THE WIRELESS WORLD

In Berlin

The Valve as an Amplifier

The Late Mr. Duddell

JANY 1918

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INDEX TO ADVERTISERS.

THE WIRELESS WORLD

With which is Incorporated "The Marconigraph."

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The
WIRELESS
·WORLD·

Volume V. No. 58. JANUARY, 1918.

Reminiscences of an Operator

By W. D. OWEN

III. In Berlin

A FEW years ago one's education in science was not considered complete unless some time had been spent at one or other of the large German training centres in Berlin, Leipzig or Strassburg. There may or may not have been good reasons for this; I am not prepared to debate the point; I only know that with some such idea floating in my mind I found myself alighting from the train at Friedrichstrasse Bahnhof in Berlin.

As my knowledge of the language was next to nothing I had purchased a whole library of conversational and topographical guides. One in particular was a wonderful book. It not only told one what to say and how to say it but it explained just exactly what to do in any given circumstances. The writer of this volume must have had a wonderful imagination, for every possible contingency (and many impossible ones) had been considered. It told you what to say if your shorts went astray in the wash, and what to do if run over by a *Droschka*. So when I needed assistance in finding my hotel I naturally turned to my "guide." Here I learnt that in approaching a *Schutzmann* it was necessary to raise one's hat and prefix

THE " KÖNIGSPLATZ," WHEREIN ARE LOCATED GROUPS OF STATUARY REMINISCENT OF FAMOUS GERMAN WARRIORS AND STATESMEN.

one's remarks with " Bitte, entschuldigen Sie mich, mein Herr . . ." I therefore stepped up to the first policeman I came across and delivered the necessary formula. Apparently my diction was a little faulty, for " mein Herr " smiled at me and said, " Now come on, spidt id out ; vot iss it you vant ? " My relief was so great I could have shaken him by the hand, but I hadn't time to consult the book to see if this was done in polite circles.

Before settling down to work in real earnest I explored the city, which, I must say, was full of interest. The multitude of statues about the place reflects the national characteristic—egotism. At the foot of Bismarck's statue in the Königsplatz there is a massive bronze figure of a man forging a sword. This stands squarely in front of the steps of the Reichstaggebaüde symbolical of the German policy.

Unter den Linden impressed me as being a most beautiful shopping centre ; probably one of the finest in the world, and the Tiergarten abounds with beauty also. One point of especial interest in Berlin is the spot where the elevated railway passes diagonally across another railway bridge over the Landwehrkanal.

My ultimate destination was the Telefunken works in Tempelhofer Ufer on the outskirts of the great parade-ground at Hasen Heath where the Kaiser reviewed his troops prior to the violation of the neutrality of Belgium in 1914.

It was evident when I got there that the whole place was in the process of reorganisation, for the smell of fresh paint permeated everything and white-coated artisans were as plentiful as mosquitoes in Port Swettenham. Various extensions were in preparation, and the conditions under which many of the mechanics were working were obviously temporary.

I was allowed to take a walk round the works and was surprised to find so

many women workers. My escort remarked that there was no sense in putting men on work that could be done equally as well by women at half the cost, quite apart from the fact that men would not stick at repetition work for any length of time, whereas women were content to do the same job, year in, year out, without getting utterly sick of it. In the more technical departments, however, I saw no women, only serious-looking mechanics and still more serious-looking scientists, all in long holland overalls and all very interested in their work.

For a while I was employed in one of the assembling shops where many types of radio-station were being put together. Several "cabinet" sets of about ½ K.W. were under construction for an English firm of shipowners who had been compelled by the American regulations to install wireless telegraphy on all ships of a certain class sailing to American ports. After meeting the requirements of the law these installations were transferred to other ships and made to serve a like purpose. The oscillating circuit was energised by means of an induction coil working from the 65-volt mains, and when the contacts were not fusing together and playing the dickens with the fuses, they were not bad little sets.

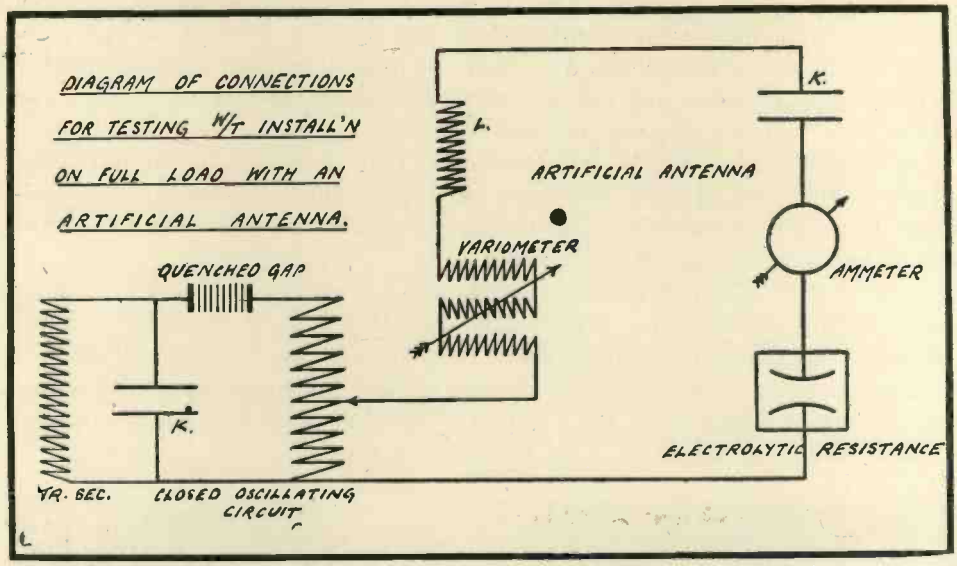
A number of field wagon sets (similar to that illustrated in this magazine recently as the spoils of war) were being put together for the German army. Although I was not actually delegated to this job no attempt was made to prevent me from becoming familiar with the details.

Later I was transferred to the testing shops where two 15 K.W. sets were being tested out prior to dispatch. I understood that they were to go to India, but I have never been able to discover where they actually went. In these sets the primary A.C. circuit was interrupted through a relay, the actual manipulating key being little more than a toy. For "full-load" tests an artificial antenna, arranged as shown in diagram, was used.

THE FAMOUS "UNTER DEN LINDEN" GARDENS IN BERLIN.

Several installations, varying in size from those mentioned down to aeroplane sets no bigger than a portmanteau, were roughly assembled and tested out. On one occasion I had to assemble a condenser for one of these aeroplane sets and had to test every piece of mica with micrometer.

These small sets were evidently of an experimental nature, for they were not standardised like the others. I saw five, and of these not two were alike. The largest of them was for a Zeppelin airship. It consisted of a vertical panel about 3 feet square on the back of which was mounted all units not likely to need attention. Switches and controls were arranged on the front of the panel, the key being supported on a neat little bracket at right angles to the face of the panel. A wooden

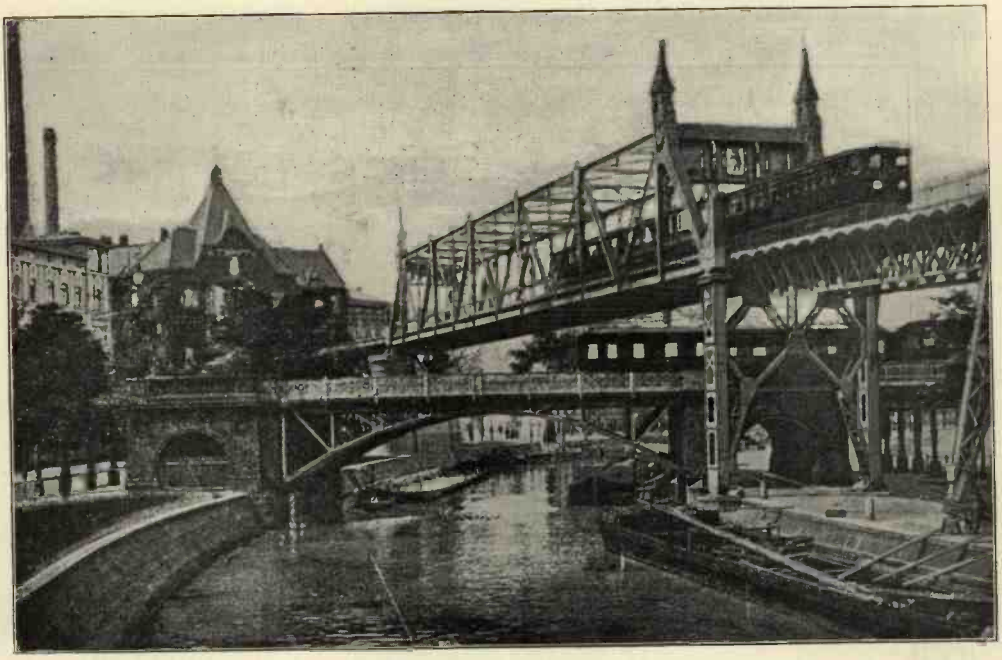


framework supported the panel, but both back and front were left open for inspection. On the top of the framework a windlass was mounted for carrying the aerial wire, a simple indicator being fitted to show the amount of wire let out. The aerial was weighted by means of a metal sphere about 60 mm. diameter.

Here again no attempt was made to conceal the details of these installations; in fact, they were all demonstrated to some Japanese visitors in my presence, and incidentally the interview was conducted throughout in English.

I left Berlin profoundly impressed by what I had seen, but it is only recently that I have realised the full significance of the methods used by the Germans in pre-war days to further their own interests by "peaceful penetration."

The Telefunken Company, whose works I inspected, constitute no mere commercial firm, run for legitimate purposes, but a potent instrument in the hands of her military and political chiefs. In pre-war days they not only supplied installations and apparatus but "experts" to work them. These experts have, all through the present struggle, proved of invaluable assistance to the Home Government for propaganda and "spy" work, in neutral countries all over the world.



The two illustrations on this page show two of the parts of Berlin whereof the inhabitants are proudest: (1) the elevated railway crossing the bridge over the Landwehr (Militia) canal, and (2) a scene in the famous Zoological Gardens. In the years immediately preceding the outbreak of war these gardens had witnessed many developments, both in the way of additions to the living creatures housed there, and enhanced care bestowed upon the horticultural decoration of the grounds. German taste inclines to the "florid"; but the general effect of the landscape gardening was decidedly pleasing.

PERSONALITIES IN THE WIRELESS WORLD

CAPTAIN EDWIN H. ARMSTRONG

THE Institute of Radio Engineers focusses the science of wireless in the United States after a fashion that does not find a parallel in this country. It attracts to itself the most distinguished theorists and practitioners of the science, and affords its members invaluable opportunities of mutual aid. Every two months the radio world is presented with its publication of "Proceedings," and the contributions therein printed proceed from America's most distinguished experts. The publications of the Institute enjoy the advantage of being edited by Dr. Alfred N. Goldsmith.

In our portrait gallery of this month we are able to reproduce a photograph of Mr. Edwin H. Armstrong, the well-known American wireless expert, who—as announced in our July, 1917, issue—was recently awarded the medal of the Institute. Such an award constitutes in itself a recognition of genuine service in the cause of radio science. Mr. Armstrong was born in the United States on December 18th, 1890, and after passing, with credit, through the usual school curriculum graduated at Columbia University, from which he obtained his degree in 1913. Since that date he has concentrated his efforts on the advancement of radio-telegraphic science, working in conjunction with Professor Pupin, the President of the Institute of Radio Engineers, in his important research work at the Columbia Laboratories. Mr. Armstrong is himself one of the Directors of the Institute, besides occupying the post of President of the Radio Club of America. Like so many other of his fellow citizens, he has answered the call of his country to aid her in the *rôle* she has undertaken in the present struggle, and recently received his appointment as Captain in the U.S. Signal Corps. This young scientist of twenty-eight has already won high distinction by his work in wireless telegraphy. Perhaps the invention most widely connected with his name is that of the "Armstrong Circuits," which have done so much to improve the sensitiveness to reception of wireless apparatus through the instrumentality of the three-electrode valve. Mr. Armstrong has thrown much energy and zeal into the work of the Institute, and has made many valuable contributions both to its discussions and its Journal.

The Valve as an Amplifier

By D. J.

I.

DURING the last few years the reception of wireless signals has been almost revolutionised by the development of the vacuum valve and the different uses to which it can be put. Perhaps the earliest of these was the employment of the three-electrode valve as a relay. By its means signals can be increased several hundredfold in strength and signals previously inaudible can be strengthened to such an extent that they can be heard from any part of a room. The methods adopted to obtain these results are therefore, naturally, of the greatest interest.

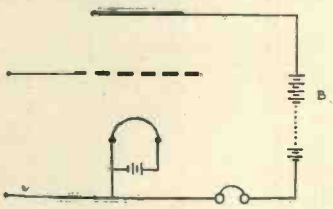


FIG. 1.

The valve as a relay has immense advantages over other types of relay. There are no moving parts or lag effects due to inertia. It is reliable, exceptionally sensitive, and capable of reproducing exactly, but on a magnified scale, the minutest current variations. It is therefore of the greatest use not only in wireless work but also in telegraphy and telephony. By using the valve as an amplifier of speech the faintest conversation may be made loud, without causing the slightest distortion. Let us consider the use of the valve for this type of amplification first.

Fig. 1 illustrates a valve with a pair of telephone receivers and a high tension battery (consisting of, say, 40 dry cells) in its sheath circuit. Electrons are being attracted to the sheath, and produce a steady sheath circuit current of less than 1 milliamp. which passes through the 'phones. The current, being steady, produces no sound in the ear-pieces. If, however, we charge the grid of the valve positively, we will cause a sudden large increase in the number of electrons flowing to the sheath. This sudden increase in the sheath current will cause a click in the 'phones. If the grid be charged negatively, the sheath current will drop below normal, as the grid now repels many of the electrons which otherwise would have been attracted to the plate. This sudden drop in the sheath current will also produce a click. If the grid is charged positively and negatively alternately, a buzz will, therefore, be heard in the telephones and will have a frequency equal to the frequency of the alternating current which is charging the grid. The signals in the receivers will, however, be very much stronger than if the 'phones were put directly in the main circuit. The energy which is converted into sound comes from the local battery *B*, and the amount of this energy depends upon the voltage changes on the grid. The actual energy required to charge the grid to a positive or negative potential is very small, as the capacity of the grid is negligible.

It is, therefore, seen that very small variations of grid potential will cause large variations of current in the sheath circuit. These variations, moreover, are reproduced correctly, as well as on a very much larger scale. The actual degree of magnification depends on the distances between sheath and filament and between grid and filament, the size and shape of the electrodes, the value of the high-tension voltage,

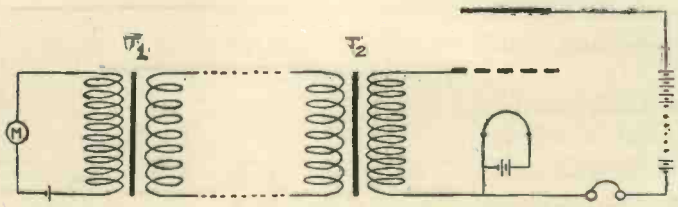


FIG. 2.

the temperature of the filament, the quality of the vacuum and several other considerations.

Fig. 2 shows a practical arrangement for the amplification of weak speech by means of a valve. The microphone *M* when spoken into causes variations of current in the primary of the usual telephone induction coil *T*. These variations are reproduced, and at the same time magnified, in the secondary coil, and are then transmitted along the line wires (shown dotted in the figure). These varying currents are passed through the primary of a step-up transformer *T*, at the receiving end. The object of this transformer is to lessen the resistance of the line circuit (which otherwise would be very high), and also to step-up the varying E.M.F.'s so as to obtain the greatest variations of potential on the grid. The secondary of the transformer T_2 has one end connected to the grid of the valve and the other end to the negative side of the filament. When the microphone is spoken into varying differences of potential between grid and filament are produced, and these are magnified by the valve. Much louder speech is, therefore, obtained when the 'phones are placed in the sheath circuit than if they were placed directly across the two line wires.

Valve amplification is not altogether as simple as might appear from the above. To enable us to use the valve most efficiently as an amplifier we have to take into consideration its characteristics and the different way it functions under different conditions.

There are three adjustments which always require to be correct before the valve can be efficiently employed as an amplifier: the adjustment of the filament current, the high tension voltage, and the normal potential of the grid.

Fig. 3 will help to make it clear why these adjustments are necessary. The figure shows, by means of a curve, the relationship between grid potential and the

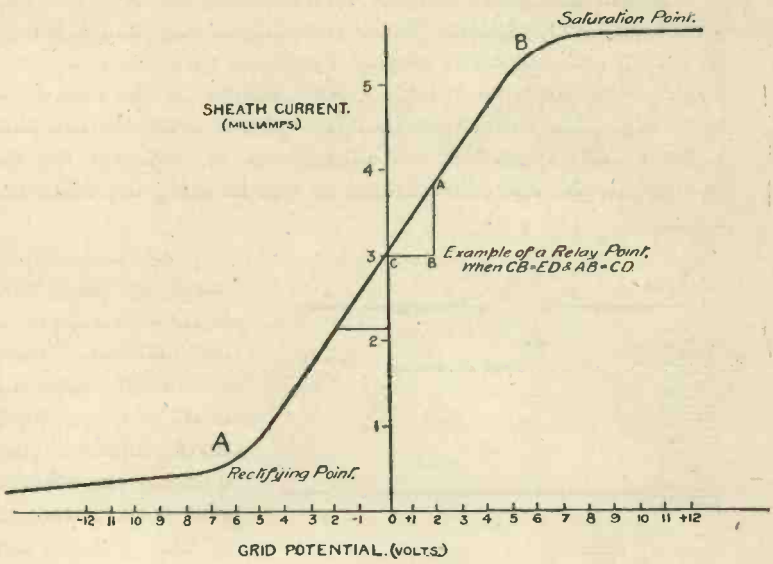


FIG. 3.

current in the sheath circuit, the filament current and the high-tension voltage being kept constant.

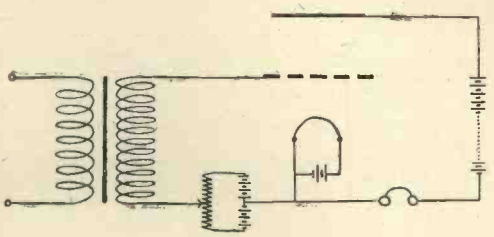


FIG. 4.

It will be seen that there are two bends in the curve, one at *A* and one at *B*. If the potential of the grid is adjusted to the point *A*, the valve will act as a rectifier, and the varying currents in the sheath circuit will not be of the same nature as the original currents which are made to influence the grid. The point *A* is, therefore, to be avoided. The point *B*—saturation point, where a further increase in grid potential produces no change in the filament sheath current—should for a similar reason be also avoided.

The best point of the curve to use is somewhere along the straight steep portion between *A* and *B*. Equal variations on either side of the normal grid potential will then cause equal variations of current on either side of the normal sheath current.

It is obvious from Fig. 3 that the steeper we can make the curve between *A* and *B*, the greater will be the amplification obtained. This can be done in practice by increasing the value of the high-tension voltage and also by increasing the filament current. The same variation of grid potential will now produce greater variations of current in the sheath circuit.

In order to ensure that the grid is at its correct normal potential, a potentiometer may be put in the grid circuit, as shown in Fig. 4, which illustrates a suitable arrangement for amplifying speech, low frequency alternations or intermittent pulses of current such as those which operate the telephones of an ordinary receiving set. This form of amplification is generally termed low-frequency amplification, to distinguish it from the special methods employed to amplify high-frequency oscillations.

A potentiometer, however, can generally be dispensed with when using valves whose curves are regular. The correct amplifying point of the curve may be obtained by varying the filament current by means of a rheostat, and by using a suitable value of high-tension voltage. For example, if the high-tension voltage is made very large, it is easily seen that the valve is being worked near saturation point—a point quite unsuitable for amplifying. If, however, we make a corresponding increase in the filament current, we will be using the valve below saturation point again.

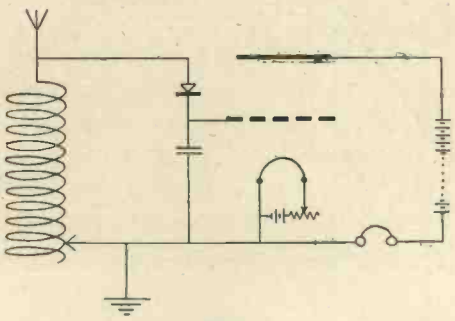


FIG. 5.

Excellent amplification may be obtained by using about 90 volts on the sheath and a 4-volt accumulator to heat the filament. Good results may be obtained by using a lower voltage on the sheath, say 30 volts, but the filament current must be reduced at the same time to ensure the valve working at the best point on its characteristic curve.

Fig. 5 shows how the uni-directional pulses from a crystal detector may be

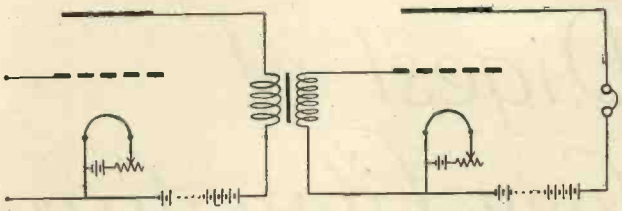


FIG. 6.

made to operate an amplifier, giving greatly magnified signals. The grid is connected through the variable inductance to the negative side of the accumulator, and is therefore neither positive nor negative with regard to the filament.

Still further amplification may be obtained by substituting the high-resistance primary of a step-up transformer for the telephones in Fig. 5; one end of the secondary of this transformer is connected to the grid of a second valve and the other end to the filament. The completed arrangement is shown in Fig. 6. By using such a system great amplification may be obtained. The secondary of the intermediary transformer has about six times as many turns as the primary, in order to obtain the maximum voltage changes on the grid of the second valve.

Fig. 7 shows how a two-valve amplifier may be arranged, using only one high-tension battery, rheostat and lighting accumulator.

Three, or even more, valves may be arranged in cascade in a similar manner, each additional valve multiplying by a certain number the magnification already obtained. Thus, if the first valve amplified signals to five times their normal strength, three valves would magnify signals 125 times.

There are several disadvantages, however, in having too many valves in cascade The least vibration will cause a loud noise in the telephones. The least leakage anywhere will also cause noises which become excessively loud if several valves are used, and will effectively drown signals which are only faint to begin with. There is also great trouble experienced through currents being set up in the cores of the transformers, and through the valves oscillating of their own accord.

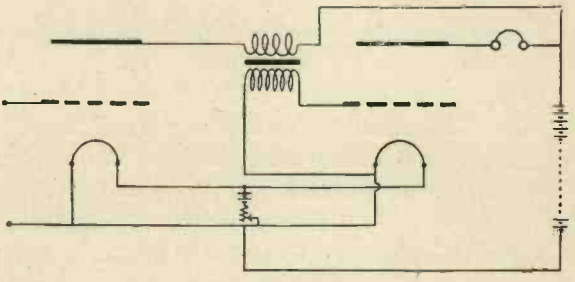


FIG. 7.

Except in special cases, it is unnecessary to amplify signals beyond their readable strength. For signals which are normally inaudible low frequency amplification is generally inefficient. The other methods of amplifying, described later, will be found far more effective.

A Correction.

In the article entitled "On Wave-lengths of Antennæ" from the pen of Dr. Balth. van der Pol, which appeared in our November issue, we regret that the letter "n" was printed in place of "π" throughout the equations. Will readers kindly note the correction?

Digest of Wireless Literature

New Form of Telephone.

The Electrician, quoting from the *Annales des Postes, Telegraphes et Telephones*, gives an account of an interesting form of telephone receiver for which several advantages are claimed. It consists of a vessel furnished at its base with a membrane facing an electromagnet, as in an ordinary receiver, but above this membrane is placed a hollow cone, the base of which contains a second membrane, parallel to, and a few millimetres away from, the first. The cone contains a second electromagnet in series with the first one, both being traversed by the speaking current. As a result, the hearing value is stated to be doubled. Moreover, the second membrane only covers about two-thirds of the first, and the annular space thus presented between the membranes and the ear has a favourable effect on the conduction of sound to the ear tending to suppress inconvenient cracking effects and resonance. In addition, the condenser effect at the telephone, which is generally regarded as the chief cause of resonance troubles, is considerably diminished by this new device. According to the patent, the method is also applicable to microphones.

* * * * * *

Microphones for Wireless Telephony.

Dr. Goldsmith, continuing his excellent series of articles on " Radio Telephony," in our contemporary, the *Wireless Age*, devotes a complete article to modulation control in radio telephony and the various forms of microphone in use.

Dr. Goldsmith commences by saying that, having considered various matters common to both radio telephony and radio telegraphy, we pass now to a matter exclusively related to radio telephony, namely, the modulation or control of amounts of power, varying from a few watts to many kilowatts *by the human voice*. The problem is indeed a difficult one, and for a long time practically defied solution. When it is considered that the rate of energy radiation in the form of sound in ordinary speech is of the order of one one-hundred-millionth to one-billionth (0·000,000,01 to 0·000,000,001) of a watt, and that the delicate and excessively complex variations of the sound energy must be faithfully reproduced with an energy amplification of *hundreds of billions*, and that the energy to be modulated is of the peculiar form associated with radio frequency currents, the difficulties of the problem become evident. And yet radio telephony is entirely dependent on the simple solution thereof.

The author advocates controlled characteristics in which microphone current is taken as the controlling element and the antenna current as the controlled element. First of all, these elements are fairly readily measurable. In the second place, what

after all is desired is that the *current* variations through the receiver telephones shall be proportional to the current variations in the microphone transmitter, as in an ordinary telephone line. It is accordingly deemed best to adhere to current control characteristics throughout.

Dr. Goldsmith then mentions that the control system of a radiophone may be qualified as stable or unstable, mentioning that, if the high resistance telephone is placed in series with the Poulsen arc in the aerial, changing the resistance of the microphone will not merely cause the antenna current to change, it may actually cause the extinction of the arc altogether, if the inserted resistance is too high. This is an example of an unstable system. On the other hand, a radio frequency alternator, driven at a constant speed placed directly in a tuned antenna in series with a microphone, would give a stable system, as alterations of the resistance of the microphone would not cause trouble in the radio frequency generator.

In rating radiophone transmitters on the basis of maximum energy radiation it must be understood that this does not imply that 1 kw. radiophone transmitter will enable the clear transmission of speech for the same distance as 1 kw. spark transmitter will enable good transmission of telegraphic signals. More than just the peaks of the received speech is required for comprehensibility, so that the received speech must be considerably more than "once audibility" to be fully understood. The exact number of "times audibility" required for satisfactory speech is not precisely determined at present, and depends naturally on the freedom from speech distortion. It is probably not less than two nor more than ten.

* * * * * *

NAMES FOR VALVES.

MR. DONALD MCNICOL, writing in the *Telegraph and Telephone Age* on the above subject, says that when the name "audion" was first introduced there was at least one scientist who deprecated the tendency to give new names to new devices used to perform mechanical or electrical functions already identified under broad classifications. The scientist in question, Professor M. I. Pupin, said that if there must be a new name for each new detector—a new name for everything that comes up in the course of the development of the electrical art—pretty soon the science of electro-technics will be a mass of new names, and the learning of the names will be much more difficult than the learning of the facts connected with the art. The name "audion," he said, was a mongrel. It is a Latin word, with a Greek ending. If it had been "acouion," or "acousticon," it might have been better, but more difficult to pronounce. Nevertheless in America the word "audion" was soon taken up as the name given to radio-telegraph detectors of the incandescent bulb type.

Nowadays it is quite evident that Professor Pupin's fear—that a maze of new mongrel names might be expected to follow—has been realised.

To-day the following words are in common use by radio engineers, as the names of devices in appearance similar to and in principle based upon the original audion :—Oscillation valve, regenerative audion, kenotron, pliotron, electron, relay, thermionic relay, thermotron, audiotron, amplitron, detecto-amplifier, Moorhead tube, oscillion, ultra-audion, dynatron, oscilaudion, and pliodynatron.

It would not be surprising to learn that many students of wireless have lost the count, or at least have not been able to keep pace with development, to the extent of having a clear understanding of the features possessed by these various devices, and the author of the article goes on to explain in simple language the main points of difference between the various types. In conclusion he says :— "After reading the foregoing, is it any wonder that Doctor Pupin was perturbed over the advent into the electrical art of new and mongrel names? When Doctor de Forest coined the word 'audion' he pulled the bung from a barrel which contained a vast and venerable assortment of Greek and Latin derivatives, and it is evident that these have been industriously raked up and picked over to supply bewildering additions to our already involved scientific vocabulary."

Here in England we are not so fond of inventing new names, although scientists have not settled down to any one title for these particular devices. In the Services, where large numbers of these instruments are in use, we believe it is the custom to refer to them simply as "valves," fancy names being debarred altogether.

* * * * * *

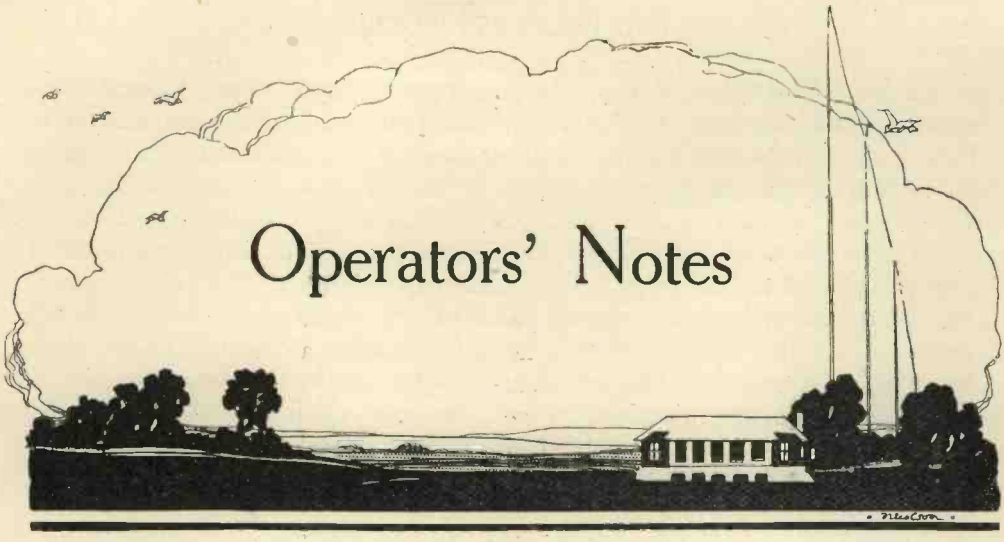
SEEING WIRELESS SIGNALS.

Under this heading, the *Electrical Experimenter* describes a device said to be used by the Germans in their wireless equipment on aeroplanes. Readers acquainted with aviation will know that the noise set up on an aeroplane by the rush of air against the wires and supports, and by the roar of the engines, makes it very difficult to receive audible wireless signals. The difficulty has, however, been to some extent overcome by the Allies, by methods which we are not at liberty to disclose, and it is presumed that the enemy have adopted similar devices. The invention described in the article above mentioned does away entirely with the need for audible signals, the high frequency currents in the receiver being made to actuate a modification of the Einthoben galvanometer. The device, which somewhat resembles a pair of prismatic binoculars, possesses at the base a small electric lamp, the light of which passes through a fine slit which is normally covered by the tiny filament of the Galvanometer. This filament is placed in a strong magnetic field, and when the current from the receiver passes through it is deflected, thus allowing the light to pass through the slits. The receiving operator, by looking into the highly magnifying binocular eye pieces, reads the dots and dashes as short and long flashes of light created by the uncovering of the illuminated slit.

The principle of optical reception of radio signals is not new. The efficacy of the Einthoben spring galvanometer in this *rôle* was thoroughly tested some years ago both in this country and abroad, and by its aid signals have been recorded photographically on paper tape. The information published by our contemporary was furnished by Mr. William Dubelier, of New York, who personally saw this apparatus in the Berliner Factory at Vienna, Austria, and had the pleasure of observing signals being received with it from a distant station.

Wireless in Russia

A RUSSIAN Radiotelegraphic Congress was inaugurated at Petrograd on December 9th.



Operators' Notes

The Operator at Sea

By F. B. RUSHWORTH

As many young men who are now joining the profession of wireless telegraphy have no previous knowledge of the life at sea, as apart from actual operating duties, some gleanings from a few years' experience as a sea-going operator may be helpful.

On board British merchant ships operators have the honorary rank of Junior Officer. To work smoothly with the other departments with which he is brought into contact the operator should know that no class of man is so jealous of their calling as those " who go down to the sea in ships." Each member has his particular place and his allotted task to perform in the organisation of the ship, and strongly resents interference or spontaneous advice from others, especially telegraphists, who are, strictly speaking, " *with* them but not *of* them."

It is better not to form intimate friendships, nor to take intense dislikes within, say, the first half hour, but nevertheless it is wise to be courteous to everybody. The operator should go about his work quietly and unostentatiously, without making himself too prominent.

Later, he will find that in order to grasp thoroughly the essentials of his work, there is much still to be learned. The reading and understanding of the various books of regulations, and general orders, is obligatory ; for without the knowledge which they impart, an important section of the work of operating cannot be properly carried out. It is impossible for any one individual to please everybody, and the operator should see that the company employing him receives first consideration. For this reason, if for no other, it is well that he should attend strictly to the duties of the profession, until all the details of it are mastered.

A man who takes his work seriously is soon looked upon by his shipmates as reliable, and thus gains in prestige. He should maintain an ever-present sense of professional duty on board, never discussing the ship, her officers, passengers, or anything that is hers, with other officers or passengers. Remarks made innocently

enough at the time have a way of returning to roost grotesquely enlarged and intensified, and becoming incidentally the cause of much trouble and annoyance. The story may be born, and grow old, all within a few hours on board ship, but alas! it is seldom or never put out of its misery. Scandal is more rife on shipboard than in any place on earth; and, unlike a wireless fault, as a rule it cannot be traced to its source. Except to recognised superiors, the Yorkshireman's motto of "See all, hear all, but say nowt" holds good.

Sooner or later at sea all the good points of a man, and those also perhaps not quite so good, will inevitably come to the surface. There are many occasions when such a life gives an insight into fine and noble qualities, which were not previously suspected of existing. Neptune's College is the only one in which a postgraduate course in Human Nature can be obtained.

UNIFORM CLOTHING.

The word "uniform" means precisely what it implies, "of one form or pattern," so that if it were possible to muster together at one time and place the whole of the company of Marconi operators serving with the British Mercantile Marine, they would all appear dressed exactly alike.

For the benefit of the "new recruit" we give herewith the regulation uniform:—"Blues": Double-breasted, eight-button (Marconi) Navy blue serge reefer coat. Outside pockets at left breast and sides, without flaps, slits at sides, with ticket pocket inside left, and an inside right breast pocket. For a senior operator, double intertwined wave of gold lace on cuffs, four inches from the wrist end of sleeve. No buttons on the cuffs. For a junior operator, only one wave of gold lace. Vest: without collar, six buttons and four pockets. The vest is not visible, the coat always being worn buttoned, and if the wearer is already in possession of a similar vest belonging to a mufti suit, the uniform vest may be omitted, the cost of the uniform being considerably less. Trousers, without cuffs, and with side pockets. The hip pocket is not uniform, and a fob pocket at the right side of the waistband is usually made in compensation.

Black boots, block fronted, without toe-caps, should be worn, but low shoes never, except white canvas or buckskin with white uniform. The cap is of Navy regulation pattern, with mohair band, and the Marconi Company's regulation badge —viz., gold "M" in gold laurel wreath. The regulation Navy pattern overcoat is not compulsory, but it has been found most useful, and will also serve as substitute for a dressing gown on occasion. Further, by changing the uniform buttons for black ones, it can be converted into a warm travelling or winter overcoat for ordinary use. The patrol coat with two plain sewn-on pockets at breasts and sides, is an excellent addition, but quite optional. By its inclusion the saving in wear and tear of the D.B. reefer, and especially the preservation of the cuff lace from fraying, when standing-bi, is very appreciable; this alone, in course of time, warrants its purchase. The reefer coat can thus be preserved in a smart and clean condition for deck and saloon wear, or muster. The buttons, lace, and badge may be cleaned and renovated many times by the judicious use of an old tooth brush and a little soap, used in conjunction with warm water containing a small quantity of ammonia. A mixture of equal parts of ammonia and turpentine (spirits of each

are the best) will remove almost any stain on blue cloth. Where the clothing has come in contact with wet paint the marks, whilst still wet, may be rubbed out by the simple friction produced by immediately rubbing the soiled parts with a similar piece of cloth, or some woollen article. If the paint has been allowed to dry it is most difficult to remove, but paraffin oil or turpentine may help.

White clothing is necessary in the tropics. Three suits are suggested as a start, or six for tropical voyages. The jackets are made similar to the patrol jacket, but with only two plain breast pockets, and with slits at the sides. The trousers correspond with the blue ones. White canvas boots or shoes, and white cap covers are also necessary. The jacket collar should be made stiff. In the East, prices are about thirty per cent. lower for " whites " than in England, and the garments compare favourably with the home article, so that additional suits should be purchased there when opportunity offers. The quality and quantity of clothing, as distinct from uniform, is regulated by the duration of the voyage, climatic changes, and the chances of laundry service at the ports of call. Woollen under-vests should always be worn next to the body, even in the hottest climate. The desire to discard underclothing for the sake of coolness should be resisted. Colds and chills caught at sea are stubborn things to throw off, and those making their initial voyages should remember this, taking due care when passing from tropical to temperate latitudes. White cellular shirts with soft fronts and cuffs are recommended. Either the starched double collar or the stand-up with turn-over points, is worn, with a black silk tie, not exceeding one and a half inches in width. Brown kid gloves are correct for outdoor wear. A brown boiler suit, or overalls, will protect the uniform when doing outside work, examining cells, or cleaning up. For a comprehensive initial stock of underwear, to be added to as found individually necessary, the following list is suggested :

Four shirts	Three pyjama suits
Twelve collars	Three black silk ties
Three pairs of under-pants	Twelve handkerchiefs
Three woollen under-vests	Three pairs knitted cotton bathing drawers (for wear with white suits)
Nine pairs of black socks	

Nail, tooth, and hair brushes, together with a boot-polishing outfit and a hussif, should be included in the kit, and a sponge for the morning tub.

" The dress of the day " will be worn as ordered from the Bridge, and at no other time. They are as follows : (1) All blue. (2) All blue, but with white cap cover. (3) Half whites—*i.e.*, white trousers, shoes, and cap cover, with blue jacket and vest. (4) All white.

Brazil

We learn from the *Electrician* that the Brazilian Government has opened a credit of 1,000,000 contos of reis (Frs. 1,400,000), to complete the work of establishing the new radiotelegraphic station and increasing the telegraph lines for the Army and Navy.

The Passing of a Wireless Pioneer

*An Appreciation of the Work and Persistency of the late William Du Bois Duddell**

By E. W. MARCHANT, D.Sc.

THE death of William Du Bois Duddell is a loss to science and particularly to wireless telegraphy which it will be difficult to make good.

He was born in 1872, and it is told of him that "when he was only four years "old he had a model mouse given him as a toy. Becoming dissatisfied with its "immobility he took the works "from a small clock and fitted "them unaided into the interior "of the mouse and turned it into "a little automobile. His nursery "from that time forward became "a fairyland of mechanical de-"vices, all made by himself, and "grouped so that several sepa-"rate toys went through their "evolutions at once, all worked "from a central source of power.

THE LATE MR. W. DU BOIS DUDDELL.

"He never went to a big "school, since, until he was past "twenty, his people never knew "whether he would live through "the current year, while in later "years he was always struggling "against asthma." It is remarkable that, while suffering such physical disabilities, he was able to accomplish so much. He was always fascinated by any fine mechanism, and showed extraordinary skill in making delicate instruments with his own hands. After an education obtained partly in England and partly (on account of his delicate health) at the College Stanislas at Cannes, he became a student under the late Professor Ayrton at the Central Technical College. When he began work there the problem of the delineation of the wave forms of alternating currents was being studied at the laboratories, and Duddell at once became engrossed in the subject. I was working

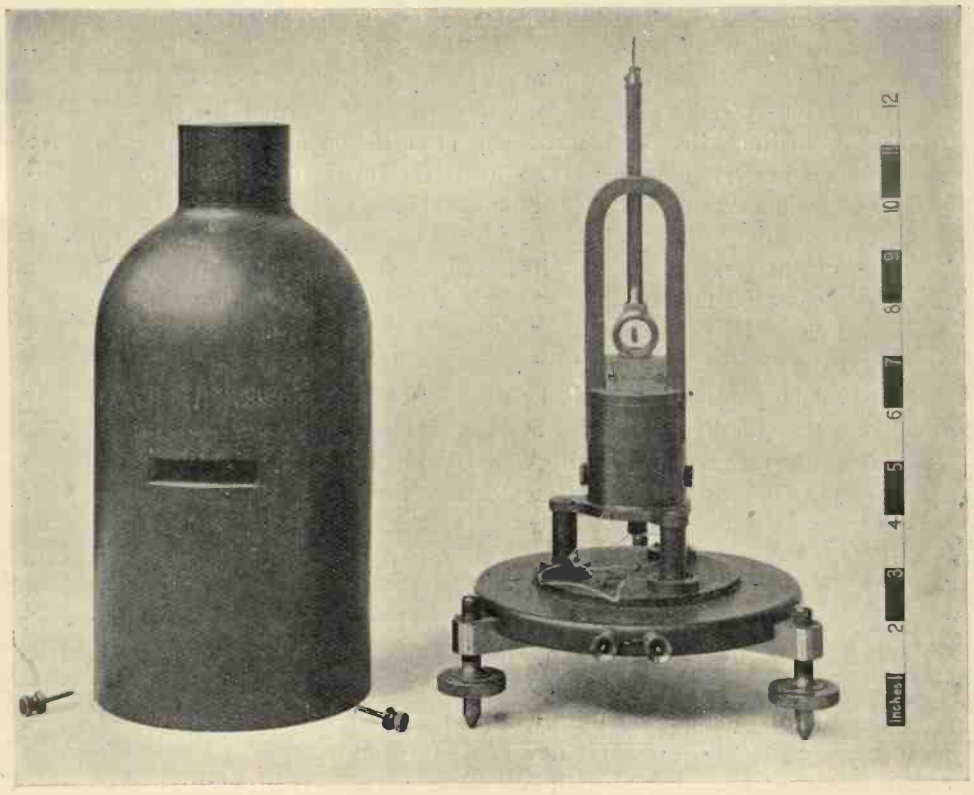
* The views of apparatus which appear in this article we owe to the courtesy of the Director of the National Physical Laboratory, Teddington; and to that of the Director of the National Science Museum, South Kensington.

with him on the wave form of the alternate current arc and we were using a laborious point-by-point method of plotting the waves of current and potential difference. He had set his mind on the production of an instrument that would record the curves instantaneously and at this problem he worked continuously.

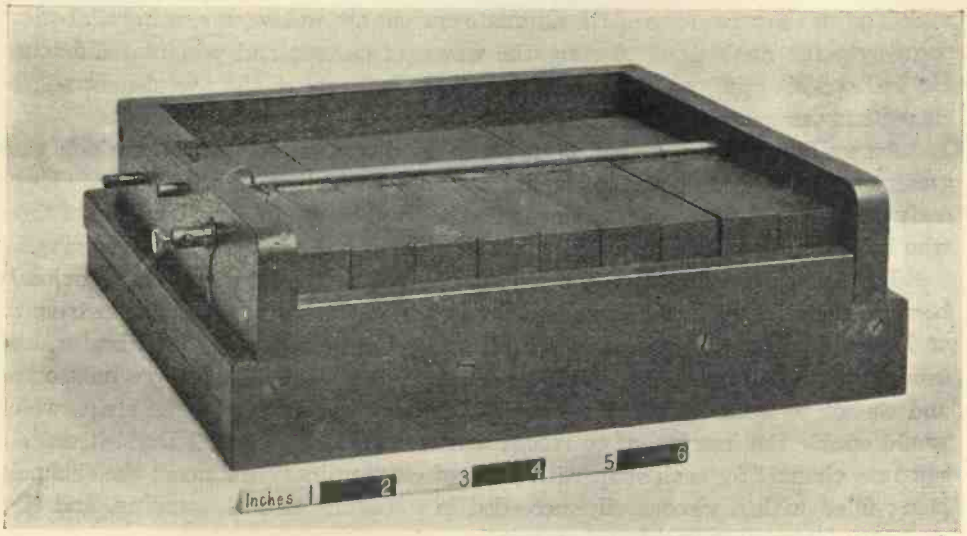
An unifilar instrument had been made by a student named Ray which gave great promise of success, and in the first instance Duddell worked with him. Ray's early death was a great loss to science; had he lived he would, in the opinion of those who knew him best, have done great work for the future of electrical engineering.

Duddell was attracted to the bifilar type of instrument which had previously been tried by Blondel and abandoned as hopeless. He made the first instrument at home in his workshop, using flat phosphor bronze strip for the vibrator, and brought it along to test; it gave promise of success, but the damping was ineffective, and we set to work to find a method of damping the motion of the strips which would enable the instrument to record a true curve. In the end Duddell made a separate channel for each strip with walls of extraordinary thinness; the channels, being filled with a viscous oil, succeeded in obtaining critical damping, and thus made the instrument a practical success.

Next arose the problem of light, and we studied books on optics for days in order to design the most efficient system possible. It was characteristic of his



THERMO-GALVANOMETER USED BY MR. DUDDELL.



MUSICAL ARC KEYBOARD MADE BY MR. DUDDELL.

thoroughness and patience that he was never satisfied until he had obtained the best results in every detail of his apparatus that he thought it possible to achieve, and his standard was a very high one. It is remarkable that, although the first oscillograph was designed by eye, when the complete theory was worked out, the best dimensions possible differed very little from those that had been chosen by Duddell by instinct, that sure sign of real scientific genius. When his instrument was complete in every detail it was shown to the Institution of Electrical Engineers, and no one who saw that demonstration is likely to forget it—it was the finest proof of his extraordinary powers that could be given, both as a designer and builder of new instruments and as an expositor. His exposition, both in its clearness and directness, charmed his audience so completely that Mr. Mordey, who opened the adjourned discussion, admitted that " his heart had been fuller than his head " when he moved the adjournment at the previous week's meeting.

In 1901 he produced a classical paper on the " Resistance of the Electric Arc " which was presented to the Royal Society. This paper was the result of over two years' continuous research. During the work Duddell discovered the " singing arc." He was trying to pass a high frequency current through the arc by using a condenser and inductance shunted across it, when he noticed that the arc itself under these conditions would produce oscillations. This part of the paper was developed late in another paper before the Institution of Electrical Engineers on " Rapid Variations " of Current in the Electric Arc," a paper which was accompanied, at the meeting, by another brilliant demonstration, which ended with the playing of " God Save " the Queen " on the arc, on a specially arranged keyboard. This phenomenon was the scientific foundation from which Poulsen subsequently developed his high frequency arc generator, which is now being used on a large scale for producing the continuous oscillations employed in long distance radio-telegraphy.

Another feature of interest in his Royal Society paper was the use of a very

high frequency alternator. In order to measure the resistance of the arc with a current of so high a frequency that the alternations could not produce any sensible variations in the temperature of the arc, Duddell built an alternator giving 120,000 cycles per second, a frequency much higher than had been attempted by any previous experimenter with a mechanically driven machine.

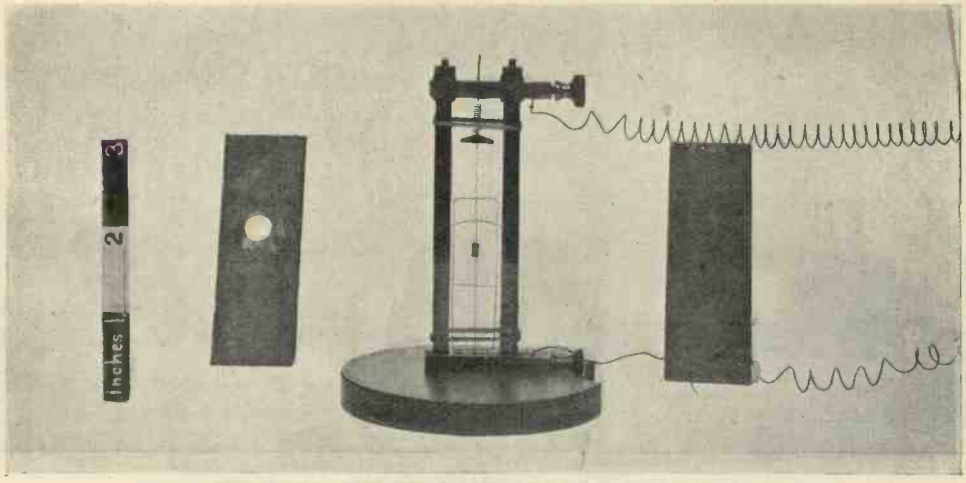
In 1905 he read a paper with Mr. J. E. Taylor on " Wireless Telegraphy Measure- " ments " which described a number of quantitative tests (made with an instrument which he himself had designed) on the variations of signal strength with varying heights of antennæ and varying distances between them. In this subject he always showed the keenest interest and had in his own laboratory in Victoria Street a small antenna with which it was his delight to read signals from distant stations of very long wave lengths. The antenna was of relatively small proportions and the records which he obtained with it formed a rare tribute to his skill as an experimenter.

In 1907 he was elected a member of the Royal Society, and in 1912 received the award of the Hughes Medal. He has designed many instruments which are of great value to those engaged on high frequency experiments.

In 1911 he read a paper to the Physical Society on a vibration galvanometer, which displayed all that care and refinement in detail that was so characteristic of him. One of the most useful of his inventions to radio engineers was the Duddell thermo-ammeter. This instrument was a development of the Boys Radiomicrometer, but modified in its final form so as to provide a portable instrument which can be used for the highest frequency currents with accuracy and certainty.

He was responsible for the design of one of the best patterns of Einthoven galvanometer and for a twisted strip galvanometer of great delicacy.

Duddell held many prominent positions in the scientific world. He was President of the " Commission Internationale de Télégraphie sans Fil " ; presided over the conference held in Brussels in 1914 ; and was responsible for the preparation of the programme of work which was ultimately decided upon. In 1907 he was President of the Röntgen Society, and became a vice-president of the Wireless Society of London.



TWISTED STRIP AMMETER FROM THE INVENTOR'S LABORATORY.

He was elected for two years in succession President of the Institution of Electrical Engineers, and for his second Presidential Address gave a lecture on pressure rises which was perhaps his most notable achievement as an expositor; the experiments were all difficult and required great skill in their performance, but they were all successful, and his model of the oscillating arc constituted a triumph in demonstration. He possessed a great gift of clear exposition, he never read a paper or lecture, but talked about his experiments with such obvious interest and delight that he fascinated his audience and made them as enthusiastic as he was himself about what he was showing them.

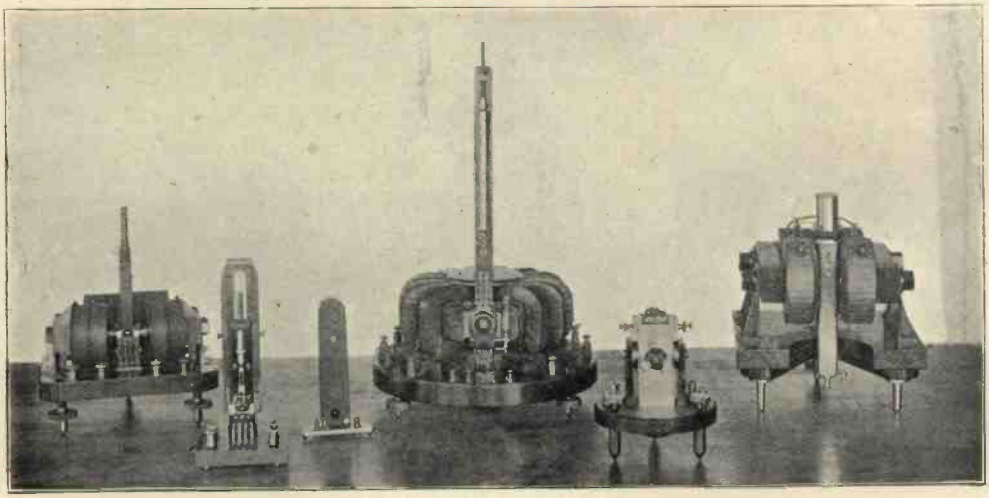
Another lecture which showed Duddell at his best was the one he gave to the British Association at Leicester on "The Arc and the Spark in Radio Telegraphy." In the course of it he passed several ampères of high frequency current through his body and some of those present afterwards remonstrated with him at the possible risk he ran in so doing. He gave a course of Christmas lectures for children at the Royal Institution which delighted them by the ingenuity of the experiments and the unfailing skill with which they were shown. He also delivered Royal Institution discourses on "High Frequency Currents" and other subjects.

He was a member of the advisory board to the Department of Scientific and Industrial Research and of the Board of Inventions and Research of the Admiralty; he was a member of many committees in connection with the Institution of Electrical Engineers and did a great deal to bring the library to its present state of efficiency.

He made an admirable chairman of committee, always business-like and to the point; no time was ever wasted when he was in charge.

He acted for some time as Government expert in connection with the Imperial chain of wireless stations which was contemplated just before the outbreak of war, and spent a great deal of time in dealing with the plans for their erection.

Duddell was no mean linguist, and those who have heard him conduct an



OSCILLOGRAPHS INVENTED BY MR. DUDDELL.

international conference will remember the wonderful skill he showed in reconciling the points of view of men of different nationalities.

It is an unspeakable grief to his friends that he has died so young. Few men have ever achieved so much in so short a time ; but the pity of it is that he worked himself to death. He was scarcely ever out of his office or his laboratory, he seldom allowed himself a holiday. It was his misfortune that he was never able to take that part in games and outdoor pursuits that is so notable a characteristic of the life of most young Englishmen. Several quotations have been made in this notice from a letter sent to the *Electrician* by Mr. Roger Smith. He has so well expressed the feelings of Duddell's friends, that I cannot do better than conclude these brief remarks with an extract in Mr. Smith's own words :

" Had Duddell's body been gifted with health and strength at all comparable " with his gifts of intellect, there is no knowing what he might have accomplished. " The success he attained in spite of all his handicaps has been, and it is hoped " will long remain, a stimulus to his less gifted friends and admirers."

For Remembrance

" The survivors, who were shelled in their boats, drifted for four days."—
DAILY PAPER.

VOICES there were, and Things with woeful eyes,
Dripping and grey as Fear,
By the boat's side, as though they tried to rise,
Splashing to make us hear.

The sea seemed full of dead that could not sink,
And women's little hands
That clutched and clung, with wedding-rings ablink.
Nurse, take away their hands !

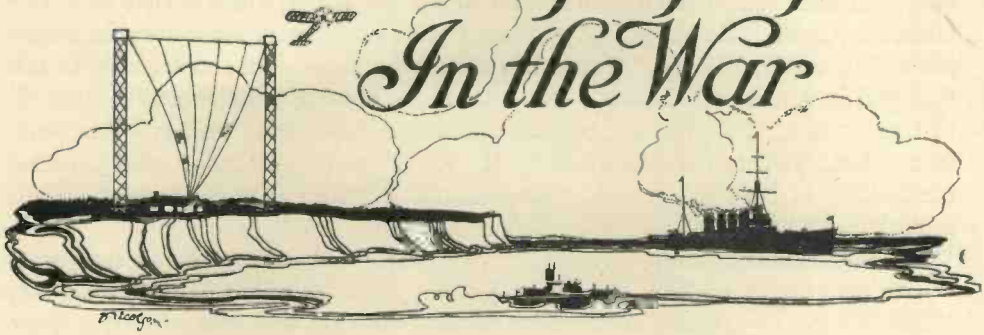
Voices there were, as wind thro' naked trees,
Called to us from the wave,
Behold ! we make the freedom of the seas
The freedom of the grave.

They shelled us, too, this knightly, cultured throng,
These children of the light ;
Angels in spectacles, who can no wrong,
Because their books are right.

We left the ship, whose stern now stabbed the heav'ns,
And thro' the swirling mists
We rowed us into battle. Four-point-sev'ns
'Gainst men with naked fists !

Voices there were, the noise of fools and blind ;
Dead, hopeless monotones ;
Cried, See ! the bright sword of our Mind
Hath won an empery of bones.

Wireless Telegraphy In the War



Surreptitious Enemy Activities.

The favourite role just at present for the German Government to assume *vis-à-vis* with their own people is that of the innocent lamb victimised by the predatory wolf. Sometimes the "character part" of the latter beast is assigned by them to England, sometimes to Russia, sometimes to some other leading actor on the stage of the world's war. This variation in "cast" follows the shifting of the scene. But whatever the identity for the moment of the nation may be, the "plot" always runs that this hated enemy conspired against the peaceful existence of Germany and sprang upon her a war which she did not desire.

It is marvellous that even the spoon-fed press of Germany can publish such rubbish, or that they can find readers capable of swallowing the pabulum thus presented to them. History has never furnished an instance of a war for which one side had made such elaborate preparations in all quarters of the globe. No nation has at any previous period organised a crime against the whole civilised world with the meticulous care lavished in this instance by Germany. Evidence thereof rolls up without cessation. We have been treated to a fairly large dose in recent days from the U.S.A. Naturally so; because, until the glorious day of April 6th last, Uncle Sam remained neutral, and thereby occupied the peculiarly favourable position of receiving the "confidences" of both parties to the dispute.

The recent exposure of Sweden's shame by Mr. Lansing has been followed by a number of further disclosures regarding secret wireless installations which have been made public by the Washington authorities. In Buenos Aires an illicit wireless outfit was discovered several weeks in advance of the Swedish disclosures. It was found in a house, located by a curious coincidence in a street called the *Calle Estados Unidos*—"U.S.A. Street." The premises fell under suspicion during the visit to Buenos Aires of the U.S.A. Squadron under Admiral Caperton, and subsequent investigations finally settled the point. A similar inquiry was instituted in Uruguay. As soon as the *exposé* was made the police authorities demolished the apparatus.

A Swedish diplomat in Mexico acted as the medium for transmitting wireless news to Germany, and it is believed that one of the means utilised by him was a

wireless station discovered on Lobos Island, a lighthouse station off the Mexican coast, north-east of Tuxpan. A complete wireless set, built by the lighthouse keeper, was discovered on the island, and its originator, being unable to give a satisfactory account of the way in which the material came into his possession, was placed under arrest. A further station was also discovered in Campeche, at the mouth of the Champoaton River. Following on these revelations a systematic search is being carried out all along the Mexican coast.

The American authorities are neglecting no precautions against treachery on their own littoral; flood-lighting is being employed to a considerable extent for radio-aerial and yard protection, and drastic measures have been devised for keeping at a distance unwelcome visitors. One of the latter was recently so indignant at the uncompromising attitude of an American marine on guard that he went the length of preferring a technical charge of assault against him. The United States Supreme Court, however, held the marine justified in the procedure he adopted.

Many of our readers will doubtless have read with some amusement the communications which passed between the Queen of Greece and her Imperial brother, published not long ago at the instance of M. Venizelos' Government. In one of her letters the royal hypocrite laments the fact that she and her beloved spouse were obliged to dismantle a wireless installation which had proved very useful, but assured "dear Willie" that she would have another set installed elsewhere, so that their intercourse might be carried on as before. Incidentally, these letters bring into glaring prominence the ineptitude of the British Foreign Office, which was representing Constantine and his wife as well-intentioned people doing their best in a difficult position! The contrast between our own authorities and those of the U.S.A. in this respect is rather marked.

Such specific instances as those referred to above constitute only a few of the more recently unearthed proofs of long-continued preparation and prevision on the part of the German Government and add a few more items to the already overwhelming mass of evidence. No such data has been adduced on the other side. There it is all the other way round. Germany's opponents have displayed a lack of preparedness extending in many instances to the verge of culpable neglect.

SCOURING THE PALESTINIAN PLATTER.

When the money-changers were driven out of the Temple the keynote of one of the nobler feelings of humanity was touched. The reprobation of evil resembles the reprobation of dirt in being a first and most essential step towards the attainment of moral, as of physical, cleanliness. The association of the Hun with the Holy Land has always had something nauseous about it to the present writer, who has himself come into contact with it there.

In THE WIRELESS WORLD for April, 1916, we published some references to a lecture by Canon Parfitt on the erection of a German wireless station upon the Mount of Olives. The penetration of the pushful German into the Turkish Empire has been forwarded not only by the two greatest modern aids to territorial development —railways and wireless telegraphy—but also by the process, blasphemous in a self-styled "Christian nation," of not merely holding in high esteem the religion of Islam, but also of semi-proselytism to it. It must have been with a sense of cynical

[*Photo, Shepstone.*

THE "KAISERIN AUGUSTA VICTORIA STIFTUNG," JERUSALEM.

satisfaction that the Turkish rulers of the Holy Land provided facilities for a Christian nation to desecrate the holiest piece of ground in the world (according to their religious faith) by a piece of warlike preparation, illicitly erected and disguised under the cloak of religious zeal.

We have recently been able (through the courtesy of Mr. Shepstone, agent of the American Mission) to secure photographs of this *Kaiserin Augusta Victoria Stiftung*, as it is called, at Jerusalem. This religious foundation overlooks Zion and its surroundings, both east and west; whilst the building cost over £120,000 to erect. The walls are of solid concrete, 12 feet thick, and the style followed is Gothic. The Tower of London was built by Norman kings to overawe and keep in subjection the citizens of our metropolis, and this German erection serves the same purpose in the capital city of the Christian faith. No details as to the powerful wireless equipment housed here are as yet available, but we shall doubtless have some information ere long when the Palestinian platter has been more completely cleansed from the filth of the Hun. The recent occupation of the City of David by the British is likely to result in the unearthing of many more revelations of the burrowings of the German mole.

WIRELESS ON ITALIAN TRAINS.

The difficulties under which Italy labours in peace time have been brought into bold relief by the stress of war. They are by no means confined to the land but extend also at sea. Mr. Edward Marshall, writing in one of our Sunday contemporaries, recently placed before English readers the heavy handicap imposed upon her by the fact that the Adriatic Sea has a cluster of islands and a long series of good ports on the Austrian coast, whilst on the Italian coast only two good harbours

are in existence. Mr. Marshall compares the resultant situation with what would be the case with America if "six hundred miles of its most priceless stretches of "Atlantic seaboard—say New Jersey or New England—were separated from the "German coast by a narrow estuary instead of by a spreading ocean."

Many evil results flow from this natural configuration. For instance, Italian ships, whenever they are damaged to any degree beyond the capacity for executing repairs on board, are obliged to traverse a long stretch of sea before reaching a harbour, wherein they may be docked and attended to. Enemy vessels, on the other hand, have but a short sea voyage and harbours in plenty.

Again, the long stretch of islands on the Austrian side enables enemy vessels to execute lateral movements, completely protected and free from observation. Such facilities give them golden opportunities for dashing out from some unexpected point and making damaging raids upon the valuable cities which dot the Italian littoral.

In order to cope with such a state of affairs Italy has been obliged to evolve a supplementary "Navy upon Rails." In other words, she equips railway trains on similar lines to ships of war, with guns of various calibres, protected by armour plating. These trains run up and down the coast, ready at any moment to counter the enemy's blows. The armoured cars are fitted with wireless apparatus and with searchlights; and, indeed, are treated more as though they were vessels afloat than railway trains ashore. Such means of defence have proved of great utility under the circumstances of Italy's present struggle, and radiotelegraphists will learn with great satisfaction that wireless has afforded as invaluable assistance to the efficiency of these "Ships upon Rails" as it has upon vessels in the less stable element.

[*Photo, Shepstone.*

ANOTHER VIEW OF THE SAME BUILDING.

The screen of islands, to which I refer above, protects not only warships but aircraft, making an air surprise by Italian flying men practically impossible, whilst the Italians can never warn their mainland in advance, unless—by chance—one of their warships sees the attacking aircraft squadron, and is able to transmit a warning message from its wireless aerials.

The article written by Mr. Marshall forms a very valuable contribution to British understanding of Italian affairs, and we would strongly recommend any of our readers who have not made themselves acquainted with it to turn to the pages of the *Observer* for that purpose. His information was obtained from Vice-Admiral Thaon di Revel, Chief of Staff, and Commander-in-Chief of all Italian naval forces, in the course of an interview, granted by the latter before the recent declaration of war by America upon Austria.

"Jack" as Gallant Ashore as Afloat

THE plot of a short story, as thrilling as any of those which might occur to the imagination of the most skilled writer, was recently embodied in a *Gazette* announcement of award for gallantry.

The scene is laid at a land wireless station (unnamed). A latticed mast supporting the aerials stretches a distance of 350 feet into the air. A small party of bluejackets are at work painting the steel girders of which it is composed, and in the midst of their labours hear the whirring hum of a seaplane. Suddenly in the course of a downward swoop, as it emerges at high speed from a cloud, the bird of passage strikes the mast not far from its apex, and the plane becomes wedged in the iron net as though enmeshed in the snare of a fowler. Yonder hangs the quarry, its head and tail projecting at right angles to the mast. But what about the pilot of its flight? He is stunned by the shock and flung from his seat. Fortunately, however, instead of falling precipitately to utter destruction, he alights upon one of the outstretched wings, and there lies unconscious 300 feet above the ground.

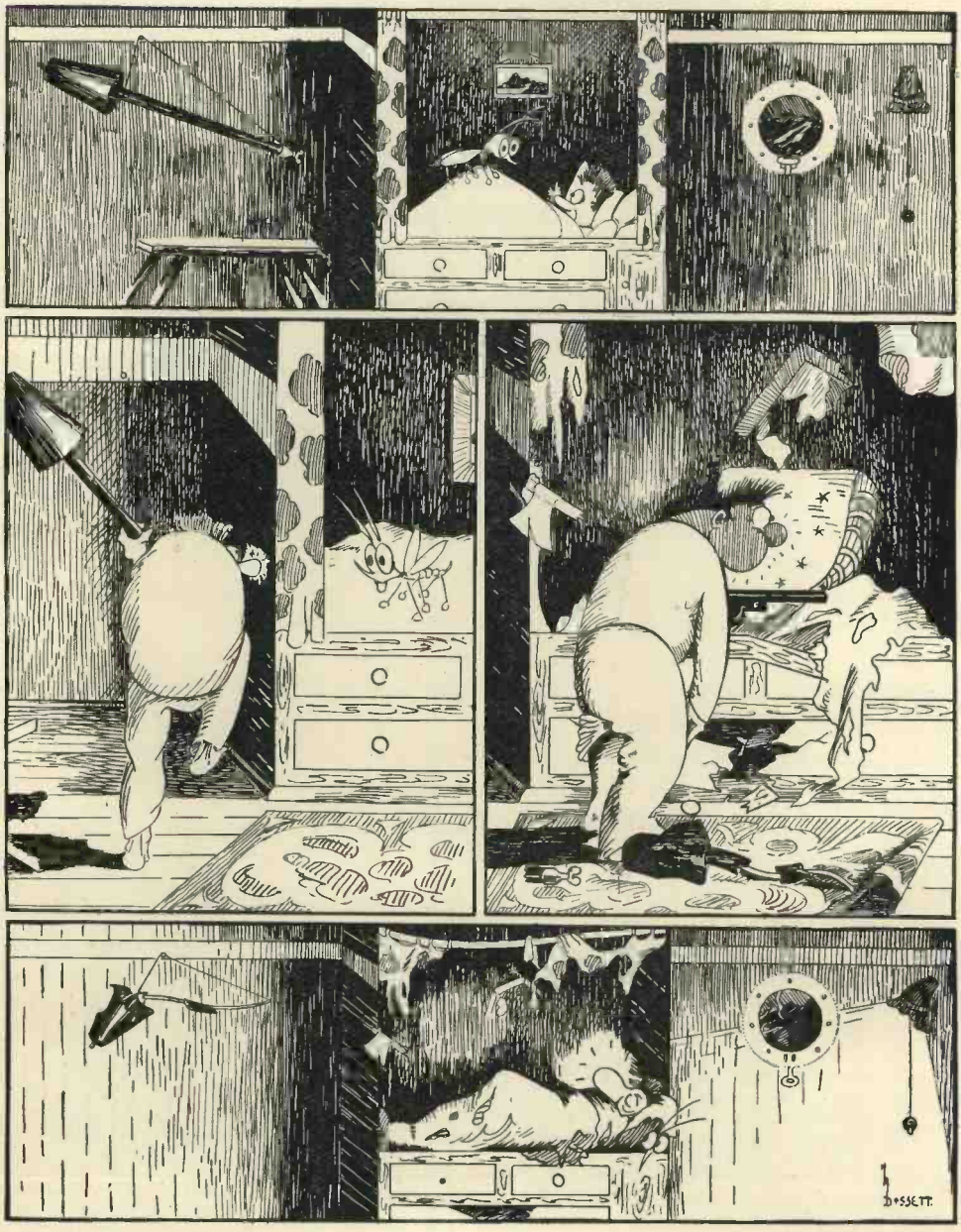
One of the painting party, a seaman named Rath, belonging to the Royal Naval Reserve, eager to rescue his comrade, climbs up the inside of the mast until he reaches the wreckage, and then crawls out on to the overhanging wing to support the unconscious aviator until help arrives. Two others—ordinary seaman Knoulton and deck-hand Abbott—climbing in their turn, pass to Rath a rope, which he secures to the body of the helpless flier. The latter is then lowered to safety, and the rescuers descend in triumph from the precarious position in which their gallantry has placed them.

Our picture (on page 683) adequately illustrates the nature of the curious accident and the fine courage displayed by the rescuers in risking their lives at the top of the sadly-damaged structure, which might at any moment have collapsed. The injured fuselage was only held in a horizontal position by the fact that the engines jammed fast between the girders. At a height of 300 feet the wind caused the mast and machine to sway, and threatened to bring about a collapse at any moment. The men were fully alive to the risks they ran, but no regard for personal safety interfered with their intrepid zeal to save the life of their comrade.

[Official Photo, Newspaper Illustrations.

THE SCENE OF A THRILLING INCIDENT AND GALLANT RESCUE. THE PICTURE SHOWS THE LATTICE-MAST OF THE WIRELESS STATION WITH THE SEAPLANE TRANSFIXED NEAR THE TOP. INSET WE HAVE (1) A VIEW OF THE PLANE AND (2) SEAMAN RATH, WHO RECEIVED THE ALBERT MEDAL FOR HIS GALLANTRY IN RESCUING THE SEAPLANE PILOT FROM HIS PERILOUS PERCH.

CARTOON OF THE MONTH



"The First Mosquito"

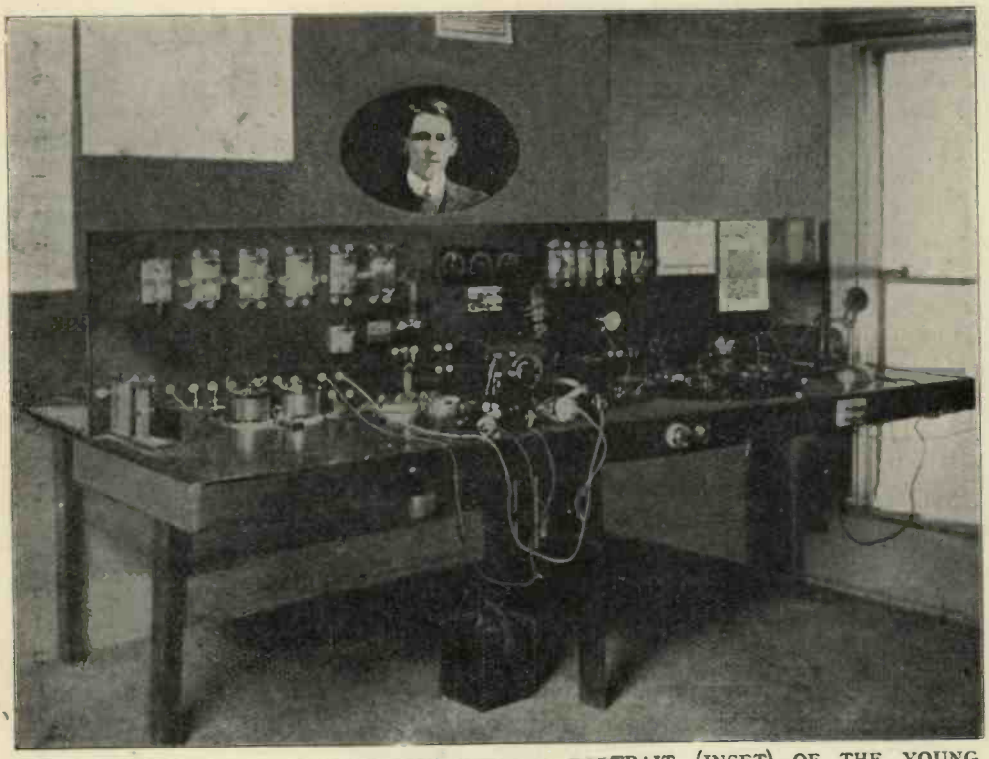
Bucolic Radiotelegraphy

The part that Wireless plays in American Farm Life

IOWA breeds men. There is no need in that favoured land for eugenists and economists to cry, "Back to the land," for the Hawkeye State is pre-eminently agricultural, and by the beginning of the twentieth century nearly 98 per cent. of the total land area was already devoted to husbandry.

The word "farming" speaks very eloquently to men of British race, calling up as it does pictures of substantially built and comfortable farmsteads, the centre of a busy group of workers, spending their lives in wresting from the earth "its fruits "in season," in tending sheep and cattle, and in the multifarious branches of industry connected therewith. But we should do well to remember that agricultural affairs are very different in the great continent of America from what they are in our own "tight little island." The farms are larger in area; in Iowa the average size ranges a little over 150 acres. The material from which farm buildings are constructed is not brick, stone or concrete, as in the United Kingdom, but mainly wood, supplemented by corrugated iron.

More striking than anything else, however, is the difference in the human factor. The traditional British farmer, although shrewd and hard-working, is easy-going,



MR. BANKS'S WIRELESS APPARATUS, WITH A PORTRAIT (INSET) OF THE YOUNG AMERICAN FARMER.

and not overmuch burdened with book lore, which he is inclined to despise. He snorts at "notions," and though forced to employ machinery, does so "against the grain."

The American agriculturist presents a striking contrast. His physique is lean and wiry, and he is pre-eminently a man of ideas. It may interest lovers of the British countryside, who desire so earnestly to ameliorate the conditions of life there, to know that the essentially agricultural State of Iowa holds the record for education amongst all the States of the U.S.A. It shows a smaller percentage of illiteracy than any other member of the Union. There can be little doubt that its prosperity is largely bound up with this fact; and wireless men will learn with pleasure, though hardly with surprise, that radiotelegraphy is finding its place amongst the latest "stunts" of the progressive State.

Our illustrations will to a large extent speak for themselves. They represent views connected with the wireless equipment utilised by a bright young farmer at Delmar. Archie Banks, the son of a well-known live stock farmer, had his attention attracted from an early age to machinery and mechanical matters. Radiotelegraphy captivated his youthful imagination; and, after a series of experiments and much study, he finally installed a wireless outfit on the farm eight years ago, at the age of but sixteen. By means of his outfit he is able to receive daily weather forecasts and market quotations, to say nothing of world-wide news intelligence, as promptly as does the city man with his elaborate organisation of newsboys, wires and telephones. No longer are the farmers who live near Mr. Banks obliged to wait for the belated newspaper which the R.F.D. carrier brings, in order to find out what weather is travelling across the country or what prices are ruling in the markets. When we come to remember that the climate of Iowa is continental—that is to say, characterised by cold winters, hot summers and sudden changes of temperature—it is possible for us to realise what this rapid intelligence means to them. All farms of any pretensions are connected up by telephones, and a ring to the Banks's farmstead brings the forecast to them immediately.

As you drive to or from Delmar City along the road which leads past the farm of this enterprising young agriculturist, your eye will light suddenly upon a large sign stretched across the road, a board 8 feet in length and 2 feet in height. Upon this sign is painted in large words: "Eat honey. For sale here. To-day's weather report by wireless on next curve. Archie Banks." Some little way further comes a turn in the road, and there stands the big bulletin board, 8 feet by 5 feet. Upon it young Banks posts the weather forecasts and news bulletins daily as they reach him through his wireless receiver.

All this is good for business. Mr. Banks is now 24 years of age and "on his own." He possesses the freehold, and operates the land, of a farm comprising 160 acres, devoted to what is known as mixed farming. His two special hobbies consist of electricity and bees. He manufactures and sells honey by thousands of pounds, producing good uniform quality; for Delmar lies in the midst of a rich honey section and trainloads of this valuable food product are shipped thence to all points east and west. Incidentally—to vary the words of Holy Writ—"men come to read wireless news and stay to buy honey." The net result of this procedure is that Mr. Banks's hobbies not only pay for themselves but produce a side-line income

MR. BANKS'S NOTICE BOARD.

which has already begun to assume substantial proportions. Virtue has been its own reward in this instance, for neither form of activity was originally taken up with a view to profit.

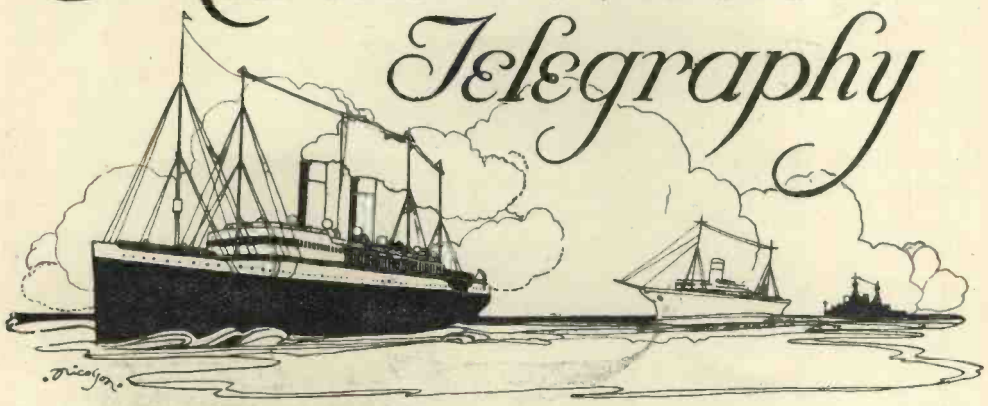
Mr. Banks keeps up his enthusiasm for radiotelegraphy and is constantly adding not only to his knowledge but to his apparatus. The station is almost as complete as it can be made. He receives messages from Darien (Panama), from California, from Cuba, from Virginia, from New York City, and so from all quarters of the world. The messages that come from New York are so loud that the signals can be heard all over the house. He has set up a special receiving set for weather reports, on which he receives nothing but spark stations, like those of Iowa State College and similar institutions. From Ames and Springfield he gets weather reports every day at noon. The fact of these being due at a certain regular hour brings scores of automobiles in this direction every day to look over the wireless bulletin board and note this all-important information.

Share Market Report

LONDON, *December 13th*, 1917.

THE market in the shares of the various issues has been very active during the past month, and the prices are well maintained: Marconi Ordinary, £3 2s. 6d.; Marconi Preference, £2 12s. 6d.; Marconi International Marine, £2 11s. 3d.; Canadian Marconi, 11s.; American Marconi, £1 3s. 6d.; Spanish and General, 10s.

Maritime Wireless Telegraphy



CAMOUFLAGE AT SEA.

THE story of the American s.s. *Edna*, alias *Jason*, alias *Mazatlan*, as told in the Law Courts about the middle of November last, constitutes a romance of the sea which makes one regret that Mr. Clarke Russell is no longer with us to "write it up." Mr. Guy Duncan Smith, now a Flight Sub-Lieutenant in the R.N.A.S., figured in the character of hero. He well deserves the title.

Built at Bergen in 1903, the vessel in question underwent a whole series of kaleidoscopic changes of nationality. First Norwegian, then Mexican, then German, and finally American, she formed one of the units utilised by our enemies for the secret coaling at sea of the *Leipzig*, a member of the German Pacific Squadron, under Admiral von Spee, which was destroyed off the Falkland Islands on December 8th, 1914, by our own gallant Admiral Sturdee.

The most important affidavit in the case was made by Flight-Lieutenant Smith, at that time serving on the *Edna* as wireless operator. He tells us therein that on a certain occasion in the course of his voyage he awoke just about midnight and put the wireless receiver to his ear. The message was worth breaking his sleep to hear; for what came through was an announcement from the Pacific mail steamer *Aztec* that war had been declared between Russia and Germany. At the moment when Mr. Smith was "listening in" to this message the *Edna* was known under her alias of *Mazatlan*. She flew the German flag and had the word "Hamburg" painted on the stern. The flag was removed and Mexican colours hoisted; "Hamburg" was painted out and "La Paz" substituted for it. Under the guise of a Mexican, and still bearing the title of *Mazatlan*, she went to San Francisco and loaded up with coal at that port.

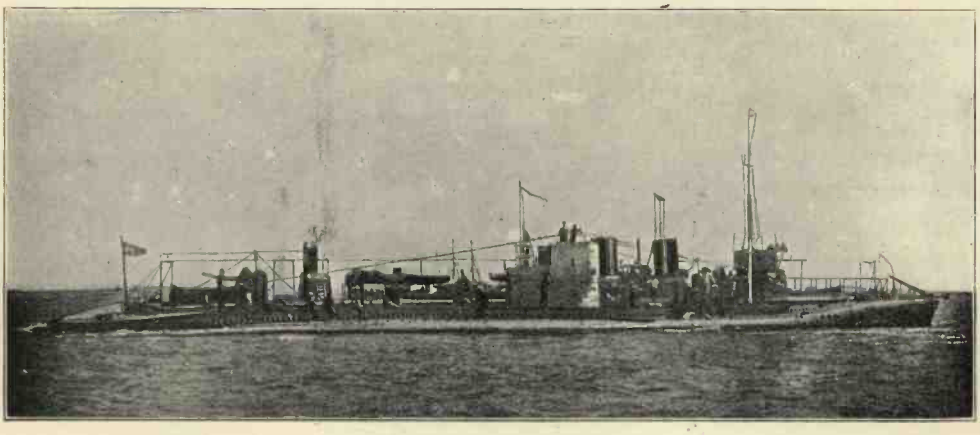
Now it so happened that before Operator Smith left San Francisco he learned that the coal which his vessel carried was intended for the *Leipzig*. This information he conveyed to his father, who passed it on to the British consul. Acting on the "information received," the authorities at San Francisco demanded a bond that the coal would not be delivered to the German cruiser. Of course, they got it at once.

Germans are not troubled about affidavits or bonds, or any amount of false swearing.

Before the vessel finally quitted the American port a German wireless operator was taken on board, and Smith was told that, if he refused to do his duty, the Teuton would take his place. The German telegraphist, however, did not understand the Marconi system, being used only to Telefunken apparatus, so that Operator Smith, who seems to have been as resourceful as he was intrepid, was able to shorten the length of the sound waves and hocus the enemy into the belief that he was sending out calls for the *Leipzig*, when nothing that was of the slightest use was being done. On one occasion the captain—a man of the name of Jebsen—instructed him to get in touch with the *Leipzig* and gave him the code call D A N S. Smith said that he was British and refused to obey; so the German operator was introduced into the wireless room. Before he arrived, however, the circuit had been put out of tune, and the wave length altered; so that though sparks showed in the wireless room nothing would radiate from the aerial. The puzzled Teuton spent three nights and three days trying to call up the raider; but all in vain. The captain was forced to re-install Smith, who put the wireless right, and—in order to allay suspicions—did actually on this occasion call up the *Leipzig*, but took care to get the messages at cross-purposes. The wireless gear resumed its out-of-order condition whenever the German operator tried to use it.

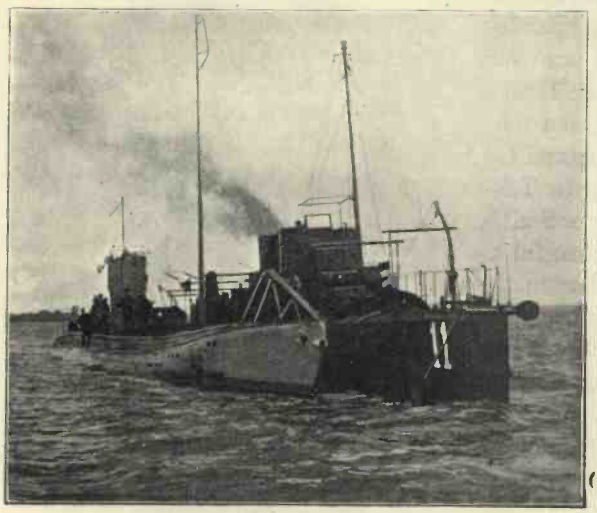
MR. GUY DUNCAN SMITH, NOW A FLIGHT-LIEUTENANT IN THE R.N.A.S.

At La Paz Smith forwarded a message to the admiral on the U.S.A. cruiser *California*.



THE GERMAN SUBMARINE U.293 INTERNED AT CARRACA, CADIZ, WHICH FILED HER INTERNMENT CHAINS AND ESCAPED ON OCTOBER 6TH, 1917.

It is perfectly obvious that this gallant young man, in thus baffling the Germans, did so at most serious risk to his own life. The officers threatened to shoot and throw him overboard on several occasions. There can be little doubt that they would have carried out their threat had not he to some extent placated them by seeming compliance. The only result of the messages which he exchanged with the *Leipzig* was an enquiry as to her location, and a reply from her to the effect that she was "waiting round" for the *Mazatlan*.



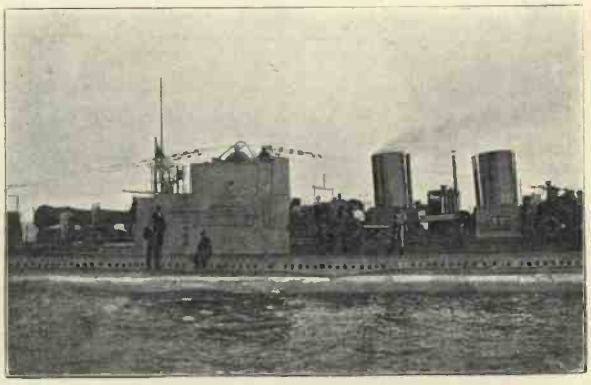
ANOTHER VIEW OF THE U.293.

In the end, the *Edna* (alias *Mazatlan*) was commandeered by the Mexican Government, who put an officer on board to take charge and prevent any further risk being incurred of non-neutral or improper usage.

ENEMY ACTIVITIES IN SPAIN.

We print here and on page 689 three fresh photographs of the Submarine U.293 which recently made its escape from Cadiz. These pictures possess an added piquancy from the fact that they were sent us by a wireless correspondent in Cadiz, a Spaniard, who informs us that they are the work of a German firm there, who—he insinuates—owe to their nationality the privilege of having been the only firm permitted to exercise their camera upon the vessels.

The writer of "A Londoner's Diary" in the *Evening Standard* recently made the statement, on the authority of a "high official," that there is reason to suspect German agents in Spain of still sending news to the Vaterland, either by wireless or by submarine. It has been persistently reported for a considerable time past that Spain has been unable to prevent the violation of her neutrality in the way of wireless communication; but the shipment of mail matter by submarine is something new. The repetition of such incidents as the escape of the U.293 above referred to would have an inevitable tendency to give colour to reports of this character.



LYING ALONGSIDE A SPANISH TORPEDO-BOAT.

He Who Laughs Last

A Crafty "Wheeze" from the Front

By "PERIKON"

"I DON'T suppose," observed Cyclone one afternoon, "you've ever heard of Larry from Limerick and the Petrol?"

I admitted I had not.

"Well, he used to be wagonman of Q Pack."

In case the reader should not know exactly what a wagonman, or rather a pack wireless wagonman, is, perhaps we had better explain. The wagonman is the man responsible for the care and cleanliness of the apparatus, the stores, the spares and the wagon. His duties are legion. They range from repairing 'phone leads to greasing the limber wheels.

"As you're aware," went on Cyclone, "you find under the heading 'Stores' the entry 'Petrol, gallons, eight.'

"Now Larry's petrol kept disappearing. He couldn't fathom where. The Q detachment were billeted with most of the Signal Squadron in the usual one-street Picardy village. It was just before the Somme, in the spring of '16. Things were being got ready for the push.

"Larry's wagon was housed in Madame Ducrocq's barn at the end of the village. To the left and right lay the K and X Packs, and near the church, the cable sections had their lairs.

"Larry knew that petrol was a fluid of excellent properties—that a rag soaked in it erased all trace of rust or dirt from almost anything, be it a rusty tug chain, a dirty rifle, or a grease-stained tunic. And he knew that quite a respectable meal could be cooked on a liquid ounce of it, properly used.

"The barn had possessed a door at one time and walls too. But the area of hole made the area of wall a minus quantity. Larry slept in the loft above and kept the wagon very much under observation. He hadn't much difficulty, as the floor wasn't exactly in its heyday. There were innumerable cracks and knot-holes in its worm-eaten planking. At times it creaked and groaned ominously in places, forcing Larry to shift his weight hurriedly to sounder ground. He frequently did this in the stilly watches and went to sleep nightly with the sort of feeling you'd have if you spread your groundsheet on the rim of a dormant volcano.

"To his great disappointment nobody ever ventured near whilst he kept his creaking vigil. Occasionally Madame Ducrocq's fowls came in, found the wagon shed devoid of sustenance and strutted wearily out.

"The thief or thieves preferred to wait till Larry was safely inside the '*Repos des Chasseurs*' at the other end of the village. Then they helped themselves.

"He ruminated for nights on the thing and caused a sensation one evening in the '*Repos*,' by banging the table so hard, that he upset his own 'starboard light' and that of his bosom pal 'Uncle John,'—so called on account of his dearth of hair.

"'What's up?' asked 'Uncle John,' as he gazed wistfully at the green pools on the varnished table.

" ' I've hit on a wheeze,' whooped Larry. ' The divil I have. They'll niver pinch the petrol on me again.'

" And undoubtedly he *had* hit on a wheeze. Next morning he called at the petrol dump and requested four empty tins. He got them. Then he proceeded to the Squadron horse troughs and filled them with clear clean water.

" Returning to the barn he moved the four tins of petrol into Madame Ducrocq's cellar and put the tins of water in the place occupied by the petrol on the barn floor.

" That night on his return from the ' *Repos* ' he found one tin lighter by at least a gallon.

" He went to sleep chuckling. The morning might reveal the light-fingered gentry.

" ' He'd have a scout round anyhow.'

" In the morning he strolled over to the K detachment lines. The first thing that met his gaze was Monty Mahogany. Monty was K's centre lead driver. He was building a pyre of wood beneath a sooty dixie. The dixie contained water. Before he placed his firewood in position he dipped each piece in a Maconochie tin containing a clear fluid.

" Now Monty was a tough customer. According to what he said he'd been a merchant service A.B. His ship, a nitrate boat from Iquique, had paid off in Cardiff somewhere about the tail end of September, '14. Monty drew his money, went ashore, and got merry. He'd seen a great procession headed by brass bands, banners, and military chaps with rosettes of ribbon in their caps. Monty saw the throng and joined it without knowing exactly what it all meant. Evidently these people were out for somebody's blood and Monty felt cheerful enough for murder. If there was a row he'd be there. In the morning he discovered he was a full-blown soldier posted to the Corps of Royal Engineers as driver. This gave Monty a permanent ' liver.' But he decided to see it through. His service grew. So did his series of ' crime sheets.' Had they been bound they'd have made the Manual of Military Law itself look but a skinny exercise book. But Monty's offences were petty affairs, nothing really desperate. Numerous nicknames were given him. The bright spark who thought out ' Sindbad the Sailor ' caused a fresh entry on Monty's crime sheet. The wit who invented ' Windjammer Will ' likewise bit the dust and earned Monty C.B. However, he didn't mind the ' Monty Mahogany ' one and it stuck to him. It was appropriate. His chest, face and arms had been scorched and tanned by sun and storm till he looked like a mahogany idol.

" ' What ho ! Monty. How goes it ? ' asked Larry.

" ' What ho ! pudden head,' responded Monty.

" ' And what will you be after wid the sticks and dixie ? ' quizzed Larry.

" Monty said he was going to boil water for bran mash. The A.V.C. officer had decreed on the preceding day that the horses of K pack must have bran mash.

" Monty went on dipping his sticks and at length completed the pyre.

" From his tunic he produced an old newspaper. He lit it and, standing well back, applied it to the pile of firewood. Nothing happened. Monty swore. He flung the flaming paper on the ground and forced it beneath the dixie with the toe of his boot. ' Now burn, you son of a——.' However, what Monty said doesn't matter. Gritting his teeth he cast the contents of the Maconochie tin on the sticks. There was a great hiss. Vast clouds of steam flew heavenwards and the fire went

out. Monty stood rooted. His jaws gaped like the jaws of a caught codfish as he blinked at the phenomena. But only for a moment. With a murderous drumfire of deep-water oaths he hurled the Maconochie tin at Larry.

" But Larry was off. Monty was the culprit. Monty had been ' had.'

" ' You blank blank Limerick blank. You blank Irish blank blank ! ' howled Monty. ' Stop there and I'll kill you.'

" But Larry didn't stop.

" Ten minutes later he returned. Monty, deeply moved, was tearing round like an angry bear, a breast-collar in one hand, a huge piece of emery in the other. He'd used the supposed petrol on his harness. The welkin rang with weird sailor swears. The metal appointments of his breast-collar instead of being brilliantly clean were brilliantly rusty. The O.C. was due to inspect harness in ten minutes' time. The O.C. was most minute in his inspection.

" Hence Monty's agitation.

" Larry kept well out of sight and feasted his eyes on the unlucky Monty.

" Suddenly Sergeant Crashem of K Pack appeared. His ' walrus ' bristled. His eyes bulged. In one hand he brandished a rifle.

" Where's that imbecile Mahogany ? ' he howled.

" ' Ah ! there you are, you—you——. Look ! Look at it ! ' he frothed, thrusting the weapon beneath Monty's nose. ' Look at the rust, damn ! What d'ye mean ? Speak, man, speak ! '

" ' Blank blank blank ! ' shrieked Monty.

" ' Office to-night,' roared Crashem. ' I'll teach you to back-answer me, you brown, flea-bitten ape. You'd have made no mistake if I'd sent you for beer, would you ? Would you ? Speak ! Answer me ! You didn't think ! You went to the usual place ! Get out ! *Allez !* You're not worth your feed ! '

" That evening Monty was doddering round the picket line still feeling pretty sore when a big grey Rolls-Royce pulled up in the roadway outside. The driver descended. As Monty seemed the only human in sight the driver made for him. Did Monty know where he could borrow some petrol ? The great man and his *aide* must be in Amiens within the next two hours, and they'd run short of petrol.

" ' Wait there. I'll be back in a brace o' shakes. I'll get you some,' and off Monty raced.

" He sought out Larry's sergeant and explained that one of the great heads was without. That the war might be lost unless the great man got petrol.

" ' What about your own detachment's petrol ? ' asked Larry's boss.

" ' I don't know where our blisterin' wagonman keeps his. He's so damn fly. And Crashem's out sinking bee——out having a stroll,' amended Monty hastily.

" ' Right. Take some of ours. You'll find it in that barn somewhere.'

" To tell Monty it was kept in the barn was merely a waste of breath. Monty knew its location to the nearest millimetre. He seized two of the tins and thrust them on the driver. Then he cleared out to wait and watch. He wasn't kept waiting long. Within thirty seconds the car's tank contained four gallonsworth of the same stuff as had put Monty's fire out and rusted his harness.

" The driver then whirled the starting handle. There was a purr. He was about to sink languidly into his seat with that *blasé* air assumed by drivers of the high and mighty, when the engine stopped. The driver then attempted the ' Dear me,

how beastly peculiah' expression and got down to investigate. He whirled the starting handle. She refused to take. He lifted the bonnet and peered within. He tested his plugs. Everything seemed O.K. He fiddled with the carburetter. It, too, was O.K.

"Then the great idea dawned on him.

"He went to the rear and unscrewed the cap of the petrol tank. He looked round for Monty, but the road was Montyless. He dipped a pencil in the tank. He applied a match to it. The match went out.

"'Gawblimey,' sobbed the driver, 'water!'

"'Heavens!' murmured the *aide*.

"'Confound it!' snapped the great man.

"Five minutes later a perspiring orderly sergeant gripped Larry in the '*Repos*.'

"'Here you, get back to your billet. Move yourself.' And Larry hurried billetwards wondering.

"He saw the car, the great man, the *aide-de-camp*, the driver. In the background he saw his own troop officer and sergeant. And peering from behind a walnut tree in Madame Ducrocq's pasture he saw the evil face of Monty, wreathed in grin.

"'What's this mean? This water in petrol tins?' demanded the troop officer.

"'It was a trap for them that stole me petrol on me, sir.'

"'H'm! Quite effective, doubtless, but dam'd awkward for honest people. Sar'nt!'

"'Sir!'

"'Arrange for one of our cars to run the general and his *aide* into Amiens immediately, and let our budding strategist help to get the water out of this car.'

"'Sir,' turning to the general, 'your car will be in running order to-morrow. I'm sorry this has occurred.'

"Well, Larry crawled into his loft somewhere round midnight with the 'haw haws' of Monty still grating in his ears. Theoretically Larry should have had *all* the laugh, but he hadn't."

Radiotelegraphic Communication between France and the United States

A RADIOTELEGRAPH station destined to establish direct radiotelegraphic communication between France and the United States of America will shortly be established by the French Government. It will be situated on the West Coast of France and will maintain permanent and continuous radio-communication by day and by night between France and the United States. It will radiate continuous waves with a wave-length of at least 15,000 metres.

The contractor must guarantee transmission from the French station to the American station (on any day of the year) of 10,000 words per 24 hours. Moreover, the transmitting and receiving apparatus will be adjusted in such a manner as to allow of continuous transmission and reception at the minimum speed of 4,000 words per hour. Adjustments permitting musical transmission and auditory reception at the speed of 200 words per hour are also provided for.

Transmission by the French station of signals destined for reception in the United States of America, and the reception by the French station of signals from the United States, simultaneously and independently, will be correctly and efficiently carried out.—*From the "Journal Télégraphique," dated Berne, November 25th*, 1917.

Notes of the Month

Boloism and Wireless.

The Allied Governments have had a rude awakening. Russia first and Italy afterwards have fallen victims, not to the German sword, but to vile German propaganda, acting through treacherous and misguided citizens. France has shown symptoms of the same trouble, in the "Boloism" which has furnished a new word to our vocabulary. So far, the British Government has done nothing further than seize literature and issue a regulation that the printer's name must appear on every publication, and that each article, or pamphlet, must be passed through the Press Bureau. Most of our daily contemporaries are of the opinion that much more is wanted, and we are certainly inclined to agree with them.

We have on several recent occasions referred to the fact that a large amount of the wireless propaganda news, radiated daily from the German Long Distance Stations, continues to be sent in English. Germany, unlike some other Great Powers, does not waste time or money for nothing. All the English-speaking races are at war with her. That propaganda, therefore, is intended for traitors within our gates. Our wireless regulations are stringent; and, as we have often said before, it is scarcely possible to imagine that information can be sent to the enemy by wireless from these shores without almost immediate detection. But reception is a different matter. These messages plainly continue to be received by those for whom the German Government destines them, or that Government would discontinue their transmission. Who are they? Are we taking any steps to find out?

Even apart from possible secret reception, there are a large number of Army and Navy operators who may pick up these messages. Constant dripping wears away a stone, and Jack and Tommy are both fond of "grousing," so fond that it is often difficult to judge whether they mean their "grouse" to be taken seriously or not. Are we sure that no harm is being done this way? It will be remembered that, just prior to the Indian Mutiny, officers of the native regiments pathetically pledged themselves for the loyalty of the men under their command. The Italian Higher Command and officers apparently were equally confident on the eve of the present *débâcle*.

A Leaf from the Enemy Book.

Our attention was arrested the other day by a short paragraph in the daily Press stating that the Republic of Brazil was intending to send officers of the Brazilian Army to study military matters in the training centres of England and her Allies. We hope that such a tendency on the part of other less favoured countries than ourselves will meet with the encouragement and warmth of welcome which it deserves. An important branch of modern military practice centres round Radio-telegraphy, and we feel sure that all wireless men, both military and civil, will

welcome the opportunity of entering into cordial relations with our Brazilian and other friends. No unimportant part of Germany's preparations for the present war consisted of the way in which the officers of other nations' armies were, for the last twenty or thirty years, consistently welcomed and trained by the German military authorities. In many cases (we may quote as an example the case of Chile) not only were the officers trained in accordance with German system and method, but were, we understand, actually given rank in the German Army itself. Such a procedure naturally produced a powerful effect upon the governments affected by it; and assuredly accounts to a large extent for the sympathy with Germany in military circles of neutral countries which would otherwise tend to be biased in favour of her opponents.

THE NEGLECT OF SCIENCE.

We have received from the "Committee on the Neglect of Science" an article by Sir Ray Lankester, lamenting the opportunity recently lost by the Civil Service Committee in failing to render certain scientific subjects compulsory in the qualifying and competitive examinations, covered by their report upon the scheme of examination for Class I of the Civil Service. The distinguished writer reminds us of the fact that, at the great conference held at Cambridge on May 3rd, 1916, under the presidency of Lord Rayleigh, resolutions were passed pressing upon the legislative and administrative authorities of this country, that they could materially assist the scientific progress of this nation by making certain subjects in this branch of knowledge compulsory for Civil Service Examinations. The Government Committeemen made important recommendations of changes in the scheme of those examinations which constitute a great advance in the direction desired. But they have not made it part of their recommendation that such subjects should be rendered compulsory; and it is to be feared that, by failing so to do, they will not force the reluctant teaching authorities of this country to institute those sweeping reforms which are so advisable in the national interest.

No one who has anything to do with the training of candidates for Wireless Telegraphy can fail to be struck with the advisability of reform in the scientific training of British students. A great deal of elementary information of the highest value for efficient wireless progress has to be acquired at the time when every moment is of importance from the point of view of pure Radiotelegraphic practice, or has to be mastered later, at a sacrifice of leisure time, which not all young wireless men are able, or willing, to give.

A FALSE STORY.

Some anonymous slanderer invented a yarn of how, during a visit paid by a certain Mme. Mona to Boom Towers, Portsmouth, telescopes and a wireless installation were placed upon the roof. In consequence of this anonymous denunciation the lady was ordered to leave the district within forty-eight hours and the premises were sealed by the local authorities. The whole story turned out to be a ridiculous fabrication and came out in the courts when Dr. Maddick, conjointly with Mme. Mona, claimed damages from the authorities.

In Memoriam of a Distinguished Frenchman

A Biographical Sketch of the late Captain Camille Tissot

By ANDRÉ BLONDEL

President of the French Commission on Scientific Wireless Telegraphy

ALL electricians interested in wireless telegraphy will learn with deep regret of the premature death of Captain Tissot, which occurred at Arcachon on October 1st last. This distinguished scientist was one of the pioneers of wireless, having interested himself in the subject from 1898, and much of the work which he executed in connection therewith is certain to retain a permanent value.

Captain Tissot was born at Brest on October 17th, 1868. His family followed the avocation of the sea, and the young lad received his education at the Brest Lycée. Sensitive, like so many other young people, to the influence of his surroundings, Camille Tissot determined upon a career afloat. He accordingly entered the Naval School in 1884, and was thence drafted into the French Navy, making his initial cruise in the Pacific. During the course of 1889 he was promoted to the rank of Junior Lieutenant, and—being drafted into a home squadron—profited by his being stationed on the French coast to take his University degree in mathematics and science. His tastes thenceforward followed a definite bias in the direction rather of a scientific than a naval career. He took advantage of a vacancy in one of the posts in Physics at the Naval College and joined the staff. First as assistant-lecturer, afterwards as Principal, and with the rank of Lieutenant in the Navy, Captain Tissot occupied one of the Chairs at the Naval College until he won his promotion to the grade of Cruiser-Captain.

It was in this capacity as Officer-Instructor at the Naval School that he specialised in the study of wireless, more particularly with respect to its applications to naval requirements. Side by side with these technical studies he directed his energies towards important theoretical researches on the same subject. Having gained considerable repute for such work, he was chosen, in company with Colonel Ferrié, to deliver lectures on Radiotelegraphy at the Higher Grade Electrical School. Later on these lectures underwent considerable development. The opening of a branch of the electrical school specially devoted to wireless telegraphy led ultimately to the organisation of highly-advanced courses of study, one of which (that dealing with the theory of wireless) was placed under his direction. Captain Tissot made a summary of the greater part of his theoretical work, posterior to 1905 in a monograph on " The Resonance of Antenna Systems," which, presented as a thesis before the Paris Faculty of Science, resulted in their conferring upon him the degree of Doctor of Science.

Wireless telegraphy, however, did not occupy the whole of his time. He turned his attention also to matters connected with the compass, especially in connection with battleships, as well as to matters connected with optics in its application to naval gunnery. It is more especially to him that we owe the system of signalling at present used by the French Navy.

The scientific services above referred to, were rewarded by a commission as Cruiser-Captain, a distinction rarely conferred in the case of an officer who, engaged on tutorial duties, has not followed the regular routine of service. Summoned to Paris to continue his labours, and there attached to the Central Laboratory of Naval Artillery, Captain Tissot gave his attention—outside his theoretical work—to questions connected with artillery optics. There again the results of his labours were seen by the introduction of certain improvements on current methods. We may instance that at the moment when war broke out he had just completed the design of a new optical instrument for gun-laying.

At the beginning of the present struggle he was placed in charge of a number of posts on the coast, which he filled with patriotic zeal, as well as technical ability. Constantly exposed by these duties to the vagaries of the weather, he contracted the germ of the cruel illness which has just proved fatal. He struggled against the ravages of his disease with high moral courage, the more admirable that he was for the last few months under no illusion as to the inevitable issue.

It seems to us an opportune moment, when one of her best and foremost wireless experts has just died for France, to give a few details of the most essential progress in this applied science which we owe to him. They are of the first importance.

He was the first to utilise the bolometer for the purpose of quantitative analysis in wireless, and to initiate a system of measurement for calculating with precision the current of the receiving antennæ. He was able to deduce therefrom the law of capacities and the numerical factor which figures therein. He was, moreover, one of the first to demonstrate the possibilities of the method of Victor Bjerknes for the measurement of damping (amortissements); he traced the resonance curve of wireless telegraphy, and instituted methods for the precise measurement of the periodicity and damping antennæ.

The experimental relationships, deduced from his experiments, have been confirmed by all the laws which subsequently found a place in the theory of radiotelegraphy, and by the results afterwards arrived at by other investigators.

Amongst his most interesting results may be mentioned also the important relation between the value of damping and the quality of earthing, as well as the introduction of the notion of resistance of radiation of the antennæ, besides the first determination of this resistance. All of these investigations were criticised by clarity of vision and exactitude of method. Finally, Captain Tissot was one of the first and most zealous in recommending the introduction of international time signals, and for the purpose of facilitating the reception of such signals he, from the start, recommended, and constructed the type of simplified receivers which have since received the name of Aperiodic.

Leaving out of account the numerous articles and papers composed by Captain Tissot on various interesting phases of radiotelegraphy—notably, his investigations into the different types of detectors, the construction of resonant transformers,

etc., we owe to him three remarkable co-ordinative essays: his memorandum of 1905 dealing with the Resonance of Antennæ; a treatise on Electric Oscillations, characterised by clear and penetrating insight, and showing complete mastery of the subject in all its great complexity; and finally, a Manual on Theoretical and Practical Radiotelegraphy, the second edition of which came out only a few months ago, and was brought thoroughly up to date by its author.

These publications and labours, which did honour to our country, possess an enduring value and ensure a niche in the Temple of Fame for Captain Tissot. His deserts were recognised not only by French wireless specialists, who in 1913 selected him as a member of their Scientific Wireless Telegraph Committee, of which he has since then formed one of the most competent and authoritative members, but also throughout the world of wireless.

His death was a sad loss to our country and to electrical science, and has caused profound regret amongst his numerous friends and colleagues, and we associate ourselves with the mourning of Madame Tissot, to whom we offer our sincere sympathy.

Tanks at Marconi House

[By courtesy of "Flight."

GERMAN AEROPLANES AND BRITISH TANKS OUTSIDE MARCONI HOUSE ON LORD MAYOR'S DAY

On the Matter and Elimination of Strays

An Investigation under the Auspices of the Dutch East Indian Department of Telegraphs

By CORNELIS J. DE GROOT, Sc.D., E.E., M.E.

(Engineer of the Department of Telegraphs, Dutch East Indies)

Continued from page 638 of our December issue.

It is easily seen that there is enough difference between day conditions (and especially morning conditions) and night conditions to enable us to conclude that if the theory of Eccles were correct, our stations on the average are not situated near the thunderstorm centre. On the other hand, it would seem that in the afternoon we were rather near such a centre, the difference between average afternoon and night observations being only small. This already indicates that the phenomena are not governed by so simple a supposition as that of Eccles. In Fig. 8 there is also shown the same curve of daily variation of stray intensity throughout the year plotted in polar co-ordinates around the circular cross-section of the earth. The direction of the impinging sunbeams and the direction of rotation of the earth around the sun are given.

We see that the polar diagram shows two curious half-oval curves of different sizes for the day and night observations (*abc* and $a^1b^1c^1$) symmetrically arranged relative to the direction of motion of the earth around the sun and connected by the steep lines (*pq* and p^1q^1), these steep portions occurring near sunrise and sunset.

It is quite clear that the night phenomena are the symmetrical repetition of the day phenomena, and that the reason for the difference between night and day must be found, in all probability, in the medium between the point of origin of the strays and the receiver, which is under the influence of the radiation of the sun. We find this same influence in a much more pronounced form in the propagation of the electromagnetic waves of the radio transmitter, and I proved elsewhere that the difference must be due to ionization of the air layers up to a height of some 200 km. (125 miles).

In this connection it is interesting to note from the polar diagram of Fig. 8 that the diminution of strays at the point *A* begins long before the time of sunrise at the place in question—that is, as soon as the layers in the atmosphere above the place are touched by sunlight the change begins.

This indicates that the source of strays is not (as Eccles supposes) in the lower layers of the atmosphere, since the difference between night and day would in that case begin only as soon as the lower layers between the source and receiver are reached by sunlight. The assumption of the source of strays in the higher layers

of the atmosphere is therefore logical, and under these conditions the difference between day and night strays is natural and to be expected.

Another interesting fact in connection with the shape of the polar curve of Fig. 8 is that the strength of strays is not a function of the direction of the impinging *sunbeams*, but that the curves are symmetrical, relative to times determined definitely by the movement of the earth around the sun. This furnishes a hint as to the manner in which the higher layers of the atmosphere may become the source of disturbances.

In its course around the sun the earth frequently is struck by cosmic particles which give rise to disturbances in the electric conditions of the upper layers of the atmosphere. It is clear that the disturbances must be different on different parts of the layer; and this difference between collisions in front of the earth and those in back of the earth (as referred to the earth's motion) would give rise to the oval form of the diagrams.

These oval curves would be easily applicable if we assume as the source of strays an atmospheric layer of considerable height which is disturbed by the irregular bombardment of cosmic particles of dust or is disturbed in any other plausible fashion. Though the theory of cosmic bombardment of upper layers appears to me to be the most plausible origin of strays of type 3, particularly since such a source of strays would explain also the cause of daily variation in the strength of the earth's magnetic field, nevertheless, we are not sufficiently well informed concerning the upper layers of the atmosphere to be able at this moment to give a definite proof of my assumption.

If, therefore, I base my explanation of the strays of type 3 on the above-mentioned proposition, it is rather because it seems to me quite a plausible explanation than because it can be absolutely proven to be the truth. If this high layer is the source of strays of type 3, it is quite clear that not only the point directly over the station (that is, the zenith) can be the source of strays, but that in every case the changes in electric conditions in the circular segment of this layer, the centre of which is the zenith of the station, will contribute to the strays observed at the station under consideration. The nearer the point of disturbance to the station zenith the more pronounced will be the disturbance.

It is, of course, of some interest, both practically and scientifically, to note the approximate radius of the segment above-mentioned, since this will give us an indication of the range of strays of type 3 and of the limiting possibility of distance at which strays of type 3 may be heard simultaneously in different stations.

Of course, the type of receiver used alters this effective stray radius, and it is well known that, with very sensitive receivers, not only the *loudness* of the strays increases, but also that the *number* of strays received every minute also increases, thus showing that in the latter case we detect more distant stray centres.

For the detector and receiving set used for the observations in the Indies, which receiver has been briefly described in Part 2 of this paper, the average range of strays of type 3 cannot be definitely determined.

On examining the oval curves of Fig. 8 it can be clearly noted that the average diminution of the night strays into the day strays (as averaged over the entire year) is complete only at the point p; that is, one hour after sunrise at the receiving

station. Similarly the increase of day strays to night strays begins as early as p^1; that is, one hour before sunset at the station under consideration. This shows clearly that the illumination by sunlight of places one hour distant from the station in question causes a limiting effect, which is just detectable by means of the resulting change in strays at the receiving station, if receivers are used of the type described. The range of these centres of stray origin, or the radius of the segment mentioned, is therefore the distance of rotation of the earth in one hour; that is to say, $\frac{1}{24} \times$ 40,000 km., or 1,670 km. (1,000 miles). In other words, stations with receivers of the type employed at our station and separated by a distance of 3,340 km. (2,000 miles) might expect to detect some strays of type 3 at the same moment; but in this case the strays would be faint to the limit of audibility. On the other hand, if the stations are 1,670 km. (1,000 miles) apart, and the stray originates just above one of the stations, the station will detect it very loudly, and the other station will detect it as just audible.

This is the reason why during tests intended to study simultaneous strays at different stations, the stations must be quite close to each other in order to detect simultaneously and continuously the same strays at the same time, as the researches carried out by Dr. Eccles showed.

Under these conditions each station hears the most powerful groups of strays. The conclusion drawn from these results has been used erroneously to prove Dr. Eccles's theory of the lightning origin of strays. Since, however, strays of type 3 were dominant, and since the range of strays from lightning is not very large, the method of simultaneous station observations will yield only slight results.

In the light of my theory concerning type 3 strays, loud groups of such strays mean that the point at which strays are originating in the upper layers of the atmosphere is near both stations—that is, at a distance considerably less than 1,670 km. (1,000 miles). Furthermore, simultaneously heard loud signals indicated, in addition, that the source of strays was not very far from the point half-way between the stations. It is quite clear that these conditions are only fulfilled for stations not more than, at the most, about several hundred km. (or miles) apart. The extreme limit is estimated by me as approximately 1,000 km. (600 miles). Also all other centres of type 3 strays around the stations will produce responses in both stations which undoubtedly occur simultaneously, but will be so different in strength, because of the difference in distance, that these stray interruptions will never give the impression of simultaneity. Lastly, the apparent similarity of strays at the two stations will be still further spoiled by the reception at each station of strays which are inaudible at the other.

The correctness of the previous reasoning is strictly confirmed by the fact that, though Fig. 8 shows a range of the strays at 1,670 km. (1,000 miles) during the daytime, no simultaneous strays could be observed at our three stations which were only between 890 km. (550 miles) and 1,610 km. (970 miles) apart; and this was the case even at night.

On the other hand, though not simultaneously occurring, the average daily curve of strays was not much different for the different stations. This was to be expected from my theory, the different stations being sufficiently near together to be under practically the same average influence of the layer above them, and

this small part of the total layer is struck by a nearly constant number of cosmic particles.

All of these effects agree with the theory here given and militate against the correctness of the theory of the lightning origin of strays, as do also the demonstrations with the Dieckmann cage. On the other hand, it is possible from the consideration of the point q of Fig. 8, where the diminution of night strays to day strays begins, to approximate the *height* of the *disturbed layer*.

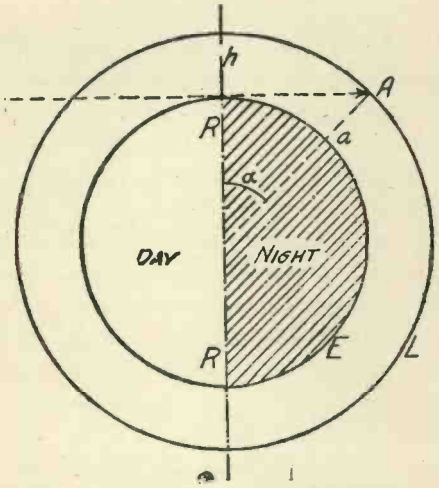


FIG. 9.—LOCATION OF CENTRES OF STRAY ORIGIN.

The diminution from night strays to day strays begins as soon as a point of the upper layer, some 15° sunward (that is, to the east) of the station under consideration, is reached by sunbeams. We must also remember that this distance of 15°, which equals one hour of earth rotation, was found to hold during the day-time (at points p and p^1). The distance between the station and the most distant perceptible centres of strays at night is larger since the propagation of strays is then better. We are at a loss, however, to determine what value shall be taken for the better transmission at night; consequently we shall assume a minimum distance—that is, 15°, and equal to that during the day. We shall see that by so doing the layer height, as calculated, will be too large.

From Fig. 8 we note that the decrease of strays begins about 2·5 or 2 hours before sunrise. The exact moment is not quite certain, because between these times the dashed portion of the curve is not absolutely trustworthy. From these figures, and taking a more frequent radius of the stray circle to be one hour or 15°, we find that the first sunbeam, after touching the earth (see beam A of Fig. 8), reaches the upper layer at a point directly above the station, provided the station will have its sunrise 1·5 to one hour afterward.

If in Fig. 9 E is the earth, L the upper layer, A the zenith point of the station, a, which is reached by the first sun ray, then we can calculate the height h of the layer from the formula

$$h\,(2r + h) = R^2 tan^2 a,$$

and since H is small compared with $2R$

$$h = \frac{R}{2}\, tan^2 a$$

in which R is the radius of the earth. For $a = 1$ to 1·5 hours $= 15°$ to 22·5°, the height, h, is found to be between 225 km. (140 miles) and 540 km. (330 miles).

It is an interesting confirmation of this theory that in the neighbourhood of the first value given (that is, between 180 and 200 km.) (110 and 120 miles) a layer of the type mentioned has been predicted by scientists in many fields. This layer,

the *Heaviside* layer, is supposed to be a sharp frontier surface between the lower poorly-conducting layers of the atmosphere and the highly conductive atmosphere above it. This layer is supposed to give rise to reflection phenomena in radio transmission at night, and is supposed also to be seat of the cause of alteration in the earth's magnetism. This height has also been estimated to have the value stated from observations on the incandescence of meteors and also from the aurora borealis. On another occasion* I showed that phenomena in the night propagation of radio waves not only sustained this calculation, but I showed also from the "silent belts" in radio transmission at night, that the height of the layer was about 200 km. (125 miles). This value corresponds very well with the values of between 225 km. (140 miles) and 540 km. (330 miles), found for the height of the layer which produces strays of type 3. The excessively large value of 540 km. (330 miles) can be easily explained by remembering, as before stated, that the radius of the segment of stray centres is not 1,670 km. (1,000 miles) as during the day, but much larger.

Taking the layer as being at the height of 180 km. (110 miles) we get for the angle, a, in the equation above 13·5°, which is equivalent to the angle traversed in 54 minutes of time by the earth's rotation, so that the radius of strays at night time would be 2·5 (or 2) hours minus 54 minutes—that is, between 1 hour and 36 minutes and 1 hour and 6 minutes. This corresponds to an effective range of night strays of from 2,670 km. (1,640 miles) to 1,750 km. (1,080 miles) as against 1,670 km. (1,000 miles) during the day time.

This is quite possible, as shown in Fig. 8, since the average loudness of strays at night is about 1·5 times that in the daytime, so that there can be no objection to taking both the day and night stray originating layers as existent and identical.

A further reason for these conclusions is the fact that the daily variation in strays, as given in Fig. 7, is quite similar in character to the curves of variation of the earth's magnetism as I saw them published in THE WIRELESS WORLD (or MARCONIGRAPH) some time ago, which latter variations are attributed to eddy currents in the Heaviside layer. By supposing this layer to be the "secondary" source of strays of type 3, we obtain a sufficient explanation for the daily changes in these strays, these variations being analogous to those of the earth's magnetism. On the other hand, the gradually altering form of the daily characteristic as it changes in accordance with the symbols given, from ⌣ through ⌢ to ⌣, is easily explained if we regard the cosmic bombardment as occurring chiefly in the plane of the earth's orbit. It was found that the type of stray corresponding to the symbol ⌣ occurred whenever the angle between the sun's declination circle and the latitude circle of the station under consideration did not differ more than 10°. Similarly the type ⌢ occurred for a difference in this angle of 10° to 20°, and when the difference exceeded 20° the symbol was ⌣ It is for this reason that strays in Europe are nearly constant over the entire day (strays from lightning sometimes excepted). In the case of the ⌣ characteristic, the distance to the strong centres of cosmic bombardment is very large, and the strays are therefore weak. This is why strays of type 3 are so heavy in the tropics and so weak in Europe. At the poles we assume that they would be almost not noticeable. It remains to

* In a dissertation for the degree of Doctor of Science, May 18th, 1918, and in "Jahrbuch der drahtlosen Telegraphie" (not yet published).

determine, however, in what way disturbances in the Heaviside layer produced strays in the antenna. This is not a difficult matter to explain, and the explanation will at the same time clear up the difference between the day and night strays of type 3.

The Heaviside layer is a conductor, as also is the earth. Between these two conductors we have a layer between 180 km. (110 miles) and 250 km. (120 miles) thick, which is a non-homogeneous dielectric. This dielectric is fairly perfect during the night, as is indicated by the goodness of night communication; but it is rather an imperfect dielectric during the day, the conductivity changing with the height above the earth. This complex dielectric forms a large condenser almost free from losses during the day, but rather imperfect at night. The cosmic bombardment by charged particles on the upper layer will be detectable throughout the dielectric, and this to a greater degree during the night than during the day. On the other hand, in the latter case, part of the effect is lost because of the imperfect character of the dielectric, and hence the difference between day and night conditions.

It must be remembered that the antenna is electrically connected to the earth (either conductively or capacitively), and that it will therefore be disturbed by all changes in the field or potential gradient of this condenser. Such changes depend upon the charge of the cosmic particles, or on other causes of excitation of the upper layer, as well as on the virginal charge of the condenser. This latter charge is the reason for the influence of the seasons on the strays, which point was not mentioned heretofore. It has already been stated that the light of the sun (and consequently the time of the year) influenced markedly the daily characteristic as expressed by the symbols ∽, ∽, ∽.

In Fig. 10 there are given the month by month characteristics for each of the three stations over a whole year, these being obtained from the average values at noon over every month.

The times when the sun's altitude is 90° for the place under consideration are also given. We see that these occur twice a year for every station. Though the symbol for every station is then ∽, we see, on the other hand, that the points of *maximum strays* do not come at the same time, but that there is a lag of as much as 1·5 months between 90° sun altitude and maximum strays.

We see that the maximum strays follow the monsoon or trade wind seasons of the year much more closely, the maxima always occurring at the time just between the west monsoon and the "intermediate period," whereas the minimum always occurs during the east monsoon, and close to the end of this season when it is passing into the intermediate period. The signs ∽, ∽, ∽, correspond to the general aspect of the daily variation curve as taken from Fig. 7 for the months to which they are assigned in Fig. 10. In fact, the Director of the Meteorological Institute of Batavia assured me that the maxima of strays found by my observations correspond to the maximum increase in potential of the earth's field. Consequently we have here located that original charge of the earth condenser which is the reason why, even though disturbances of the upper layer do not alter with the sun's altitude, changes in the strength of their fields, and consequently changes in strength of the strays produced must be dependent on the season.

In concluding this paper, I may state that inasmuch as type 3 strays do not

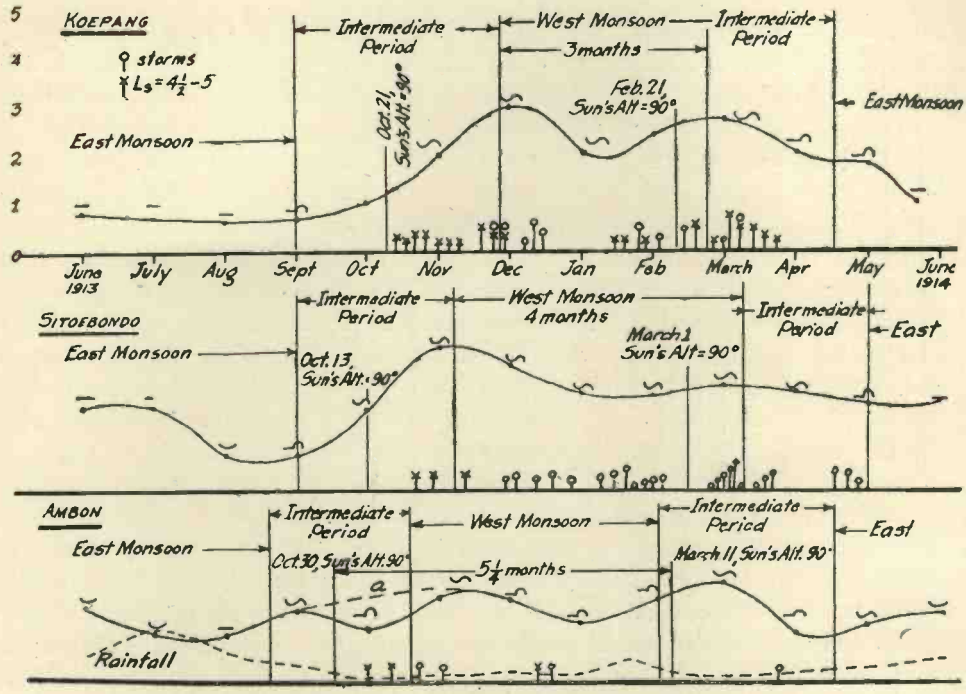


FIG. 10.—YEARLY VARIATION OF STRAYS.

originate in lightning, their maxima do not coincide with those of thunderstorms either near the stations or distant from them.

In Fig. 10 thunderstorms and very heavy strays of the thunderstorm type were indicated by the symbols ♀ and ⚡, the length of the vertical line giving the duration of the outburst of strays on a certain scale.

We see that for all three stations the periods of thunderstorm ♀ were preceded by heavy strays, ⚡, of type 1. These strays did not occur simultaneously at the three stations, which is the best proof that their range is short. For the station at Keopang (Oiba), it might be stated that strays of both classes occur almost simultaneously, though the thunderstorm, ♀, occurred most nearly at the middle of the west monsoon period, where the type 3 strays have no maximum whatever.

For the Landangan (Siteobondo) station, the difference just mentioned is still more striking, and of the same type. For the Ambon (Noesanive) station it is even more evident that there is no connection between the two classes of strays. It is obvious that both are to be considered separately, and compensated for in different ways.

Other atmospheric conditions were shown not to have any difference on the strength of strays. Of course, thunder clouds coincided with strays of type 1, and low-lying rain clouds with type 2. In spite of the common belief, rainfall in itself has no influence on strays, at least so far as types 1 and 3 are concerned. This is clear from the curves for Ambon, in Fig. 9, where are shown the strays, and at the same time the dotted rainfall curve.

(Concluded.)

Among the Operators

OPERATOR V. E. DAVIES.

OUR readers will have seen in the daily press a report of one of Germany's latest crimes —the sinking of the Elder Dempster liner *Apapa*. The ship was struck by two torpedoes, and in all some seventy lives were lost. We deeply regret to announce that Mr. Victor Edward Davies, the junior operator, was among those who lost their lives.

Mr. Davies, whose home was at Golders Green, was 19 last March, and a comparatively recent recruit to the wireless service. In February, 1916, he joined the Marconi House School as a learner, and in August of that year obtained his Postmaster-General's Certificate. He was first appointed to the s.s. *Parthenia*, on which vessel he made two trips, after which he was transferred to the s.s. *Cæsarea*. After two more transfers he was then appointed to the s.s. *Apapa* in October of this year, remaining on that vessel until the time of the disaster.

Mr. Arthur Howarth, who we regret to state is reported missing and presumed drowned after the sinking of his ship, was born at Pendlebury, and at the time of the wreck was 19 years of age. After receiving his education in his home town, he entered his father's business at Swinton, where he remained for six years. Soon after leaving this position, he commenced a course of wireless at the City School of Wireless Telegraphy, Manchester, where he obtained his Postmaster-General's Certificate. He was appointed to the staff of the Marconi Company in October of this year, and lost his life on his first trip.

OPERATOR A. HOWARTH.

It is rarely that we have to record both senior and junior operators on the same vessel who have lost their lives, but this unfortunately happened in the case of a ship recently sunk by a German torpedo. The senior operator, Mr. Charles Alwyn Needham, of Sheffield, was born in that city in 1899. Receiving his education in Sheffield, he entered an accountant's office on leaving school. Later he entered the employ of a firm of steel manufacturers, leaving this in April, 1917, to study wireless telegraphy at the Fallowfield Wireless

College, Manchester. Having been an amateur wireless enthusiast before the war, he obtained his First-Class Certificate after a few months' study, and joined the staff of the Marconi Company in the autumn. The ship on which he lost his life was the first to which he was appointed.

The junior operator, Mr. George Mangan, of Inchicore, Dublin, is also a recent recruit to the Marconi Service. He was born at Limerick, and educated in Dublin and Clondalkin. After leaving school he studied wireless at the Irish School of Wireless Telegraphy, Cork, where he obtained his Postmaster-General's Certificate. He joined the Marconi Company in September, 1917, and was appointed to the s.s. *Caledonian*, from this ship transferring to the vessel on which he lost his life.

OPERATOR C. ALWYN NEEDHAM.

AFTER TWO ESCAPES.

A particularly sad case is that of Mr. Reginald Percy Waters, of Peckham Rye, torpedoed twice before, and fortunately being rescued uninjured in each case, who has now lost his life in a third disaster. Mr. Waters, who was 18 years of age, was born in Kennington, and educated at a private school. Before studying wireless telegraphy he was employed at a cornbroker's office, and later with a shipping firm. In March, 1916, he accepted the Marconi Company's offer of free training, and by September of that year had obtained his certificate, whereupon he was appointed to the s.s. *Mongolia*. Completing one voyage on this ship, he was transferred to the s.s. *Kashgar*, and later to the s.s. *Vancouver*. The next ship on which he served was torpedoed, but fortunately Mr. Waters was amongst the rescued. Shortly after this first disaster he resumed duty, and was appointed to and made several voyages on different vessels without incident. In September of last year, however, he suffered a second misfortune, the vessel on which he was serving being torpedoed. But here, again, he was safely rescued. Once more he resumed duty, only to meet with this third disaster, wherein we learn, with deep regret, he laid down his life.

OPERATOR GEORGE MANGAN.

COMRADES IN HEROISM AND DEATH.

Mr. Robert McCulloch Paterson, of Glasgow, sailed on the same vessel as Mr. Waters in the capacity of assistant telegraphist. Mr. Paterson, who was born in the vicinity of Glasgow in 1898, received his education in that city, and on leaving school entered the Civil Service. Here

OPERATOR R. P. WATERS.

he remained for two years, and then becoming interested in wireless telegraphy, studied the subject at the North British Wireless Schools, Glasgow. In February, 1917, he entered the Marconi Company's London School, where he received further training and was appointed to his first ship within a few weeks. On this vessel he made one voyage, after which he was transferred to the vessel above referred to. We deeply regret to say that he, too, lost his life in the disaster.

We trust that it will afford some consolation to the parents and relatives of these young men who have lost their lives as a result of the dastardly work of the German submarines to know that they gave their lives to their country equally as well as those who have been lost on the fields of Flanders, or on those other battlefields where our men are fighting so bravely to defeat the Hun. We have many times pointed out this fact, but it is one of those truisms which cannot be too often reiterated.

OPERATOR R. M. PATERSON.

OPERATOR HAROLD SUDELL.

Our last photograph shows Mr. Harold Sudell, who lost his life recently on the torpedoing of his vessel. Mr. Sudell, whose home was in Liverpool, was a keen scout before joining the Marconi Company and was well known in Liverpool as a patrol leader and King's Scout. Joining the wireless service in March, 1917, he soon went in charge of the installation on board ship, but unhappily was torpedoed on his first voyage. From this disaster he was rescued, only to lose his life on the next vessel to which he was assigned. Deep sympathy is felt for his relatives.

New Station for Hong Kong

THE U.S.A. Consul at Hong Kong states that an installation for the radio station at the Royal Observatory, Hong Kong, is being constructed. The installation consists of a triangular steel lattice mast, 150 feet high. The aerial will spread from the mast to six chimney stacks of a terrace of houses 150 yards to the south of the mast. The receiving apparatus, of British manufacture, is to be used in conjunction with a Brown relay and high resistance telephones. At present the installation is only to be used for receiving time signals from Shanghai, Manila and Hanoi, and possibly from Tsingtau and one or more Japanese stations by night. After the war, it is proposed to instal apparatus for distributing time signals by relay *via* d'Aguilar radio station. The Government hopes that arrangements may then be made for receiving, at stated times, meteorological observations from ships.

The Fatherland of Marconi

SINCE the appearance of our last issue, when we recorded the sympathy which all radiotelegraphists felt with our gallant Italian Allies under the strain imposed by their recent military disaster, we have witnessed with joy a dramatic recovery. Senatore Marconi recently paid a visit to the new fronts, inspecting the wireless telegraph stations and interviewing the army commanders, and came away with high hopes. On parts of the Italian front the wireless is perched in mountain cantonments such as those depicted in our illustration below.

CANTONMENT OF ITALIAN TROOPS.

Instructional Article

NEW SERIES (No. 10).

EDITORIAL NOTE.—In the opening number of the new volume we commenced a new series of valuable instructional articles dealing with Alternating Current Working. These articles, of which the present is the tenth, are being specially prepared by a wireless expert for wireless students, and will be found to be of great value to all who are interested in wireless telegraphy, either from the theoretical or practical point of view. They will also show the practical application of the instruction in mathematics given in the previous volume.

ALTERNATING CURRENT GENERATORS.

53. Production of Alternating Currents.—In Article 1, Section 1, it was shown that if a coil of wire is rotated in a magnetic field an E.M.F. is induced in that coil, and that if the coil is rotated with a uniform velocity in a uniform magnetic field, the induced E.M.F. varied as the sine of the angle through which the coil is turned.

Now in order that the current flowing round the coil can be **collected** and made to flow in an outside circuit, **insulated** bands known as **slip rings** are fitted to the shaft on which the coil is mounted, each end of the coil being electrically connected to a slip ring as shown in Fig. 47.

Since a so-called direct current generator actually generates an alternating current in the armature coils it will be seen that there is no fundamental difference between a D.C. generator and an alternating current generator, the main difference being that the direct current generator is fitted with a **commutator** for mechanically transforming an alternating current into a direct current, while the alternating current generator is fitted with **slip rings** in place of the commutator.

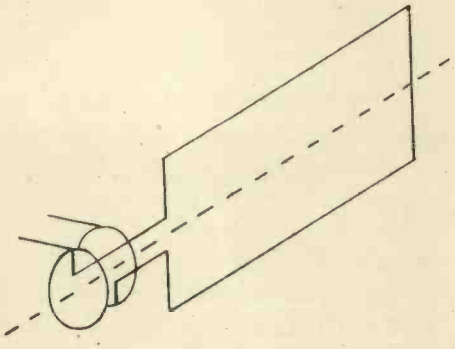


FIG. 47.

In the early form of alternators the field magnets were made of strongly magnetised hard steel, thus forming permanent magnets, but these were soon superseded by electromagnets. It is obvious therefore that some means must be employed to cause a direct current to flow in the field windings. This can be accomplished by means of a small direct current generator coupled to the shaft of the alternator, and termed an "**exciter.**" Another method is to mount a commutator on the armature shaft and a **direct** current winding on the armature. The armature therefore has a direct current and an alternate current winding with commutator and slip rings respectively. Such alternators are termed "**self-exciting** alternators."

In large alternate current generators the field and armature windings are in

most cases transposed: the armature or rotor being wound with the field windings and the stator with the armature windings.

54. Average E.M.F.—If a wire is moved across a magnetic field so that 10^8 lines are cut in 1 sec. an E.M.F. of 1 volt is induced in the wire. Referring to Figs. 1, 2, 3 and 4, Article 1, it will be seen that the current in each side of the coil is assisting the other.

Let the strength of the magnetic field = N lines,

and the coil make one revolution in $\frac{1}{n}$ seconds,

then one-quarter of a revolution takes $\frac{1}{4n}$ seconds.

$\therefore$ N lines will thread the coil in $\frac{1}{4n}$ seconds,

and 4N lines will thread the coil in $\frac{1}{n}$ seconds.

$\therefore$ The average E.M.F. in one turn of wire $= \frac{4Nn}{10^8}$ volts.

If there are L number of coils or loops in series then the average E.M.F. $= \frac{4NnL}{10^8}$ volts.

The actual E.M.F. induced at any instant is proportional to the sine of the angle through which the coil is turned. Therefore

$$E_1 = \frac{2\pi \sin \theta \, NnL}{10^8}$$

Where θ is the angle of rotation.

It will be seen that in order to increase the voltage of a machine it is necessary to increase any or all of (1) the strength of the magnetic field; (2) number of turns; (3) speed of rotation.

55. Armature Winding. (a) **Ring Winding.**—If a loop of wire as shown in Fig. 48 is rotated in a magnetic field an E.M.F. is induced in each limb according to the direction of the field and rotation. Now, since both the limbs AB, CD cut the lines of force in the same direction the current set up in each limb will be in the same direction, say A to B and C to D. The currents will therefore oppose each other, but the limb AB cuts the lines of force at a greater rate than the limb CD. The E.M.F. induced in AB

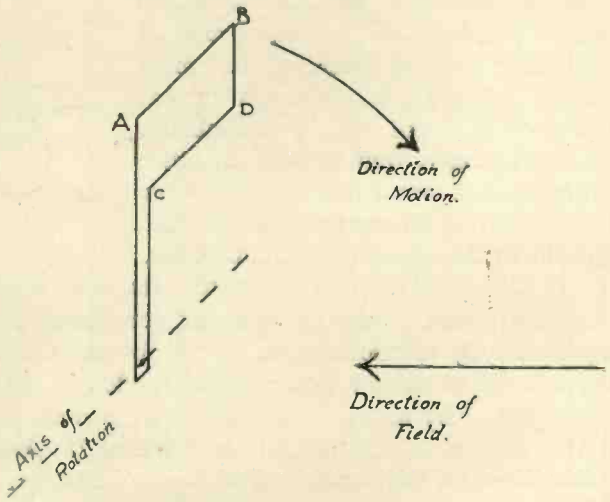


FIG. 48.

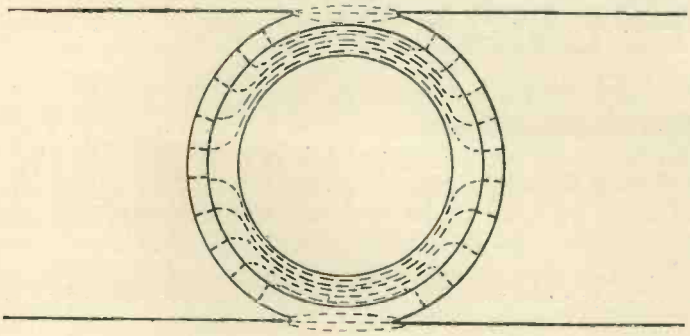


FIG. 49.

will therefore be **greater** than that induced in *CD*, and the current flowing round the coil would be that due to the *E.M.F.* induced in *AB* over that in *CD*.

Now if the loop is wound round an iron core ring practically **no** lines of force would cut the limb *CD* since the lines of force would be confined to the ring as shown in Fig. 49. The E.M.F. induced would now be due to *AB* cutting the lines of force, since **no** E.M.F. is induced in *CD*. The wire *AB* is termed the **active** conductor, while *CD* is simply a **connecting** wire.

When an armature is wound in this manner it is said to be a **ring-wound armature.**

If, now, the ring is wound with more than one turn of wire, the E.M.F. produced will be proportional to the number of active conductors, since the E.M.F. induced in each conductor will be added together.

The induced E.M.F. can therefore be increased by increasing the number of active conductors.

In order to obtain a **greater** E.M.F. than would be obtained by winding a few turns round the ring there is no reason why the turns cannot be wound **all round** the ring. If, however, more than **half** the ring is wound with wire in one continuous coil it would be found that the induced E.M.F. would be gradually **decreased** until the coil is wound all round the ring, when the induced voltage would be **zero.** This is because the magnetic field will induce an E.M.F. in **one** direction in **one-half** of the coil, and in the **opposite** direction in the **other half** of the coil, the E.M.F. of one half of the ring being 180° out of phase with that of the other half of the ring.

In order to obtain, therefore, a maximum E.M.F. the coil must be disconnected at its centre point, and the **positive** end of **one** coil connected to the **negative** end of the **second** coil, the two free ends being connected to the slip rings. The connections of two such coils are shown in Fig. 50.

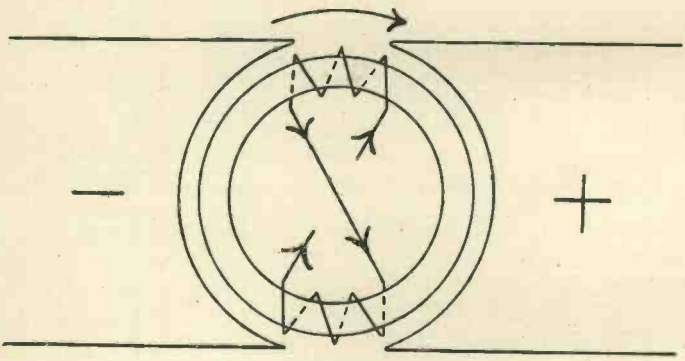


FIG. 50.

The total E.M.F. now developed is that

due to the sum of the E.M.F of each coil, since they are in series.

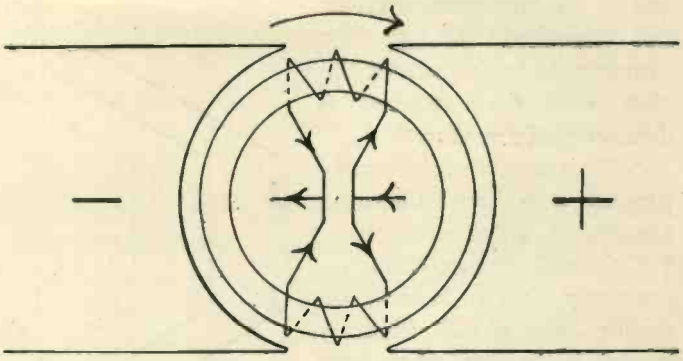


FIG. 51.

Another method of connecting these two coils is by putting them in **parallel.** The **positive** end of **one** coil is connected to a slip ring, while the **positive** end of the **second** coil is connected to the **same** slip ring. The two **negative** ends of the two coils are connected to the **other** slip ring as shown in Fig. 51.

In this case the **total** E.M.F. produced is only equal to the E.M.F. of **one coil,** that is, **half** that of the previous method of connecting. Since the two coils are connected in parallel, however, the resistance is **one quarter** that of the two coils in series. The current is therefore double that obtainable when the two coils are in series.

In each of these cases **one** alternation or complete sine wave is produced by **one** revolution of the armature. It therefore follows that, since one alternation of E.M.F. is produced in one revolution of the armature between **one pair** of magnet poles, two complete alternations will be produced if **another** pair of poles is added round the armature, and that for **every pair** of poles added one alternation is produced by one revolution. The frequency of any alternator can therefore be obtained from the formula :

$$\text{Frequency} = \text{No. of revolutions per sec.} \times \frac{\text{No. of poles}}{2}$$

$$\text{or} \quad \text{Frequency} = \frac{\text{R.P.M.}}{60} \times \frac{\text{No. of poles}}{2}$$

(b) **Drum Winding.**—When a coil of wire is wound in the form of a **rectangle** and rotated about its axis in a magnetic field, it has been shown that the direction of the current in one limb of the coil is in the opposite direction to the current in the other limb. The wires to connect the active conductors must therefore be brought across the **end** of the armature. An armature wound so that the connecting wires are brought across the

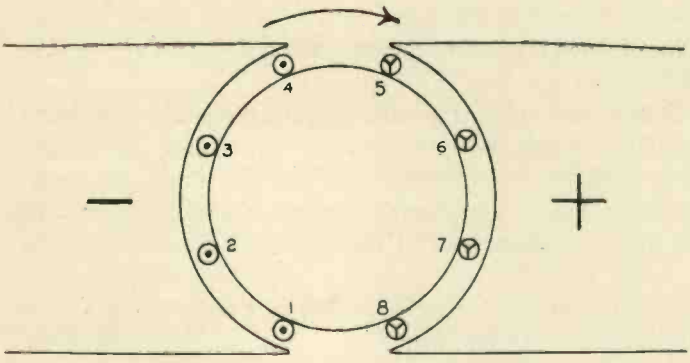


FIG. 52.

end of the armature, and are not threaded through the armature as in the case of the ring winding, is termed a **drum-wound** armature.

If a ring and drum armature are wound with the same number of **active** conductors, and the coils connected in the same way, that is, in series or parallel, the E.M.F. induced in each is the same when they are rotated at the same speed in the same strength magnetic field.

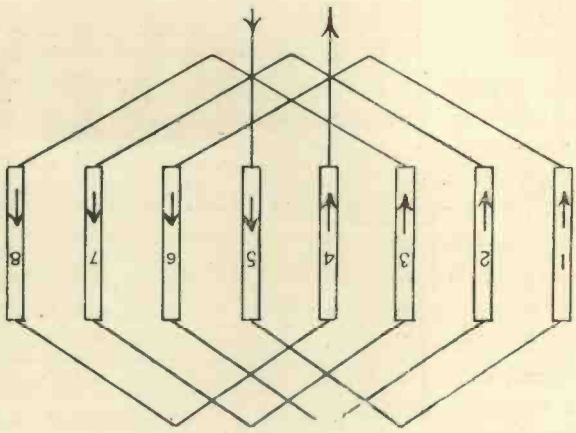


FIG. 53.

In Fig. 52 is shown a drum-wound armature with four coils, that is, eight active conductors. In the diagram currents which go down are shown by the tail of an arrow, as ⊗, while currents which come up are shown by an arrow point, as ⊙.

Since it is difficult to show clearly the connections of the conductors at the front and back end of the armature at the same time, consider the armature conductors to be divided in half and laid out straight. The connections of the conductors can then easily be followed from Fig. 53, and it will be seen that all the conductors have been connected in series.

It is only a very few machines that now have ring-wound armatures, as it is much cheaper and quicker to wind a drum armature, the conductors usually being wound on what is termed a " former " and then placed in position round the armature.

(To be continued.)

New Wireless Stations for Sweden

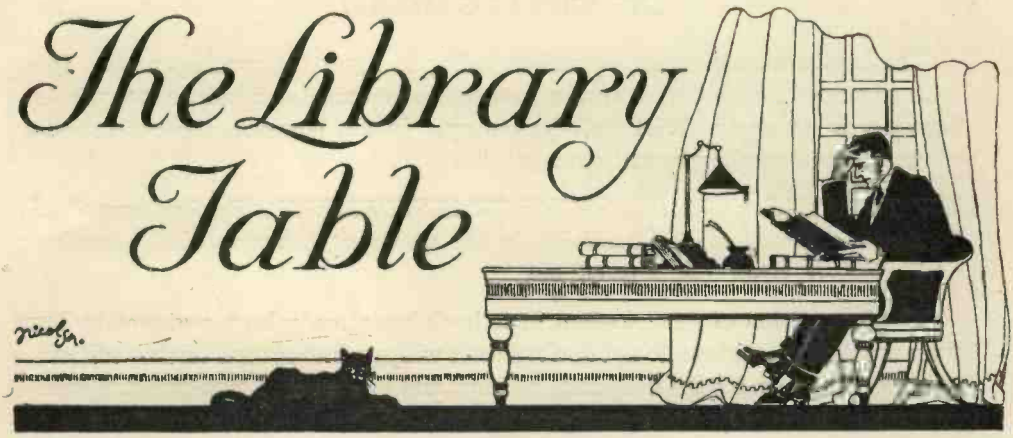
ACCORDING to *Lloyd's List and Shipping Gazette*, a large radiotelegraph station has recently been erected at Karlsborg, in Sweden.

The station has a radius of 5,000 kilometres (about 3,100 miles), and will thus be able to communicate directly with America.

In addition to the Gothenburg and Carlscrona stations, three others are being built in Sweden—at Boden, Hernosand, and Vaxholm near Stockholm. The station at Karlsborg has two masts, each 210 metres high. The aerials between the masts consist of six wires 450 metres long. The electric current is supplied from the Trollhattan hydro-electric power station, and is converted at the station to a periodicity of 15,000.

Rundemand station, near Bergen, with a radius of 800 to 1,100 kilometres, has been in use some time, and Tryvand station, near Christiania, will be ready in the near future.

The Library Table



THE *SUBJECT-INDEX TO PERIODICALS*, 1916, published by the *Athenæum* at the request of the Council of the Library Association, has just come into our hands. Readers interested in wireless matters will find their own subject adequately treated therein, and no serious student of any branch of knowledge can afford to do without this valuable publication. The indebtedness of the whole reading public to the work of the *Athenæum*, both past and present, is too frequently overlooked or ignored. The number of publications dealing with every subject, both of general and special interest, is so vast that no man is able, without such aids as are afforded him by the *Athenæum* Press, to keep abreast of what others are doing or endeavouring to do. From a commercial standpoint, such work is hardly what our American cousins would call "a paying proposition," and our distinguished contemporary richly deserves every assistance that can be afforded in this direction.

ADVANCED TEXT BOOK OF MAGNETISM AND ELECTRICITY. By Robert W. Hutchinson, M.Sc., A.M.I.E.E. London: The University Tutorial Press, Ltd. 8s. 6d. *net.*

This book, which extends over two volumes, the first containing some 470 pages and the second about 100 pages less, is designed "to give a clear and comprehensive account of the main principles of the subject based on accurate scientific definitions embodying the distinctive results of modern research." Both the experimental and theoretical sides of the work have been dealt with, and the author has endeavoured to cover the ground of the final Degree Examination of the Universities.

On first opening the book it would not appear that the author has taken an advanced standpoint, for the first twenty or thirty pages treat of magnetism in a very elementary stage, informing the readers of the origin of the word "magnet" and showing the conventional lodestone with its bushy collection of filings. However, the author stated in his preface that the elementary matter has been included so as to give the student a chance of revising his knowledge on scientific lines. Other portions of the subject are dealt with in a similar manner, and seeing the wide scope of the book, and that it claims to be an advanced text book, we think much of this elementary matter might have been omitted with advantage.

In the mathematical explanations, use is made of the notations and first principles of the Calculus.

The book seems to suffer by endeavouring to cover too much ground. Thus for an advanced text book the section devoted to electrical oscillations and wireless telegraphy is rather too brief and elementary. In all, however, the book should be found helpful, and command a ready sale.

HOW TO MAKE HIGH-PRESSURE TRANSFORMERS. By Professor F. E. Austin. Second edition published by the author at Hanover, N.H. London: E. & F. N. Spon, Ltd. 3s. 9d. net.

The first edition of this excellent little book has already been reviewed in THE WIRELESS WORLD, and we do not doubt that it will run into several further editions. The directions given for the designing, making, and operation of high-pressure transformers are thoroughly sound and practical, and the book has the great virtue of being free from unnecessary matter. To all amateurs and experimenters who wish to understand the design of such instruments we can strongly recommend this book.

EXAMPLES IN BATTERY ENGINEERING. By Professor F. E. Austin. Published by the author at Hanover, N.H. London: E. & F. N. Spon, Ltd. 5s. net.

This volume, also from the pen of Professor Austin, gives, as its title indicates, a number of examples and problems connected with primary and secondary batteries. An interesting preface draws attention to the increasing use of primary and storage cells at the present time, and the greatly extended applications possible in the future. Unlike many books on the subject, this volume gives a small place to the chemical side of the question; as the author states, it being deemed expedient to devote the discussion to those features that are of importance in the efficient industrial operation of any and all types or kinds of cells and batteries.

In Lesson I. we find a review of important considerations, such as the mechanical and electrical equivalents of heat and heat resulting from chemical change. In Lesson II. we find a brief consideration of the electrical principles of primary cells and batteries, and in Lesson III. electromotive force and a cell and battery resistance are dealt with. Subsequent lessons carry the student in easy stages through the questions of series and parallel connection and various arrangements for groupings of cells, and consideration is given as to how to obtain the maximum current from the battery. Lesson X. should be found very useful, dealing as it does with the power efficiency of a cell or battery, and in Lesson XIV. the student comes to a consideration of storage batteries, including a good illustrated description of the Edison storage cell. This chapter deals with the charging of batteries, including a consideration of how to charge batteries from an alternating current main. The volume is plentifully sprinkled with worked-out examples and problems—a feature for which Professor Austin's books are particularly noteworthy. This is a very useful book for a student of electricity.

THE DUPE. By Charlotte Mansfield. London: Simpkin, Marshall, Hamilton, Kent & Co., Ltd. 6s.

Novels dealing with spies and spying have always proved popular with the British public. Probably the demand for such literature prompted Madame Raffalovich—better known to the reading public as Charlotte Mansfield—to write

this book. From cover to cover the book abounds with spies and intrigue, and there is no lack of exciting incident.

The scenes in the opening portion of the book are laid in London, the time being some months prior to the outbreak of the war. The central character of the book, who rejoices in the inspiring name of Gladys Potts, is the widow of an American, who had squandered his fortune in experiments, in the course of which he had invented a wonderful flying torpedo-gun. On more than one occasion German spies had attempted to steal these plans, and now that Mrs. Potts had settled in England, German agents were still endeavouring to obtain them. The German authorities, with their usual insight into human nature, had decided that the only way to obtain these plans was for a German official to marry the widow, and one Otto Kuntzhein had been detailed for this duty. Otto is provided with ample funds, which he spends lavishly on entertaining. A young girl named Dawn Mather, a close companion of Mrs. Potts, takes an instinctive dislike to the German suitor and later on, as the reader will find, takes an active part in upsetting his evil plans. How the plans were not forthcoming after the marriage and how the new Mrs. Kuntzhein becomes the dupe of the Germans and an unwitting aid in their nefarious tasks, we will leave the reader to discover for himself.

Wireless men will be particularly interested in those sections of the book which deal with a secret wireless installation erected in Durban by spies and used for the purpose of communicating with the raider *Königsberg*. The apparatus is carefully described, as will be seen from the following extracts: "On the inside of the lid "was shown a wiring diagram and full instructions were printed in German for "working the apparatus. There was one conspicuous little switch handle painted "a bright red, making contact to either an 'A' or 'B' terminal. The instructions were "very emphatic about this switch. Should any message have to be sent to a "German ship or a German wireless station the switch was to be put on 'A,' whereby "the British stations would not discover that an hostile station was in their midst "sending and receiving messages and tapping their communications, as the waves "used on 'A' were of such a nature as not to be caught by the antennæ of the "British systems, whereas the British messages could be intercepted by the German "apparatus. . . . The power for driving the small *high currency** motor to work "the wireless was taken by a twin flexible wire from an electric lamp hanging in the "store, and the ends of the cable coming up out of the tunnel were fastened to a "terminal inside the case, where there was a Morse key, three telephone receivers, "coils, condensers, resistances, and many other contrivances."

And now note the German thoroughness:—"On the lid of the case were "fastened three slates with slate pencils attached. The whole thing was a truly "wonderful apparatus. . . ." We quite agree.

At the critical moment the villain of the piece is electrocuted by falling across this wonderful apparatus, the aerial for which is formed by the tram rails outside. Whether the fatal shock was caused by the tram rail or the electric current from the lamp bulb we are unable to state.

Although it is impossible for a technical man to take this book seriously, it is nevertheless very exciting reading, and will doubtless have a large sale amongst those who are fond of spy literature.

* The italics are ours.

Personal Notes

OUR hearty felicitations to Chief Petty Officer Fred Nicholls, R.N.R., on his recent receipt of the D.S.M. for repairing wireless gear under fire.

A NOBLE RECORD.

We learn from the *Court Journal* that Wireless Telegraph Operator Malcolm J. Macdonald was killed on September 12th by the explosion of a mine on board ship. He was the third son of George and Elizabeth Macdonald, Shin House, Lairg, Sutherlandshire, Scotland. A dutiful and affectionate son, Mr. Macdonald had remained unmarried, so that his loss falls with double severity on his sorrowing parents. Born on the 18th May, 1894, and educated at the Higher Grade Public School, Lairg, he had just passed his twenty-third year. In June 1910 he went to Glasgow to learn engineering in the workshops of the Caledonian Railway Company, where he continued until the outbreak of war, in August 1914. All through the period of his training in Glasgow, he had, after his ordinary day's work was over, devoted many hours of study to wireless telegraphy at the North British Wireless Schools in Bath Street. Soon after the outbreak of war, he applied for a situation in the wireless department of the Navy, and was directed to proceed to Portsmouth for examination. He passed successfully and received his first appointment to the battleship *Agamemnon*. A few weeks later he was transferred to a patrol vessel of the Royal Naval Reserve.

MR. DONALD GORDON AND HIS BRIDE.

A BOOM IN AIRMEN.

The realisation that this war must be decided in the air, because there appears no *possibility on earth* for a decision in other quarters, seems to have sent up the aeronautic stock in the matrimonial market! At any rate, we notice that there is a heavy crop of airmen's weddings

just now. One of the latest is that of Wireless Operator Donald Gordon, R.F.C., and Miss Marion Reynolds. We are fortunately able, through the courtesy of the *Daily Graphic*, to secure a photograph of the happy pair as they were leaving the church on October 10th. Best luck to them, and may " their shadows never grow less "—as the poet hath it !

THE LATE MR. F. R. WATSON.

In Memoriam.

The accompanying photograph shows the late Mr. F. R. Watson, who lost his life at the front recently. In civilian life Mr. Watson was a member of the Marconi Company's clerical staff, and his loss is deeply deplored by his comrades.

Reported Lost.

We much regret to announce that Warrant Officer Frank Cook, R.N.R., youngest son of the late Mr. and Mrs. Joseph Cook, of Boston, Lincolnshire, is reported " lost."

The late officer was at one time engaged on the staff of the *Boston Guardian* and was for several years in the service of the Marconi Company, being transferred to the Admiralty on the outbreak of war.

A Double Distinction.

From the *Ashton-under-Lyne Reporter* we learn that a second honour has been bestowed on Lieutenant J. H. A. Wood, R.N.V.R., son of Colonel John Wood, M.P. for Stalybridge and Dukinfield. He has been decorated with the Distinguished Service Cross for gallantry while serving in the *Moth* in the operations on the Tigris at the re-taking of Kut in the early part of this year. He had already won the distinction of the Military Cross, while serving with the East Surrey Regiment in France in February, 1916. It is probably unique for an officer to have gained these two decorations—M.C., D.S.C.—one in the Land and one in the Sea Service.

Lieutenant Wood joined the East Surrey Regiment as Second Lieutenant on August 10th, 1914, and remained with his battalion until after Christmas, except for a short period when he was in command of a detachment guarding a Marconi station in Cornwall, and during another interval when he commanded a detachment of picked men engaged in searching some islands where it was thought that signalling to the enemy might be taking place.

Mourned by All.

Some further details as to the circumstances under which their gallant son,

Gunner L. H. Rooke, R.G.A., wireless operator with the British Forces in France, met his death have recently been received by the young man's parents in Batley. They are of such a character as are calculated to temper their sorrow for his loss with parental pride in the qualities he displayed.

Second-Lieutenant R. Read, an officer in the deceased's battery, writes :— "I grieve with you over the death of your dear son. Your loss was ours in the passing of such a gallant British soldier. He was with me on the afternoon of July 31st on a special task, and appeared in the best of spirits. The job was a dangerous one, and we all knew that at any moment one of us or all of us might be called to a better and more peaceful world. I left your son with three others under cover of an old trench, whilst I went forward to another position. During my absence a stray shell dropped in their midst and your son was killed instantly."

AN INDOMITABLE BELGIAN.

Few things stir the emotions more deeply than a display of "real grit." A most encouraging feature in the present war, from the point of view of lovers of humanity, lies in the manifold exemplifications thereof, which are constantly turning up. The following is a case in point.

MR. ARMAND SAUVAGE.

Mr. Armand Sauvage, born at Verviers (near Liege), on May 10th, 1888, was 26 years of age when the war broke out. He was employed at the Head Office of the Belgian Marconi Company, and immediately volunteered for the Service, being enrolled in the Eleventh Regiment of the Line. He passed through the defence of Liege, and the first campaign in Flanders, being wounded in the abdomen by shrapnel at Dixmude in November, 1914. The following month he was discharged from the army unfitted by his wounds for further service. He immediately reported at London for duty, and obtained leave, in order to undertake the risky task of deporting his wife from a quarter of Belgium occupied by the Germans. He succeeded in his task; but was himself trapped before he could leave the country, and incarcerated at Münster. After a brief period of imprisonment he escaped; and, after a fortnight's tramp, reached Holland, whence once more he turned up in London in March, 1915. He trained as a wireless operator and qualified in October, 1916. Since then, he has made four voyages to the Congo; served for a time on a Russian ice-breaker; and was acting as wireless telegraphist on the Portuguese steamer *Lagos* when she was wrecked on October 7th last. Thanks to the ability with which he handled the wireless apparatus on the occasion of the disaster, assistance quickly arrived, with the result that the vessel and all her crew were saved. Mr. Sauvage is still "carrying on," and we have much pleasure in reproducing his photograph here.

To Make Sure.

A message from the *Daily Mail* correspondent in Paris says that the heroic conduct of Vignola, the wireless operator in the Messageries liner *Natal*, recently sunk in the Mediterranean, has been brought to light by survivors. When the collision occurred, Vignola, who had been temporarily relieved by a petty officer, rushed to his post and, telling his substitute to save himself, sent out a signal of distress. Then he reported to the captain, who replied, " All right, now save yourself."

Instead of doing so, the operator returned to his telegraph cabin, and with absolute imperturbability sent out fresh signals, which were picked up by the Marseilles station. When the ship sank, a quarter of an hour later, Vignola went down with it.

Gassed.

We are sorry to learn that Sapper Stanley J. Smith, wireless operator, R.E., is suffering from gas poisoning. He went out to France early in May and this is his first misadventure. For six days the effect of the gas rendered him quite blind. After a short treatment in France he was sent to hospital in this country, where he is now making good progress.

Lady Operators for the Military Forces.

We have the pleasure of herewith presenting to our readers the photograph of Miss Mary E. Creswell, one of the Marconi Company's City Office operators, who joined His Majesty's Forces on October 29th last at Hastings as a member of the W.A.A.C. Miss Creswell, together with Miss Marguerite P. Carter, volunteered and was accepted for service with the Military Forces abroad. Both ladies left for France in the course of November. We hope that the experiment of using women with the Forces in the fields will prove successful. Anyhow, no one can refuse a tribute of praise to the pioneers of this work.

MISS MARY E. CRESWELL.

A Testimonial of Popularity.

During the early part of last month a very pleasing incident took place at the Admiralty Wireless Station of —— (somewhere in Scotland) when Sub-Lieutenant Hall, R.N.V.R., the officer in charge, presented P.O. Maltby, R.N.V.R., with a handsome canteen of cutlery in token of the good wishes of his fellow operators on the occasion of his wedding to Miss E. Copland.

P.O. Maltby is one of the most popular operators on the station, and—previous to his joining the R.N.V.R.—was employed in a similar capacity by the Marconi International Marine Communication Company. He joined the company in 1910. since which date he has had the usual varied experiences of a wireless operator.

MARCONI WEDDINGS.

The marriage of Miss Frances Gibbs, until recently telegraphist at the Fenchurch Street office of Marconi's Wireless Telegraph Co., Ltd., and Mr. John Smith, supervisor at the same office, took place on Saturday, December 1st, at the Church of the Convent of Jesus, Crown Hill Road, Willesden. The wedding breakfast, at the home of the bride's parents, at Willesden, was a very enjoyable affair, and amongst those present were Mr. John Smith, Sen. (father of the bridegroom), Miss Christian, Miss Dawson, Mrs. Frampton and Mr. G. E. Clarke, City Superintendent, who conveyed the hearty good wishes of the Traffic Manager to the happy pair.

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The marriage of Mr. Alfred Eddington, son of the late Mr. Sylvanus Eddington, of Chelmsford, and Mrs. Eddington, now of Whitby, and Miss Gertrude Willats Smith, daughter of Mr. and Mrs. J. A. Smith, of Great Baddow, and granddaughter of Mr. W. R. Smith, J.P., of King's Lynn, took place at Sandon Church on December 1st. Mr. Kenneth Walker, cousin of the bride, was best man. The honeymoon is being spent at Bournemouth. The presents, which were very numerous, included a silver tea and coffee service with trays from the staff of the Marconi works at Chelmsford and at the London office of the Company. Mr. Eddington is Assistant Works Manager at the Marconi works at Chelmsford and has been in the service of the Company for a number of years.

New Zealand Postmaster-General's Report

IN the Report of the New Zealand Post and Telegraph Department for the year ending March 31st last, the Postmaster-General gives some interesting information regarding wireless telegraphy in the dominion of New Zealand. In referring to a fault which developed in a telephone cable between Centre Island and Colac Bay, the statement is made that the repairs were not effected as it was considered that it would be more economical to substitute a wireless telephone system to operate between Centre Island and Awanui. The report states that the working of the wireless stations continues to be satisfactory. Improved methods of detecting signals by means of the three-electrode valve were introduced at Awanui, Wellington, and Auckland a few months ago, and apparatus for the other stations has been prepared and will shortly be brought into use. The results obtained at Awanui, where the apparatus has been extensively experimented with, have been particularly gratifying. Signals of stations using damp and undamped waves invariably come in of readable strength from American, Asiatic, and European stations. The use of this detecting apparatus with a particular combination of the receiving circuits has demonstrated that daylight signals from stations using the ordinary wave-lengths can be rendered plainly audible, which by the ordinary methods and the use of the crystal detector could not be heard. Time signals have been transmitted from the Observatory clock, Wellington, to Tahiti, the distance covered being 2,245 nautical miles.

Questions & Answers

NOTE.—*This section of the magazine is placed at the disposal of all readers who wish to receive advice and information on matters pertaining to both the technical and non-technical sides of wireless telegraphy. There are no coupons to fill in and no fees of any kind. At the same time readers would greatly facilitate the work of our experts if they would comply with the following rules:* (1) *Questions should be numbered and written on one side of the paper only, and should not exceed four in number.* (2) *Replies should not be expected in the issue immediately following the receipt of queries, as in the present times of difficulty magazines have to go to press much earlier than formerly.* (3) *Queries should be as clear and concise as possible.* (4) *Before sending in their questions readers are advised to search recent numbers to see whether the same queries have not been dealt with before. This will save us needless duplication of answers.* (5) *The Editor cannot undertake to reply to queries by post, even when these are accompanied by a stamped addressed envelope.*

A. H. P. (Rhostyllen) does not comply with our rules by sending his full name. His queries are therefore held over until we receive a further communication from him.

"WORRY" (Walworth) asks if a student gains a first-class P.M.G. Certificate, and fails to pass the medical examination of the Marconi Company's doctor, of what use would his certificate be?

Answer.—The medical examination set by the Marconi Company's doctor is designed purely to test a man's suitability for sea life. It is just possible that such a man as our correspondent mentions may obtain employment in some wireless capacity where the requirements are not so strict, but in our opinion it is improbable that he would receive any sea appointment.

S. J. V. (Terschelling).—We have carefully examined the excellent sketch attached to your letter, and we are sorry to say that we cannot give you any idea whatever of the use of the instrument which it depicts. It is unknown to us.

PICKLES (Monifieth).—A certain number of lady operators were engaged for the land station service of the Marconi Company some while ago, but no more are being accepted at present. There was no definite age limit, all of the ladies in question being accepted, among other reasons, for their telegraphic skill. They do not wear a uniform. No lady operators are employed by the Marconi Company on board ship, nor is there any likelihood of their being so employed in future.

"TEMP" (Barry).—You apparently do not understand the meaning of "root mean square." If you will study *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett, the meaning will be clear to you, as also will be the reason for the formula given in your letter.

"L'INSTITUTRICE" (Shawforth) asks what steps a boy of 17 should take if he wishes to be trained in wireless telegraphy on being called up. If our correspondent means when he is called up for military or naval service, the question of his training will rest with the authorities. If he joins the wireless section of the Army or Navy then he will be given the training necessary for his work after he joins up. If, however, the boy has in mind entering the wireless service of the mercantile marine before he becomes eligible for military service, then he should apply to the Marconi Company, who, provided he is found suitable, will give him the necessary training free. Application should be sent to the Traffic Manager, The Marconi International Marine Communication Company, Limited, Marconi House, Strand, W.C.2, when all particulars will be forwarded by return of post.

A. L. (Gateshead).—For the answer to your first question, we would refer you to the excellent article entitled "The Operator at Sea," which appears under the heading of "Operators' Notes" in this number. (2) A young man with no knowledge of wireless telegraphy who accepts the Marconi Company's offer of free training receives, of course, no salary. We do not know whether our correspondent is aware that a number of free scholarships are being offered by the Rutherford College School of Wireless Telegraphy, Newcastle-on-Tyne. Particulars may be obtained on application to the School Representative, The Marconi International Marine Communication Company, Limited, Milburn House, Newcastle-on-Tyne. (3) Applicants for free scholarships at Newcastle can be medically examined in Newcastle itself.

A. W. (Faversham) is anxious to become a wireless operator in May next and meanwhile wants to use his spare time to the best advantage. He says he has already a knowledge of French and mathematics. He asks (1) whether he should study electricity; (2) if we could tell him a good book on the subject; and (3) could he obtain a keyboard and learn the Morse code and so teach himself to use the same.

Answer.—(1) Our correspondent should certainly study electricity as well as the theory of wireless. To do this he should

obtain *The Elementary Principles of Wireless Telegraphy*, by R. D. Bangay, Parts I. and II. bound together, price 4s., post free 4s. 5d.; and when he has studied this, *The Handbook of Technical Instruction for Wireless Telegraphists*, by J. C. Hawkhead and H. M. Dowsett, price 4s., post free 4s. 5d. This contains a good deal of instruction in elementary electricity and magnetism. To study the Morse Code at home, our correspondent should first obtain *Morse Made Easy*, price 3d., post free 4d. A key and buzzer can be obtained from one of the advertisers in THE WIRELESS WORLD, and excellent receiving practice can be gained from the Marconi Official Gramophone Records, which he can obtain from his local dealer in gramophones. These records are graduated in speed and have been specially designed for home instruction. Particulars regarding them will be found in the latest catalogue of "His Master's Voice" records. If our correspondent is over 16 we would strongly recommend him to apply to the Marconi Company for the particulars of the free training scheme now in force. The offer of free training is not being made for an indefinite period, and those who wish to avail themselves of it should do so without delay. No one can fully qualify for the Postmaster-General's Certificate at home, although a great deal of the preliminary work can be done in that fashion.

H. S. (Co. Durham) asks (1) How is it possible to test the sensitiveness of a crystal and (2) Is it advisable to break a small piece off, if one is unable to obtain a good contact otherwise? (3) How is one to identify incoming signals which are leaking to earth?

Answer.—(1) It is usual to test the sensitiveness of a crystal detector used on a wireless receiver by means of artificial signals created by a buzzer. The buzzer, which is usually controlled by a push button or small key, generates very feeble electric waves which fall upon the wire connected to the receiver. By listening in the telephones and altering the position of the contact between the crystal and the point or plate, the most sensitive position can be found. If, on test, no sensitive place can be found on the surface of the crystal, a small portion may be broken off, and the surface again searched. The breaking off needs to be done very carefully, otherwise the whole crystal will be fractured and rendered useless. The third question is not exactly clear. Signals which are leaking to earth will obviously not be passing through the receiver and therefore will remain undetected. If the operator has good reason to believe that signals are coming through, and he cannot hear them, he should systematically examine all connections of his receiving apparatus, with a view to finding the fault. The method of tracing faults in receivers is fully dealt with in *The Maintenance of Wireless Telegraph Apparatus*, by P. W. Harris, price 2s. 6d., post free 2s. 10d., from our publishers.

S. A. L. (H.M.S. ——) states that on a certain crystal receiver used by him good signals (strength four) were received from a station two miles distant with the crystal disconnected, and signals (strength one) with the battery and crystal disconnected. He asks for an explanation of this.

Answer.—The signals received by our correspondent would be due to the very strong current generated by the first wave received from the transmitting station. This initial rush of current down the aerial would create in the receiving instruments a similar rush, quite sufficient to affect the telephone receivers without any rectification by a crystal or other detector. It should be remembered that the telephone receivers are very sensitive to small currents, and the object of the crystal or other rectifier is not to increase the current, but to convert the high frequency current into unidirectional impulse. In the case our correspondent mentions the first impulse of current is sufficient to actuate the telephone receiver, and there is no need for resonance or a building up of unidirectional impulses.

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