircraft Corps last October, owing to ill-health. Probably the night duty last winter started his illness, which developed into an affection of the lungs.

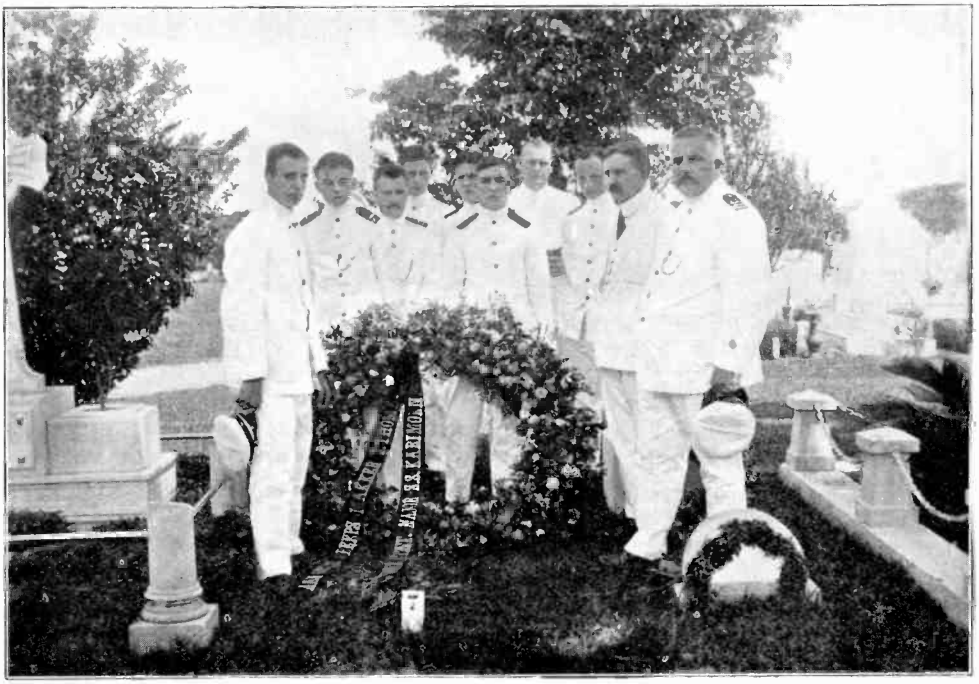
* * * * * *

Señor Enrico Perez, editor of *El Marconigrama* and *O Marconigrama* (the Spanish and Portuguese editions of The Wireless World), will lecture at the King's College. London, at 5.15 p.m. on February 15th, on "England's Political and Economical Influence on Latin America." Señor Perez, who is intimately acquainted with all matters pertaining to the political evolution of Latin America, is giving this lecture by special request of Dr. Burrows, Principal at the College. Tickets may be obtained on application to the Secretary, King's College, London, W.C.

* * * * *

The first graduate of the Canadian Company's School of Instruction obtained his Government Certificate on November 20th and was immediately assigned to ship duty. Mr. Begin (not an inappropriate name for the holder of diploma number one !) is now on a three months' voyage, which should provide all the excitement he expressed himself as being so anxious to encounter.

MR. BEGIN.



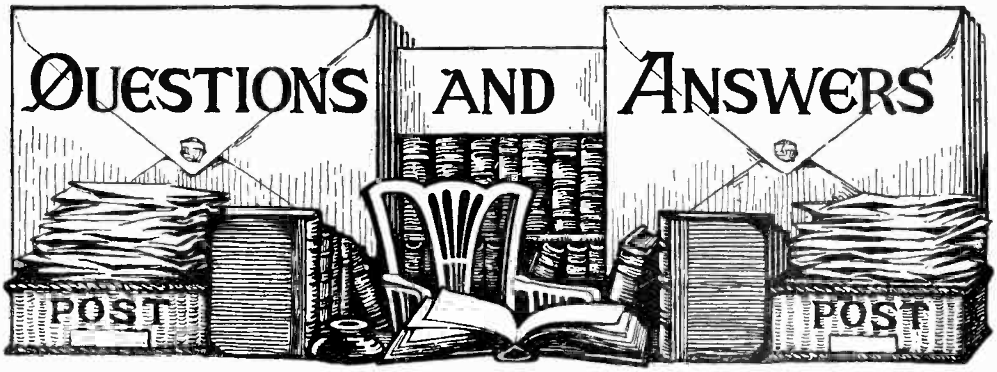
THE GRAVE OF THE LATE OPERATOR THOMA.

Wireless Operators in the Société Anonyme Internationale Télégraphie Sans Fil are deeply grieved at the loss of their confrère, T. Thoma, who died of dysentery at Manila last year. At the time of his illness Mr. Thoma, who was a native of Holland, was the wireless operator in charge of the Netherlands steamer *Karinaen*. The photograph, which we reproduce on this page, shows the grave of the late Mr. Thoma at Manila. The late operator's fellow officers are seen standing by the grave with a wreath presented by the ship's company. The late Mr. Thoma is seen in the small photograph.

* * * * *

Mr. W. A. Winterbottom has been appointed Division Superintendent of the Pacific Coast Division of the Marconi Wireless Telegraph Company of America, with headquarters at San Francisco. Mr. T. M. Stevens, who has been appointed Marine Superintendent of the same Company at San Francisco, will have charge of all matters pertaining to the operation of Coast Stations, including personnel in the Marine Service. Mr. M. E. Morris has been appointed Superintendent of the Southern Division, with headquarters at Baltimore, in the place of Mr. T. M. Stevens, who has transferred to the position above mentioned.

THE LATE MR. THOMA.



Readers are invited to send questions on technical and general problems that arise in the course of their work or in their study to the Editor, THE WIRELESS WORLD, *Marconi House, Strand, London, W.C. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered; and it must be clearly understood that owing to the Defence of the Realm Act we are totally unable to answer any questions on the construction of apparatus during the present emergency.*

POSITIVELY NO QUESTIONS ANSWERED BY POST.

NOTE.—*In view of the large number of questions which now reach us from readers, we regret that we cannot undertake always to answer queries in the next issue following the receipt of letters. Every endeavour will be made to publish answers expeditiously.*

T. C. H. (Herne Hill).—Apply to Officer-in-Charge, Royal Naval Air Service, Wireless Section, Wormwood Scrubbs.

C. W. (Devonport).—See our article entitled "Operating in the Marine Service" in the January issue.

E. W. J. (Broadstairs) inquires the cost of entering the Marconi Company's service after the Postmaster-General's Certificate has been obtained. As this is a matter which interests a large number of our readers, we give a few notes on the subject herewith. It is impossible to say in so many pounds, shillings and pence how much an operator must spend after obtaining his P.M.G. Certificate, as much depends upon the demand for operators at the time. Provided there is a vacancy and the applicant is asked to call for a test at Marconi House, there will be first of all the travelling expenses to London, and, if he comes from a distant part, the cost of stopping in town for the night. If he is accepted there will be one guinea for the doctor's fee, the cost of the uniform and outfit, and the cost of living in London until he has completed his finishing course in the Marconi School. With the present demand for operators a man with a Postmaster-General's Certificate is most unlikely to stop in London more than a week, or ten days at the very outside, before appointment to a ship, and frequently the period is much shorter than this. The cost of board and lodging in London varies, and depends, of course, entirely upon the student's tastes. It should be remembered that while he is in the school the student will receive a salary of £1 per week, which will go towards his expenses.

SPARKS (R.F.C.).—We cannot give any information regarding wave-lengths or details of circuits for reception during the present restrictions.

H. H. (B.E.F.).—It is not possible to pass the Postmaster-General's Examination by postal tuition alone. A great deal may be learnt by correspondence and, provided the lessons are carefully followed, enough theory should be acquired to pass the theoretical test. Actual handling of the apparatus, however, is absolutely essential before going in for the examination, and the time taken to acquire this part of the knowledge depends entirely upon the student's abilities. If you were thoroughly acquainted with theory telegraphy and the reception of signals in the telephone headpiece it is possible that practical instruction for two or three weeks might enable you to pass; but we are inclined to think that this is the very shortest period in which it could be accomplished. If this answer should meet the eye of a student who has studied wireless by correspondence and passed the P.M.G. Examination after a shorter period of practical instruction than this, we should be glad if he would write and give us particulars.

A. W. J. (Aberavon) asks what is the highest wage obtainable as a Marconi operator and what is the average wage paid by the Telefunken Company to their operators. In reply to the first question, in peace times the highest wage obtainable by a sea-going operator who does not hold some other post as well, such as travelling inspector, is £2 15s. per week, with all found on board ship. It is not possible to

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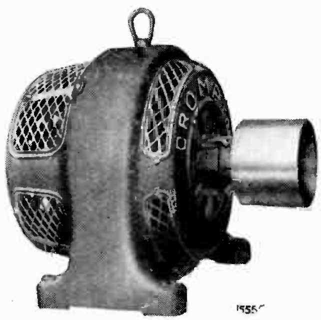

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state the highest wage paid to a land station operator, as this depends entirely upon the locality of the station and the man's experience and skill. We cannot give any particulars of wages paid to the Telefunken Company's operators, the German mercantile fleet being conspicuous by its absence at the present time.

A. B. (Killamarsh).—You will find all your questions answered in the article in our January number entitled "Operating in the Marine Service."

M. H. I. (Chelmsford).—Your question being of a constructional nature cannot be answered at the present time.

S. A. (Mullingar).—The explanations regarding "phase" and "angle of lag and lead," given in *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett, should be quite sufficient to make the matter clear to you. Have you studied the first part of the book carefully? We would advise you to read through the explanations again, and if they are still not clear to you write to us again, stating exactly the points that present difficulty. It is not possible for us to deal with these matters in the "Questions and Answers" columns unless we know how far you understand the theory of alternating current. It is just possible that there may be a *Wireless Diary and Note Book* left by the time this issue is published, and if you apply at once you may be lucky enough to obtain one. There has been a tremendous demand for these useful books.

F. R. E. (Oban).—We are sorry to say that the fact that you have an artificial foot would debar you from employment in the marine operating service of the Marconi Company.

B. G. A. (B.E.F.) is another correspondent who asks questions on wave-lengths of stations, their programmes and their call letters, etc. All the stations he mentions are being used for war work by the countries to which they belong, and we are therefore unable to publish any information regarding them.

E. J. P. (R.F.C.) asks our opinion on a wireless system which he has devised. Briefly, it consists of a transmitter which can be made to radiate 26 different wave-lengths by means of as many keys, and a receiver with 26 tuned circuits to respond to the waves from the transmitter. Each tuned circuit of the receiver would be connected to a detector in circuit with a relay which would in turn operate a key like that of a typewriter or some device which would disclose a letter of the alphabet. Thus, if one depresses the letter A on the transmitter, the receiving circuit tuned to the particular wave-length would respond and mark A. The letter B would only operate the B circuit on the receiver, and so on with the rest of the alphabet. A system such as that described is open to a number of objections, the first of which is that no one station would be allowed to monopolise 26 wave-lengths for its transmission. Secondly, problems of interference and jambing would be 26 times as bad as they are now, which is a disadvantage not to be ignored, to say the least of it. Thirdly, atmospherics would probably operate all the letters of the alphabet at once; and fourthly, it would be possible to obtain precisely the same results by much simpler methods. There is at least one telegraph transmitter which has a typewriter keyboard and which automatically translates the signs into the Morse code as the keys are depressed. Similarly, there are receivers which translate signals of the Morse code into typewriting. These instruments can be adapted to wireless telegraphy in certain circumstances when it is thought advisable.

W. J. L. (B.E.F.).—Candidates for employment in the marine operating staff of the Marconi Company must not exceed 25 years in age, and this rule is rigidly adhered to. In reply to your second question, as you have Bangay's and Hawkhead's books, you have available all the theoretical information necessary for passing the Postmaster-General's Examination. It is difficult to recommend further books for study without knowing the extent of your knowledge. If you have not already a good knowledge of alternating current work, we would recommend you to purchase *Alternating Current Work*, by W. Perren Maycock (price 6s., post free 6s. 5d.). You should also study as many as possible of the technical articles which have appeared in our pages. They contain much practical information unobtainable elsewhere and are carefully chosen to meet the needs of such as yourself.

"JIGGER" (Tewkesbury).—We are not able to pass any opinion on the wireless course of the College you mention. We would suggest that you write and obtain particulars from several and choose the one which appears to you to be best.

"STATICA" (B.E.F.).—We do not think the effect you mention would be obtained if the apparatus was in proper order.—Are you quite sure that all the connections are tight? Many thanks for your kind wishes.

A. MACC. (Glasgow) sends us a number of questions of which we can answer only four owing to limitations of space. (1) If our correspondent will read carefully the article in our October issue entitled "Naval and Military Wireless Telegraphists," he will see that the wireless operators in the R.N.V.R. to whom he refers were normally civilian wireless operators. Prior to the war a number of these were in the service of the Marconi Company, and some have previously served on board ship. Others have had previous land station experience. We have not heard of any cases where they have been promoted to commissioned rank. (2) A wireless engineer is a man with a theoretical and practical knowledge of electrical engineering as applied to wireless telegraphy. Such men are chosen from applicants who have a practical electrical experience and are specially trained for their work by the company employing them. In most cases they have not previously been operators. (3) Usually the wireless apparatus on mercantile ships is owned by the Marconi Company, who also employs and pays the operator. In most cases the inspectors are employed by the Marconi Company, although the Government have some inspectors of their own. (4) The operators on board ship are under the control of the captain and must obey his instructions.

A. C. (Paris).—(1) There are a number of receiving circuits at the present time with which continuous waves can be received as a musical note without any tikker or tone wheel. The note given can be adjusted at will. In the diagram to which you refer the note given is that of the difference in frequency between the circuit composed of the inductance coupled to the aerial and the condenser shunted across it, and the circuit made up of the same inductance the lead through S, B, round to the plate, across from the plate to the grid, and through the condenser to the inductance again. Question 2. The total resistance of the two telephone receivers in series should, where possible, be equal to that of the detectors to which they are used. Crystal detectors vary considerably in their resistance. Thus the resistance of the zincite-bornite combination is much lower than that of some specimens of carborundum. Further, some carborundum crystals are of much higher resistance than others. The valve detector has a very high resistance and a total for the two receivers of 8,000 ohms is not too high in this case. Question 3. In certain receivers the aerial tuning inductance is placed at right angles to the coupling coil in order that there may not be any inductive effect between them. Question 4. The only advantage of the condenser C1 in your diagram is to make the secondary circuit a tuned one. When it is in place it forms with the coupling inductance and the stopping condenser a circuit which must be tuned to the frequency of the aerial. It should, therefore, be made variable. Thank you for setting out your questions so clearly.

"APOLOGY" (Londonderry).—The reason that you received such a reply from the Marconi Company was not that they had no vacancies for operators, but that the Company make a rule not to engage men of military age without a certificate. As a matter of fact, there is a very great demand for wireless operators at the present time and there is likely to be for some months to come. If you had a certificate it is most likely that your application would receive immediate consideration. In reply to your second question, there are one or two schools in Ireland where wireless telegraphy can be studied and where the Postmaster-General's Examinations are held. For particulars of these see our advertising pages. It would be quite satisfactory to take a correspondence course and finish off your training at one of these places. In practically all cases the Marconi Company employs the wireless operator. In reply to your last question, the International Morse Code is used in the Postmaster-General's Examination and the candidate is required to understand both the full and abbreviated numerals.

A. F. H. (Bishop's Waltham).—Actually there would be a very small charge in the condenser, but it would not be sufficient to give an indication when the voltmeter was connected across the condenser terminal. If the dielectric of the condenser is not punctured and you still get sparking at the contacts this tends to show that the capacity condenser is too small for the purpose.

Queries from M. F. and one or two other correspondents are held over through lack of space.

SPECIAL NOTICE.

Readers will considerably facilitate the work of our Expert if they write their questions on one side of the paper only, and make their queries as clear and full as possible. Questions should be numbered for reference and should not exceed four.

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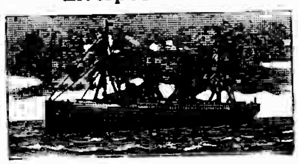

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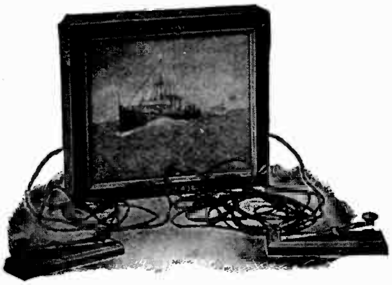

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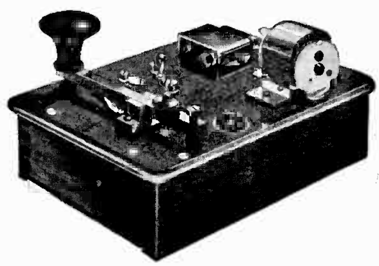

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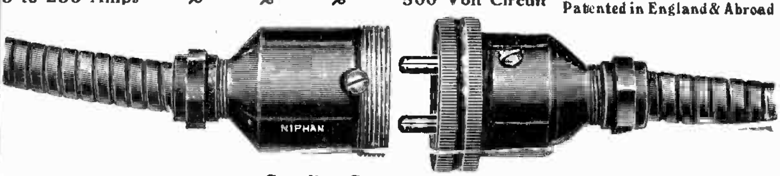

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