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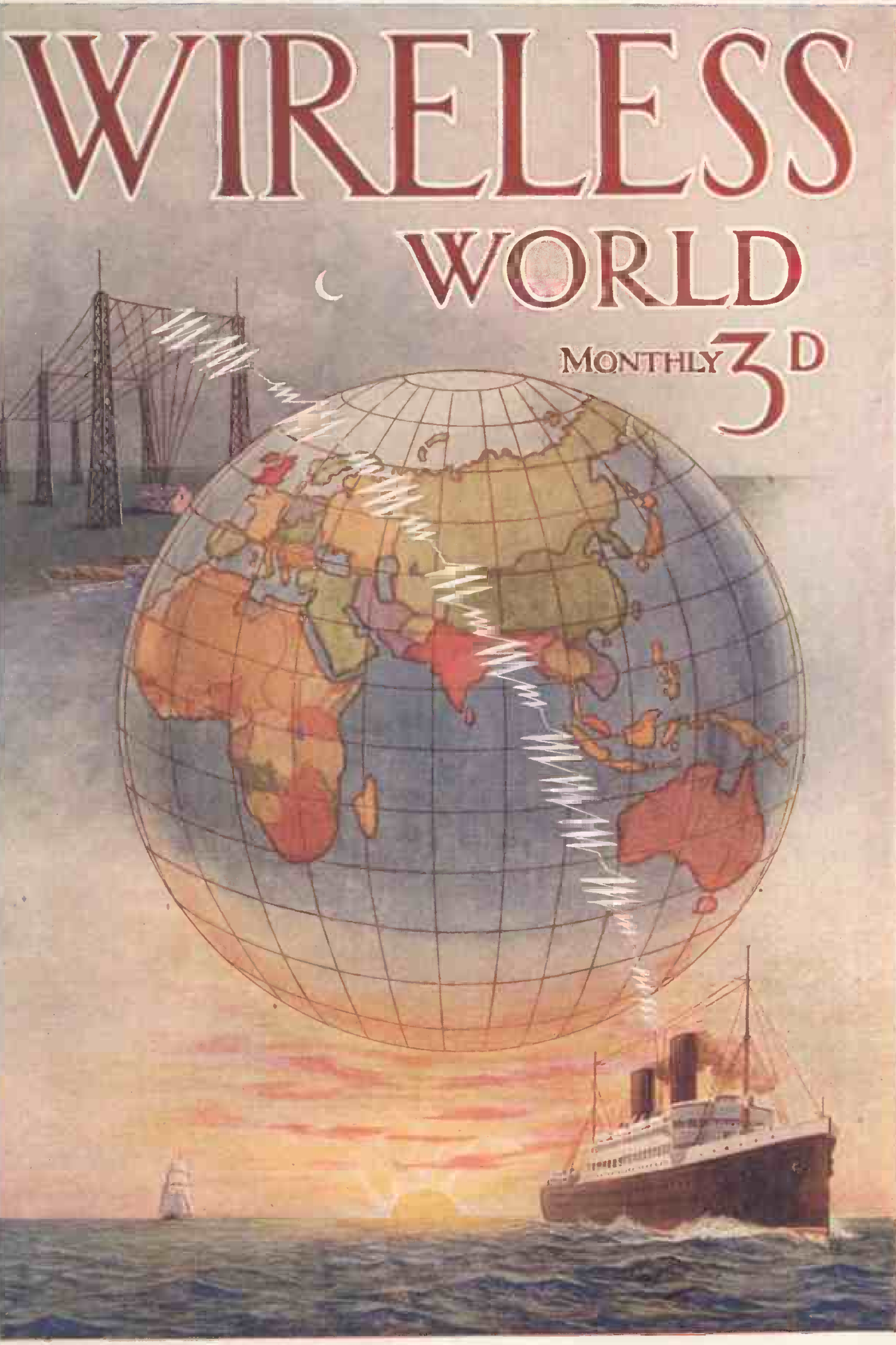
WIRELESS WORLD

MONTHLY 3D



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The Editor will be pleased to receive contributions; and Illustrated Articles will be particularly welcomed. All such as are accepted will be paid for.

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THE WIRELESS WORLD

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A Word in Season

Some Remarks Resulting from Observation and Correspondence.

If we may judge from letters which continue constantly to reach us, wireless amateurs appear still to experience some "searchings of heart" as to the suspension of their interesting and instructive hobby. Some even appear to be in doubt as to their duty with regard to wireless apparatus. We confess that this seems strange in view of the fact that "The Defence of the Realm (Consolidation) Regulations, 1914," issued as long ago as November 28th last, distinctly state that:

> "No person shall, without the written permission of the Postmaster-General, buy, sell, or have in his possession or under his control any apparatus for the sending or receiving of messages by wireless telegraphy, or any apparatus intended to be used as a component part of such apparatus."

Acts of Parliament and Government Regulations are not always clear in their language; but surely it would be impossible to speak more plainly.

In view of this "plain speaking," there cannot be any possible excuse for the retention of unsealed wireless apparatus. Moreover, the long list of convictions under the Act should surely, by this time, have carried conviction. Post Office Regulations, even in times of peace, make it necessary for the possessors of complete installations to procure a licence before putting their sets into operation; but, as we have seen, the Defence of the Realm Act goes further, and forbids the possession of individual items of apparatus as well as complete sets. Reference to details of cases reported tends to show, moreover, that the *onus probandi* of showing that his intentions are innocent, rests with the person possessing the apparatus. This, at all events, has been contended by the prosecutor on more than one occasion. But we would put the matter on a higher plane than that of mere self-interest.

We take it as a truism that every Englishman is "heart and soul" with His Majesty's Government in their fixed purpose of ending, once and for all, the attempted world tyranny of Prussian militarism. It follows that the Regulations of that Government must be obeyed, not grudgingly but cheerfully and without reserve. Of course, we English have been so long accustomed to individual freedom that submission is harder for us than for others used to a sterner *régime*. Does not this very fact render it all the more incumbent upon us to make the sacrifice? Every uniform that we see must speak eloquently to us of the sacrifices made by other people for their fatherland. Where others are prepared to lay down their lives, cannot we be content to part with our wireless instruments? It is foolish to write and ask questions as to the retention of this, that, or the other item of apparatus. It is the bounden duty of everyone possessing any component part of wireless machinery to advise his Local Authority and to submit cheerfully to their decision.

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DR. LUIGI LOMBARDI.

Personalities in the Wireless World

DR. LUIGI LOMBARDI.

MR. RICHARD BAGOT points out that a young nation like modern Italy has need of men who can contribute in a practical manner to its social and economic progress, rather than of great artists. " A Marconi," he says, " has been of more use to Italy, and to the world, than a second Raffaelo or a second Michaelangelo could have been." The student of electricity finds that he can penetrate very little distance into the history and theory of his subject without coming across an important contribution by an Italian physicist. If " wireless " is his study, then this special department abounds in the names of compatriots of the famous pioneer. A prominent place on this list is occupied by the name of Dr. Luigi Lombardi, whose portrait faces this page.

Dr. Luigi Lombardi had the good fortune to be born in Dronero, a picturesque little village in the Maira Valley of the Maritime Alps, some 2,035 feet above sea level. He will be forty-eight on August 21st. His entry upon the career in which he has achieved more than usual prominence may be said to date from 1890, when at the age of twenty-three he obtained the diploma of civil engineer at the Royal Engineering School of Turin. This initial success was but the herald of others shortly to follow, for in the next year he secured the diploma in electricity at the Industrial Museum of Turin, and coupled with it the academic honour known as the Gori-Feroni Prize.

Zurich University was early alive to Dr. Lombardi's capabilities, and before any of the Italian institutions were able to elect him to their professorates, Zurich had called him over the frontier to conduct electrical studies there. For five years Dr. Lombardi continued in Switzerland, until, in 1897, Turin, the city of his first triumph, called him back as Professor of Electricity at their Industrial Museum. Since 1911 Dr. Lombardi has occupied the Chair of Electrical Science at the Royal Polytechnic in Naples.

The fruit of these appointments has not been " cabined " for the exclusive use of students in the several institutions. They have been widely published and form a series of most important contributions to electrical literature. Amongst them is a book on the *Scientific Principles of Electricity* and numerous papers on subjects of electrical interest. To the student of " wireless," however, he can be best introduced as the author of a study on the employment of condensers for the transmission of electricity, a study which received high recognition in the form of the Kremer Prize of the Lombard Institute.

It is well within the order of things that an expert on the employment of condensers for special purposes should himself devise a high-tension condenser of special design. This condenser has been the subject of much favourable criticism.

Proof of Italy's appreciation of Dr. Lombardi's work in the cause of " wireless " appears in the important tasks which have been delegated to him from time to time. At the St. Louis International Congress of Electricity Dr. Lombardi represented the Italian nation, and on many occasions by his election to the presidency of international congresses and scientific societies his merit has been similarly recognised.

If there be one outstanding feature of modern Italy's prominent men, it is their loyalty to the mother-country. Dr. Lombardi provides an excellent example. His interest in electricity and his faith in the future of " wireless " led to an appeal that every facility should be given to his students to gain a practical as well as a theoretical knowledge of its possibilities. Consequently he has himself erected a fine station at the Royal Polytechnic School at Naples and has secured the permission of the controlling body to conduct a special course.

Conditions Affecting the Variations in Strength of Wireless Signals.*

By Professor E. W. MARCHANT, D.Sc.

The following paper was read at Liverpool on February 9th by Professor E. W. Marchant, D.Sc. He has attacked the well-known problem presented by the fact that under certain conditions remarkable distances can be covered by small-power radio apparatus, although at other times their radius is proportionately curtailed, whilst high-power stations also show remarkable variations in the distances over which they can transmit. After mentioning the results of the investigations made by other scientists, and referring to the fact that the stations between which most measurements have been recorded are Liverpool and Paris, lying in a plane N.W.—S.E. with respect to one another, Professor Marchant proceeds to discuss his own work from the Liverpool centre.

Methods of Observation.

In order to obtain comparable measurements of signal strength it is of importance that the aerial circuit should be of a definite form; preferably the aerial should be isolated from buildings and other obstructions which might interfere with the waves that are received from the transmitter. On general grounds it would seem desirable that an antenna of symmetrical form should be employed. Where these ideal conditions cannot be obtained absolute measurements are of little value, but the figures which show the variations obtained on an aerial working under less favourable conditions should give reliable comparisons between signal strengths from day to day.

The aerial employed in connection with these tests was of an L shape, having a horizontal length of over 600 ft. and a vertical height above ground of 150 ft. It is run over land which is covered with buildings, and consequently the natural wave-length (about 1,200 metres) does not correspond very closely with that found by calculation from inductance and capacity of the wires.

The second factor which has a great influence on the strength of signal received by an antenna is the resistance to earth. The earthing system used in connection with these tests was comparatively simple. The main part of it consisted of a ring of two 3-in. water pipes laid in the form of a square of about 50 ft. side. The earth-wire was attached to one side of these pipes, and they, in turn, were connected with the water-pipe system of the building. This arrangement was found to give very satisfactory results.

The arrangement of the circuit used in connection with the aerial is shown in Fig. 1. The coupling between the aerial circuit and the receiving circuit varied within wide limits; for most of the records it was 3·75 per cent.—*i.e.*, this coupling was used

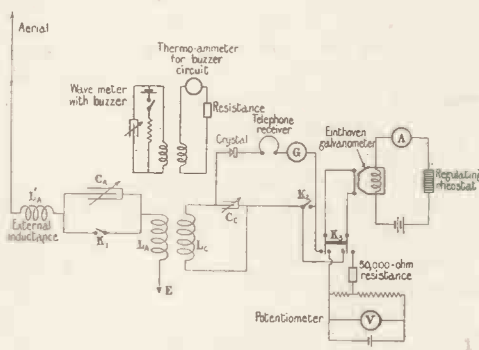


Fig. 1.—Receiver Circuit.

for the Paris signals. The coupling coefficient was accurately measured in all cases, and, by means of calculation (of which particulars are given) the current received in the aerial circuit could be determined from the readings of the galvanometer in series with the crystal detector on the closed circuit.

The resistance of the secondary circuit was estimated by inducing a high-frequency current in it by means of a buzzer. The natural wave-length of the aerial was determined by exciting it inductively from a closed circuit coupled very loosely to it, and varying the natural period of the oscillating circuit until maximum antenna current was obtained. The natural frequency of this oscillating circuit was then found by means

* Abstract of a Paper read before the Institution of Electrical Engineers.

of a wave-meter. The decrement of the secondary circuits was determined by exciting them inductively from the buzzer circuit.

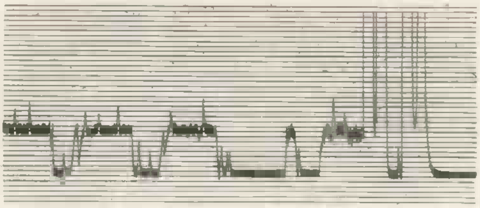
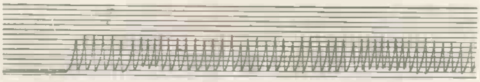


Fig. 2.—Signal from Brussels showing "Atmospherics."

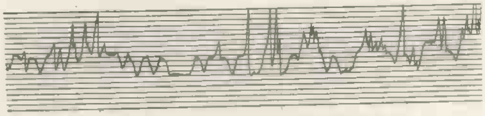
It is difficult to measure the earth resistance of the antenna circuit, but the determination of the decrement of the signals received enables the constancy of the resistance of the earth to be determined to any required degree of accuracy.* It was found that the decrement did not vary very much from day to day, and in making calculations of received energy, the earth resistance has been assumed constant.

MEASUREMENT OF CURRENT IN THE CRYSTAL CIRCUIT.

The current received by the antenna was estimated from the current flowing through the crystal circuit, as mentioned above. As far as variations are concerned, it was sufficient to note the changes in the galvanometer currents due to the received signals. The crystal combination used in nearly all the tests was the one known as perikon, with crystals of zincite and chalcopyrites.



Signal from Paris (Low Frequency Spark).



Signal from Clifden showing bad "Atmospherics."
Fig. 3.

NOTE.—The Clifden record was obtained on an exceptionally bad day. The result shown was quite unusual, and no special arrangement for eliminating "atmospherics" was used.

* Assuming that the decrement of the wave train emitted is constant.

In order to simplify the work as much as possible, the secondary circuit was calibrated on the same wave-length as that of the received signal. As has been shown by the author and many others, the current flowing in the crystal circuit connected to any oscillating system is proportional to the square of the oscillating current. This result has been checked in connection with all the crystals used in the experiments.

In series with the crystal was placed a high-resistance (8,000 ohms) telephone receiver, an ordinary Broca galvanometer with a period of about 9 seconds, and an Einthoven galvanometer with a silvered quartz fibre having a natural period of about $\frac{1}{20}$ second when working at normal sensibility. It might have been expected that for long dashes the Broca galvanometer would have proved satisfactory and sensitive enough for the purpose. The actual deflection of the instrument for a given current in the circuit is greater than that of the Einthoven, the normal sensitiveness of the instrument being 400 mm. per micro-ampere, but in practice it was found that extraneous causes made it almost impossible to use the Broca galvanometer for purposes of measurement. The greatest difficulty was met with in connection with the atmospheric discharges which at certain times of the year are liable to interfere very seriously with the reception of signals. Especially was this the case during the months of June, July, August and September. During many months in the winter the Broca galvanometer was quite effective, though even under the most favourable atmospheric conditions trouble was sometimes met with from ships and other stations sending on much shorter wave-lengths.

The number of such stations in the vicinity of Liverpool, it may be mentioned, prevented any accurate observation being made on the shorter wave-lengths, and it is for this reason that the work has been confined almost entirely to the wave-lengths used by Brussels, Paris and Clifden. The Einthoven galvanometer in most cases was not used in the way in which it is usually employed, as it was found that a less sensitive arrangement was quite effective for the currents which had to be measured. Under normal conditions the magnification of the image of the fibre was reduced by omitting the micro-

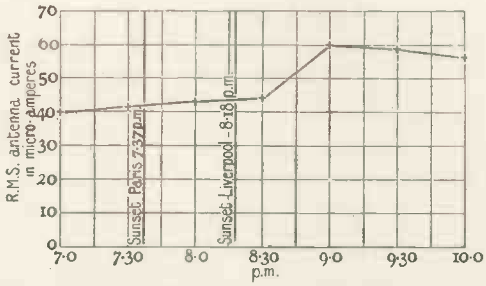


Fig. 4.—Paris Sunset Test, July 26, 1913: Paris Antenna Current, 43-45 amperes. Weather clear.

scopic eye-piece, and the image of the fibre was, therefore, much thinner than would otherwise have been the case (*see* Fig. 3). For weak signals the greater magnification was used, Fig. 2.

Under the latter conditions it was possible to obtain a sensibility of 200 mm. per micro-ampere with a period of about $\frac{1}{20}$ second. The sensitiveness without the magnifying eye-piece was usually 25 mm. per micro-ampere, but owing to the smaller size of the image of the fibre it was possible to measure the deflection with almost the same precision as with the larger magnification. Examples of signals received with these two different arrangements are shown in Figs. 2 and 3.

In connection with each test, or measurement of signal strength, a calibration of the crystal sensibility was made by means of the buzzer shown in Fig. 1. In each case the current flowing in this circuit was measured by a Duddell thermo-ammeter, and the corresponding current in the galvanometer circuit observed.

The accuracy of the measurements of signal strength is not closer than ± 5 per cent., and too much attention should not be given to small variations or irregularities in the curves.

OBSERVATIONS ON SIGNAL STRENGTH.

Sunset Effect.—One of the earliest observations in connection with wireless telegraphy was that it was possible to transmit over much longer distances by night than by day, and it has been a matter of discussion ever since as to what is the cause of that variation. Several observations have been made at the time of sunset, and the results are recorded in Figs. 4, 5, 6, 9, 10 and 11. The first point which deserves notice is that the increase in strength of the signal does not occur at the time of sunset, but some time afterwards. This is what might have been expected if the state of ionisation of the atmosphere is the controlling factor in determining the signal strength. The increase in signal strength occurs at almost the same time as daylight ceases—*i.e.*, at the same time as the number of ions per cubic centimetre in the atmosphere would rapidly diminish.

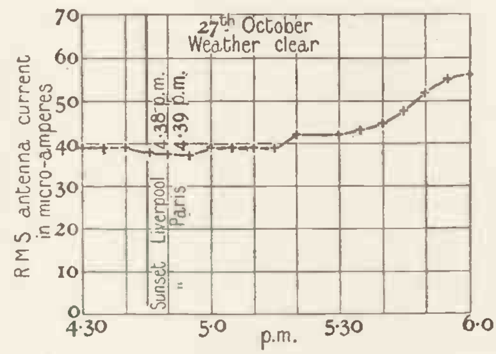


Fig. 6.—Paris Sunset Test, October 27.

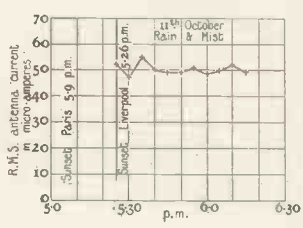
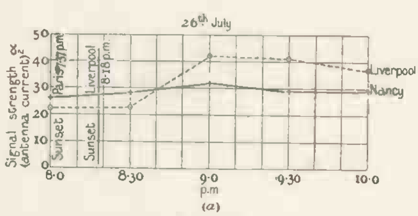


Fig. 5.—Paris Sunset Test, Oct. 11. Paris Antenna Current, 43-45 amperes.



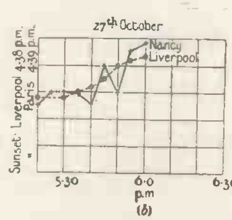


Fig. 7. *Fig. 7a.*

Special Signals emitted from Paris. Comparison between variation in signal strength at sunset at Nancy and Liverpool.

Observations in America appear to show that with places lying due east and west of

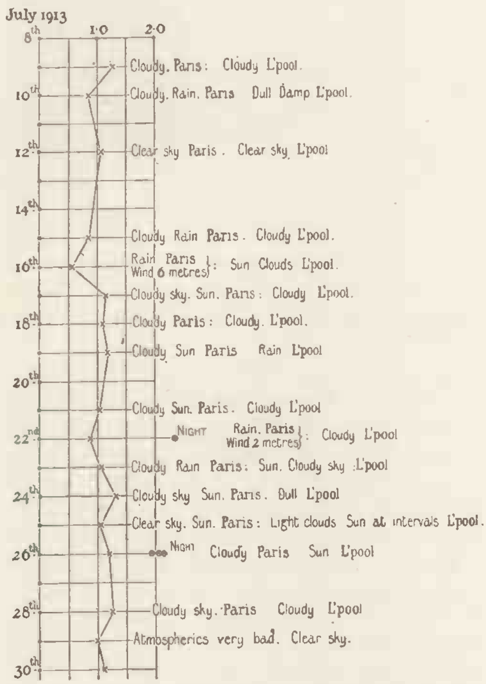


Fig. 8.—Curve showing Variation in Signal Strength, with Day and Month.

each other there was weakening * in the strength of the signals while the dark-light band lay between the two places. This effect is, of course, well known in connection with the Transatlantic transmission. It will be noticed from the curves that there is little evidence of such an effect occurring between Liverpool and Paris. If this effect occurs it is, comparatively, very slight. It would seem, therefore, that the "fog" in the space covered by the dark-light band is not a very dense one.

The curves show, however, that the sunset effect varies with the weather conditions at the time of sunset. On July 26th (Fig. 4) and October 27th (Fig. 6) the sky was clear and the effect was what may be called of the "normal" type—*i.e.*, there was an increase in strength commencing from ¾ hour to 1 hour after sunset. On these days, however, the antenna current measured before sunset was only 40 micro-amperes. On October 27th the rise in strength was perceptible at 5.35 p.m., the time of sunset being 4.38 p.m.; on this day sunset occurs at the same time in Liverpool and Paris. In December, 1913 and January, 1914, there was no evidence of a sunset effect, the signal strength at 10.45 a.m. being the same as that at 5 p.m. on the shortest day, when the time of sunset here is 3.49 p.m., and the 5 p.m. signal is, therefore, over one hour after the time of sunset.

In the all-night test on March 26th and 27th the increase in strength at sunset was comparatively small. There was a slight maximum at 7.25 p.m. and another at 10 p.m., but the greatest strength was not reached until 2 a.m.; the time of sunset was 6.34 p.m. (Greenwich mean-time).

The observations on October 11th also show that there is practically no increase in signal strength, even one hour after sunset, in accordance with the observations of March 26th. On both these days, however, the day strength of the antenna current was 50 micro-amperes, the atmosphere was damp and cloudy, and rain fell at intervals in Liverpool and on March 27th in Paris. In the all-night test on May 4th with Brussels there is also no evidence of a sunset effect, though there is a marked strengthening of the signals at about 10.30 p.m. On June 8th, in a 24-hour test with Paris (*see* Fig. 11), when the conditions here were fine, there is again no increase in strength during the whole night, a result which confirms Mosler's observations for the month of June. The observations by Mosler * on the variation in the ratio of night to day strength with the time of year are of great interest, but it does not seem possible to get a definite ratio between night and day strength which will hold with any approximation to accuracy for any day in any given month. As Mosler himself shows, and as these tests have also shown, the variations during a single night may be very large, and the difference in the ratio from day to day in any given month may also be very large. It is interesting to notice that the greatest ratio observed between night and day strength occurred in July, 1913. The ratio on July 26th was 1·8, while on July 22nd it was 2·4.

A possible explanation of the observed phenomena may be as follows: When the atmospheric conditions are bad and rain has fallen, the transmission is good and the

* A. E. Kennelly, *Proceedings* of the Institute of Radio Engineers, *loc. cit.*

* *Loc. cit.*

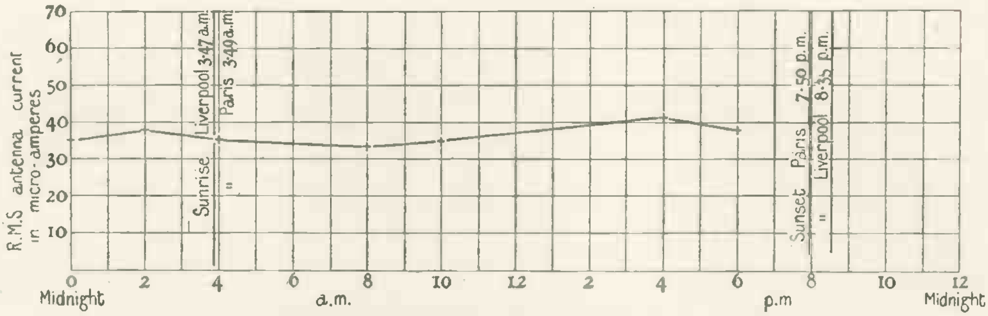


Fig. 9.—March 26th, 1914, 6 p.m.—March 27th, 6. a.m. 12-hour Test. Paris Antenna, 43-45 amperes.

effect of the removal of sunlight, which is one of the chief causes of ionisation in the atmosphere, produces little effect. Irregular reflections and refractions from masses of ionised air in the upper regions of the atmosphere, which cause irregular increases in the received antenna current, such as are observed in the all-night tests referred to later on, are prominent, because of the transparency of the lower atmospheres to the waves. On the other hand, when the day is clear the received antenna current is less strong during the day, and when darkness falls there is a considerable strengthening of the signals, owing to the atmosphere becoming more transparent to the waves as it becomes de-ionised after daylight has ceased. The reflections from masses of ionised air in the upper regions of the atmosphere are less prominent, because of the less transparent condition of the lower atmosphere after a fine day than after rain.

One point of great interest in connection with these tests is that, as has already been mentioned, the signals sent out on July 26th and October 27th from the Eiffel Tower were measured at Nancy by MM. E. Rothé and R. Clarté.* These results have been plotted for comparison with those obtained at Liverpool on July 26th (*see* Fig. 7a). They found that the increase in signal strength was very slight. Here, on the other hand, it was very considerable, the antenna current received after sunset being nearly 1·5 times that received just before sunset. The difference in the time of sunset at Liverpool and Paris on July 26th is just over 40 minutes, whereas on October 27th the difference is less than one minute.

On October 27th (*see* Fig. 7b) there is some correspondence between the results obtained at Nancy and Liverpool, though there are considerably greater irregularities in the strength of signal measured at Nancy than are found here. It is difficult to see how these differences can be explained by the different orientation of Liverpool and Nancy in relation to Paris, and the consequent difference in the reflection and refraction at the shadow band. The theory of cloud reflection, however, may easily be applied to explain the difference in the effect observed at these two places.

If the atmospheric conditions between Paris and Nancy were good—*i.e.*, if the sky were cloudy and rain had fallen—the signal strength would be good and no increase would be observed at sunset. If conditions between Paris and Liverpool were bad (from the signalling point of view), with a clear sky, the fall of darkness would give rise to the normal sunset effect.*

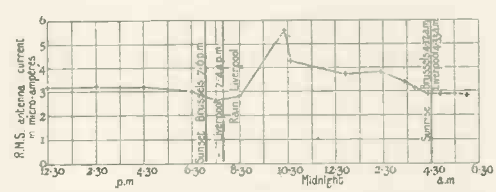


Fig. 10.—May 4, 1914. Brussels 24-hour Test.

The observations by Mosler on the variation in the ratio of night to day strength with time of year are of great interest, but it does not seem possible to get a definite ratio between night and day strength which will hold for any day in any given month.

* *Loc. cit.*

* An examination of the charts published by the Meteorological Office shows that the atmospheric conditions were very similar in the region Paris to Nancy, and Paris to Liverpool, on October 27th, some rain having fallen.

The variation between one day and another in the same month are very great, as is shown by the curves for October 11th and October 26th. It is to be hoped that it may be possible to examine the sunset effect much more completely than has been possible up to the present.

Comparison between Morning and Evening Signals.—Observations show that signals received at 5 p.m. do not show any increase above those at 10.40 a.m. on the shortest day of the year, and throughout the months of December and January. There is, in fact, throughout the year very little difference between the morning and evening signals, certainly none greater than that due to more or less irregular variations in the morning signals. The facts stated above may perhaps be taken as additional proof that variation in signal strength is a phenomenon depending more on reflection and refraction from masses of ionised air, as suggested by Fessenden,* similar in character to the clouds which affect atmospheric conditions, than to variation in earth-surface conductivity. One may suggest, therefore, that, besides the conducting outer envelope which Heaviside and Eccles have postulated, there exists in the upper atmosphere a cloud condition which affects the transmission of electric waves of much the same character as the cloud distribution with which everyone is familiar, and which affects the transmission of light waves. These clouds may consist of masses of ionised air which are transparent to light, but which absorb or reflect the long waves used in wireless telegraphy.

Since the nature of the clouds which affect the transmission of light waves differs from that affecting the transmission of long electro-magnetic waves, so the distribution of these masses must be different in the two cases. From the fact that the signals observed in the day are less variable than those received at night, it is evident that this "electromagnetic atmosphere" is prevented from producing much effect during the daytime; it cannot, in other words, produce much effect until the de-ionisation of the lower atmosphere by the withdrawal of sunlight makes it sufficiently transparent to enable the waves to pass through it and reach the cloud masses which reflect them.

In Fig. 10 signal strength or (antenna current)* is plotted and a record of the weather conditions at the two places is given for comparison. It was noted in these tests, which were described at Birmingham,* that there was a marked fall in signal strength when heavy rain fell in Paris, and it was suggested in the discussion of this Paper that this was due to defective insulation in the Paris aerial. Possibly this may be a true explanation of this phenomenon, but, as has already been mentioned, the constancy of the antenna current in Paris does not support this view.

It seems quite conceivable that, even with a highly insulated aerial, rain should carry away some of the charge that would otherwise accumulate on it—*i.e.*, that the aerial would become less well insulated although the insulators themselves were quite sound. The results obtained are not conclusive on this point, as on several other

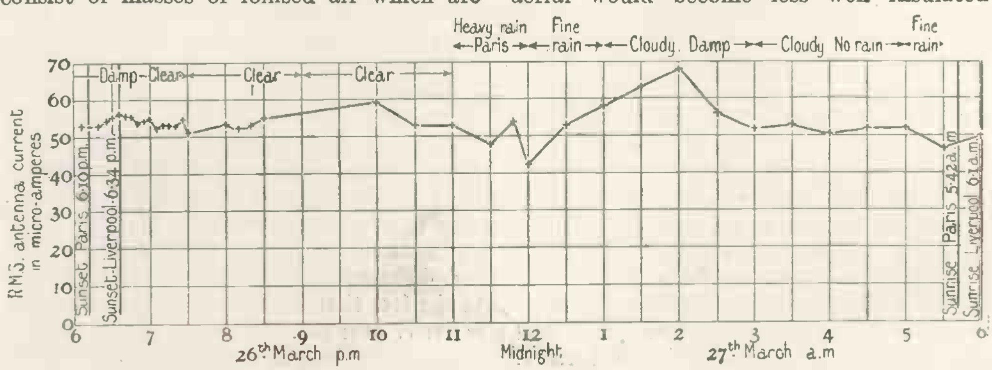


Fig. 11.—Paris, June 8, 1914. Midnight to 6 p.m. Paris Antenna Current, 43-45 amperes.

* *Nature*, Vol. LXXVI., p. 444, 1907.

* *British Association Report, loc. cit.*

days in the year when it was raining in Paris the signal received was of full strength.

Speaking generally, one may say that the best conditions for wireless signalling are cloudy skies, except, of course, when there are strong atmospherical discharges in the clouds which make signal reading difficult.* Records show that bright sunshine is not satisfactory for transmission, and this is borne out by the observations of operators, who have stated that during a spell of very sunny weather their range appears to be very much restricted (this may possibly be due to large earth resistance).

The records obtained from Brussels show much greater differences in signal strength from day to day; but as the station is in an experimental stage it is hardly possible to base accurate comparisons upon them.

Variation in Signal Strength during the Night.—Looking now at the all-night records, Figs. 9, 10 and 11, it is remarkable that there appears to have been on the nights of March 26th and 27th and of May 4th a very considerable increase in strength after rain. On the record for March 26th there is a decided minimum at midnight, there being an actual diminution in the strength of the night signal as compared with the day. This minimum, however, corresponds with heavy rain in Paris; it is possible that the minimum may have been due to defective insulation of the Paris aerial. This is not likely for the reasons just given. At midnight, for example, the antenna current used for the three long dashes sent out was 44, 45, 45 amperes. The sending antenna current when the sky was clear, say at 7.20 p.m., was 44, 45, 44 amperes. Two hours after the rain had ceased the antenna current received rose from 52 to 68 micro-amperes. The same thing occurred in an all-night test which was made in connection with the Goldschmidt stations at Brussels. In that case the antenna current received at 10.35 p.m. suddenly increased to 5·5 micro-amperes, about twice what it had been at 8.30 p.m.; at 10.45 p.m. it had fallen, and then diminished still further, until at midnight and 2.30 a.m. it was only 3·9 micro-amperes, falling to normal day strength (about 3 micro-amperes) just after sunrise at 4.33 a.m. In this case, also, there was heavy rain just before 10 p.m., and this would correspond with the same atmospheric condition as occurred during the Paris all-night test.

It would seem from these results, therefore, that one of the causes of change in signal strength at night is rain. After the fall of rain the atmosphere becomes more transparent for the electric waves, and allows the reflections already referred to, which cause an increase in the strength of signals to become more marked; that this is possible is evident from the fact that a fall of rain must tend to de-ionise the air and carry down the charged nuclei on which raindrops form, and which make the air conducting and therefore absorbent.

It is interesting to notice that in the plates giving records of the signals taken during the all-night run from Paris there is a very considerable variation in the strength of the signal during a 10-seconds' dash. At first sight it might appear that the explanation of this is that the sparking was irregular; but if these records are compared with those obtained with similar dashes sent out during the daytime it is noticeable that the variation in strength is much greater at night—*i.e.*, there will be during one second of the dash an increase in signal strength amounting to as much as 10 to 15 per cent. of the mormal value. The increase in strength may decrease or increase as the sparking continues.

These variations only emphasise the fact that changes in signal strength during the night are due to some rapidly fluctuating influence such as might be expected to arise from the variation in form or composition of a reflecting mass of vapour.

Monthly Variations.—The day strength of the signals varies within comparatively narrow limits, but the average strength of the signals during June and July is noticeably less than that during December and January. This is not in accordance with the results obtained by Mosler, and it is possible that the difference in the figures may be due to the fact that the transmission in this case is partly over sea.

The variations in strength of signal from day to day are comparatively slight, but they are noticeably greater for March and July than they are for December and January.

The Paper concludes with two appendixes dealing with the estimation of antenna current and the current in the buzzer circuit.

* As has been noted by many observers, however, strong atmospherics often coincide with strong signals.

Practical Hints for Amateurs.

RADIO-PHOTOGRAPHY—III.

By MARCUS J. MARTIN.

In this, and in preceding articles, the author explains as simply as possible the various systems that have been devised for radio-photography, i.e., transmitting photographs, drawings, etc., from one place to another without the aid of artificial conductors.

* * *

AS the reader will have gathered from a perusal of Article 2, the image of the prepared print consists of a number of bands of insulating material (each band varying in width according to the density of the photograph at any point, from which it is prepared) attached to a metal base so that each band of insulating material is separated by a band of conducting material. It is, of course, obvious that the lines on the print cannot be wider apart, centre to centre, than the lines of the screen used in preparing it. A good screen to use is one having 50 lines to the inch, but the beginner is advised to use one a little coarser—say, 35 to the inch. To use a screen having 50 or more lines to the inch, the transmitting apparatus (as will be evident later on) will require to be very nearly perfect.

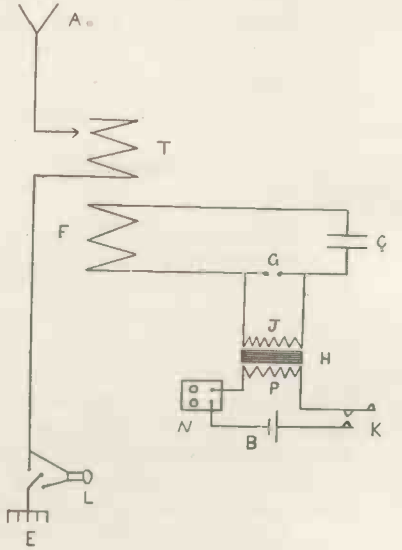


Fig. 9.

In the present article it is proposed to deal with the apparatus used in transmitting the prepared photograph to the receiving station. The diagram, Fig. 9, gives the connections for a syntonic transmitting station. A is the aerial, T the inductance, E earth, L hot wire ammeter. The closed oscillatory circuit consists of an inductance, F, spark gap, G, and block condenser, C. H is a spark coil for supplying the energy, the secondary, J, being connected to the spark gap. A mercury break, N, and a battery, B, is placed in the primary circuit of the coil. The Morse key, K, is for completing the battery circuit for signalling purposes. When the key, K, is depressed, the battery circuit is completed and a spark passes between the balls of the spark gap, G, producing oscillations in the closed circuit, which are transposed to the aerial circuit by induction. For signalling purposes it is only necessary for the operator, by means of the key K, to send out a long or short train of waves in some prearranged order, to enable the operator at the receiving station to understand the message that is being transmitted.

If a photograph could be prepared in such a manner that it would serve the purpose of the key K, and could so arrange matters that a minute portion of the photograph could be transmitted separately but in succession, and that each portion of the photograph having the same density could be given the same signal, then it would only be necessary to have apparatus at the receiving station capable of arranging the signals in proper sequence (each signal recorded being the same size and having the same density as the transmitted portion of the photograph) in order to receive a facsimile of the picture transmitted.

Before proceeding further it will perhaps be as well to make an experiment. If we take one of the metal prints or, more simple, draw a sketch in insulating ink upon a sheet of metal, A, Fig. 10, and connect the battery

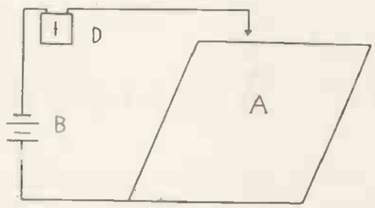


Fig. 10.

B and the galvanometer D as shown, we shall find, on drawing the free end of the wire across the metal plate, that all the time the wire is in contact with the lines of insulating material the needle of the galvanometer will remain at zero, but when it is in contact with the metal plate the needle is deflected. From this experiment it will be seen that we have in our metal line print, which consists of alternate bands of insulating and conducting material, a method by which an electric circuit can be very easily made and broken. It is, of course, necessary to have some arrangement whereby the whole of the surface of the metal print is utilised for this purpose to the best advantage.

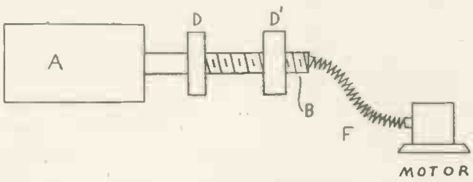


Fig. 11.

One type of transmitting machine used for this purpose is represented by the diagram Fig. 11. The cylinder A is fastened to the steel shaft B, which runs in the two bearings, D and D¹, the bearing D¹ having an internal thread corresponding with that on the shaft. The stylus in this class of machine is a fixture, the cylinder being given a lateral as well as a revolving movement. As it is impossible to use a rigid drive, a flexible

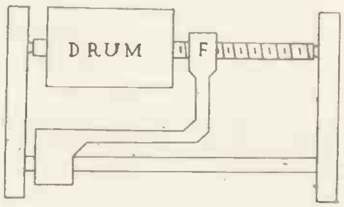


Fig. 12.

coupling, F, is employed between the shaft B and the motor.

Another type of machine is shown in Fig. 12. The drum in this case is stationary, the table, T, moving laterally by reason of the screwed shaft and half-nut, F. The table, shown separate in Fig. 13, carries a stiff brass spring, A, to which is attached a holder, B, made to take a hardened steel point. The holder is provided with a set screw, P, for securing the steel point, Z. The spring and needle are insulated from the rest of the machine as shown in the drawing.

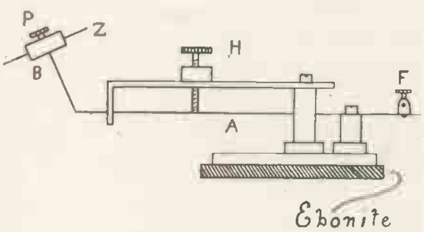


Fig. 13.

In working, the metal print is wrapped tightly round the cylinder of the machine, the glue image being, of course, uppermost. To fasten the print a little seccotine should be applied to one edge and the joint carefully smoothed down with the fingers. If there is any tendency on the part of the print to slip round on the drum a couple of small spring clips placed over the end of the drum will act as a preventive. It is necessary to place the print upon the drum in such a

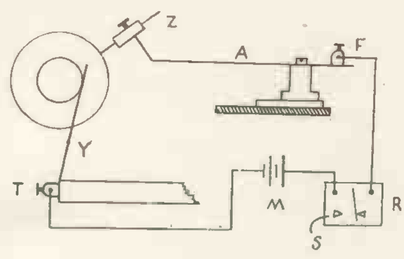


Fig. 14.

manner that the stylus draws away from the edge of the lap, and not towards it. The metal prints should be of such a size that when placed round the drum of the machine a lap of about $\frac{3}{16}$ of an inch is allowed.

The steel point Z (ordinary gramophone needles may be used and will be found to answer the purpose admirably) is made to

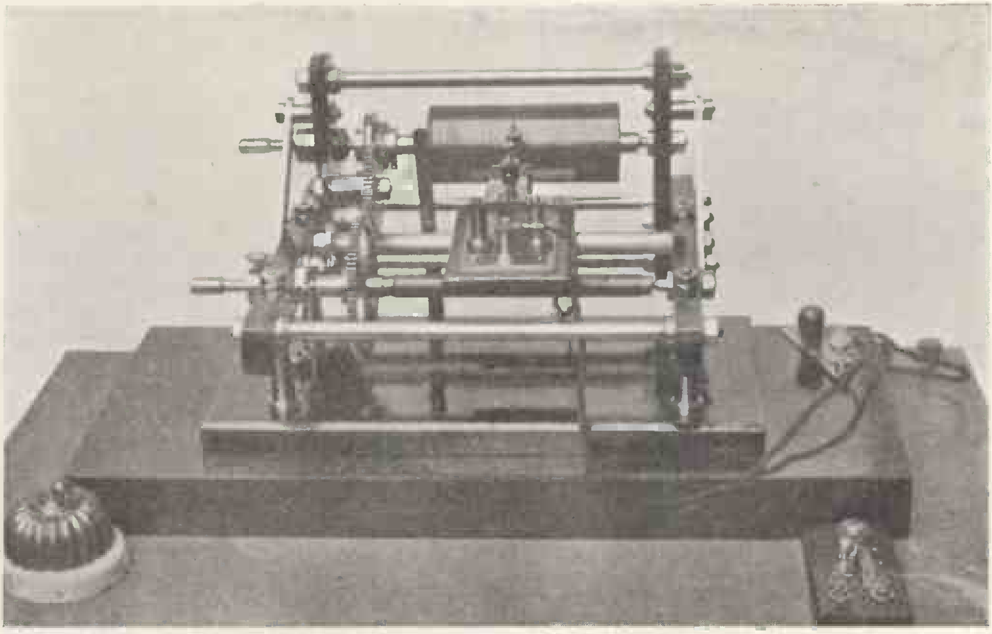


Fig. 15.

press lightly upon the metal print, and while the pressure should be sufficient to make good electrical contact, it should not be sufficient to cause the needle to scratch the surface of the foil. The pressure is regulated by means of the milled nut H. The electrical connections are shown in Fig. 14. One wire from the battery M is taken to the terminal T, and the other wires from M and F lead to the relay R. The current flows from the battery M, through the spring Y, through the drum and metal print, the stylus Z, spring A, down to the relay R, and from R back to the battery M. As the drum carrying the single line half-tone print is revolved, the stylus, by reason of the lateral movement given to the table or cylinder as the case may be, will trace a spiral path over the entire surface of the print. As the stylus traces over a conducting strip, the circuit is completed, and the tongue of the relay R is attracted, making contact with the stop S. On passing over a strip of insulation the circuit is broken, and the tongue of the relay R returns to its normal position.

As already stated, the conducting and insulating bands on the print vary in width according to the density of the photograph from which it is prepared, so that the length of time that the tongue of the relay R is held against the stop S is in proportion to the width of the conducting strip which is passing under the stylus at any instant. The function of the transmitter is, therefore, to send to the relay R an intermittent current of varying duration.

The two photographs, Figs. 15 and 15*a*, are of a machine designed and used by the writer in his experiments. In this machine the drum is 3·5 inches long and 1·5 inches in diameter. The lead screw has 30 threads to the inch, and the reduction between it and the drum is 3 : 1, so that the table has a lateral movement of $\frac{1}{90}$ inch per revolution of the drum.

From the brief description of the various types of machines that have been given it will be apparent that in the design of the machine proper there is nothing very complicated, although the addition of the driving and synchronising apparatus complicates matters rather considerably. The questions of driving and synchronising the machines at the two stations will be fully dealt with in a subsequent article.

Although the design of the machines is fairly simple, great attention must be paid, both to accuracy of construction and

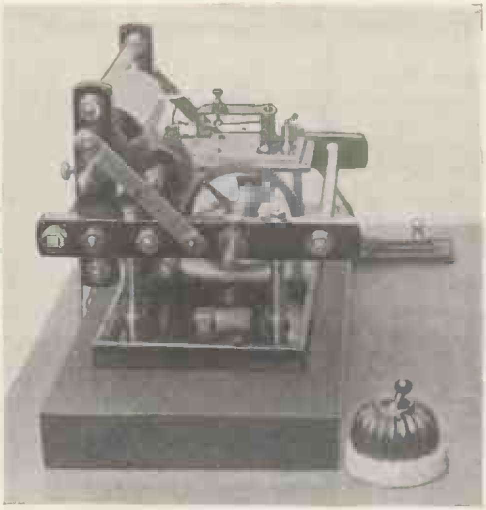


Fig. 15a.

accuracy of working, and this applies not only to the machines (whether for transmitting or receiving), but to all the various pieces of apparatus that are used. Too much care cannot be bestowed upon this point, as, in the wireless transmission of photographs, there is a large number of instruments all requiring careful adjustment, and which have to work together in perfect unison at a high speed.

The machine shown in Figs. 15 and 15*a* was designed and constructed by the writer solely for experimental work,* the machines intended for commercial purposes having undergone great changes in design, the improvements being the outcome of a great deal of experimental work. It will be noticed in the description given in Article 2 of the method of preparing the metal prints that a 5-in. by 4-in. camera was recommended, while the machine Fig. 15 is designed to take a print procured from a quarter-plate negative. This size of drum was adopted for several reasons, and, although it will be found quite large enough for general experimental work, the writer has come to the conclusion that for practical commercial work a drum to take a print 5 in. by 4 in. will give better results.

In making a negative of a picture that is required for reproduction purposes, the line screen in the camera is replaced by a "cross screen"—*i.e.*, two single-line screens placed with their lines at an angle of 90° to one another, and this breaks the image up into squares instead of lines. By looking at any ordinary newspaper or book illustration through a powerful magnifying glass the effects of a cross screen will readily be seen.

With a cross screen a certain amount of detail is necessarily lost, but with a single line screen the amount lost is much greater. If there is any very small detail in the picture most of this would be lost with a coarse screen, hence the necessity of employing as fine a line screen as practicable to get as much detail in as possible. It is mainly on this account that a 5-in. by 4-in. print is recommended, as if fairly bold subjects are used for copying the small detail (this is, of course, a very vague and indefinable term) will not be too fine, and the time required for transmitting is reasonable. For obvious reasons it is a great advantage to put the metal print under pressure to cause the glue image to sink into the soft metal base and leave a perfectly flat and smooth surface. It is essential that the bands on the print lie along the axis of the cylinder, so that the stylus traces its path across them and not with them.

We have now a transmitter that is capable of taking the place of the key K, Fig. 9, and the diagram Fig. 16 gives the connections for the complete transmitter. A is the aerial, E earth, T inductance, L ammeter. The closed oscillatory circuit consists of a spark gap G, inductance F, and a condenser C. The secondary J of the coil H is connected to the spark gap and the primary, P, is in circuit with the mercury break N, the battery B and the local contacts of the relay R. The action is as follows. When contact is made between the stylus Z and the drum V, by means of the conducting bands on the line print, the circuit of the relay R and the battery M is completed. The closing of the local circuit of the relay R actuates the second relay R^1, allowing the primary circuit of the coil H to be closed. As soon as the primary circuit of the coil is completed sparks pass between the electrodes of the spark gap G, causing waves to radiate from the aerial. The duration of the wave-trains radiated depends upon the duration of contact made by the relays R and R^1, and

* It is hoped that a few of these experimental machines will shortly be placed on the market.

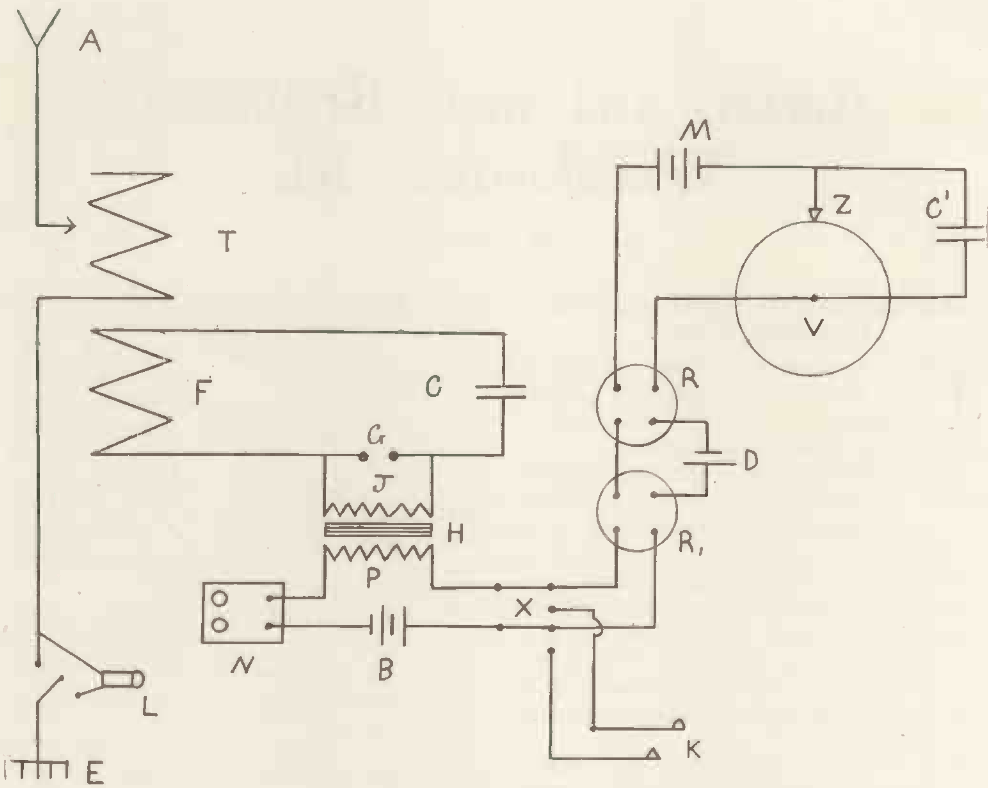


Fig. 16.

this in turn depends upon the width of the conducting strip passing under the stylus. The battery M should be about 4 volts and the battery D about 2 volts. The two-way switch X is connected up so that the relay R^1 can be thrown out, and the key K switched in for ordinary signalling purposes. If any sparking takes place at the point of the stylus, a small condenser C^1 (about 1 microfarad capacity) should be connected as shown. In the present instance the condenser should be used more as a preventive than as a cure, as in all probability the voltage from M will not be sufficient to cause destructive (if any) sparking, but, as most wireless workers know, anything in the nature of a spark occurring in the neighbourhood of a detector (this, of course, only applies when the receiving apparatus is placed in close proximity to the transmitter) is liable to destroy the adjustment.

In transmitting over ordinary conductors, where the initial voltage is fairly high and the self induction of the circuit very great, the use of the condenser will be found to be absolutely essential. It has also been noted that the angle which the stylus presents to the drum has a marked effect upon the sparking, an angle of about 60° being found to give very good results.

If the size of the single-line print used is 5 in. by 4 in. and a screen having 50 lines to the inch is used for preparing it, the stylus will have to make 250 contacts during one revolution of the drum. Assuming the drum to make one revolution in 3 seconds, then the time taken to transmit the complete photograph can be found from the equation, $T = w \times t \times s$, where w is the width of the print, t the travel of the stylus during one revolution of the drum, and s the time required for one revolution of the drum. In the present instance this will be $T = 4 \times 90 \times 3 = 1{,}080$ seconds $= 18$ minutes. The number of contacts made by the stylus per minute is 5,000.

Aerials and their Radiation Waveforms. XI.

By H. M. DOWSETT.

The Bellini-Tosi Aerial and the Heaviside Layer.

THE free radiation from the top of the Bellini-Tosi Aerial—X in the diagram*—is of some importance, and deserves further consideration.

The tendency is to reduce it to a negligible amount by bringing the free ends of the aerial close together, but it is always there. Its maximum intensity is in the plane of the aerial. It increases in volume but diminishes somewhat in intensity if the ends of the aerial are opened out. If the conductivity of the earth below the aerial falls off due, say, to dry weather—it will be increased both in volume and intensity by a certain proportion of the field lost by the earth.

Now, as long as space above the aerial is free from ions this radiation will persist, growing constantly weaker in intensity as it expands, but it will still remain in evidence.

But let it enter a rain cloud, R, or an ionised belt of atmosphere. What will happen to it ? Will it be reflected and sent earthwards again, or will it be absorbed and dissipated ? In this case there need be no doubt as to the answer. An ionic current will pass along the strain lines and the radiation will be more or less dissipated, its final disappearance naturally depending on the intensity and depth of the conducting layer.

But a still more important operation will be taking place at the same time. The same ionic current will be tending to short circuit at their antinodes the two electric strain waves travelling along the earth and sent off from the sides of the aerial. This means that signals at a station receiving from this aerial will partially or wholly fail, depending on the atmospheric conditions prevailing.

The operation which is likely to take place is illustrated in the accompanying diagram. At any phase of the radiation sent off from the aerial before it reaches the cloud, draw in the mid-section lines U_1S_1 and U_2S_2. Then find the normals to these lines which cut the extreme limits of the cloud. These normals are shown at r_1T_1 and r_2T_2 respectively. Then if R is a sufficiently good conductor, all that part of the radiation having the mid-section T_1U_1 and T_2U_2—the unshaded part—will be absorbed and dissipated, leaving the shaded part, T_1S_1 and T_2S_2, to continue its expansion.

The possibility of wave reflection has not to be considered, as r is at opposite potential to r_2, and—provided the medium is conductive enough—there must in consequence result a current between them.

Thus the radiation from an open top Bellini-Tosi Aerial is affected both by variation in the earth below and in the atmosphere above, and to a greater extent than any aerial yet considered in these articles.

If its varable performance is an argument against its practical use,* the same quality should recommend it for experimental investigations. As an instrument for determining the electrical condition of the upper atmosphere it appears to be remarkably suitable. A specially designed, good conducting earth, extending in all directions for a sufficient distance from the centre of the aerial, could render the reaction between aerial and earth as constant as possible, so that any variation in signal strength observed might be almost entirely credited to atmospheric electrical conditions, principally in the region immediately above the aerial.

At the first meeting of the Internationa Commission on Wireless Telegraphy held at Brussels on October 13th, 1913, Mr. Duddell recommended that a form of Lodge

* See also WIRELESS WORLD, February, 1915, page 701.

* This, of course, is only one of many points which would have to be considered. Its efficiency as a radiator in the plane of the aerial—which is of paramount importance—appears from the Bellini-Tosi tests to be very good.

Aerial should be used for certain of the Commission's investigations, as a radiator of signals which might be expected to give as near as possible constant results. If an open top Bellini-Tosi Aerial were used in conjunction with it, the strength of its transmission would act as a gauge of local atmospheric conditions to which the Lodge Aerial would be far less subject, and the comparison would materially assist in separating out the accumulated effects which make themselves felt at every receiving station.

On one interesting point connected with the theory of transmission it can even now give us information.

Dr. Eccles has stated* that wireless telegraphy affords us almost the only evidence we have of the existence of a permanently conducting layer in the upper atmosphere.

But, as far as the writer is aware, this evidence is only valid if certain theories as to the propagation of electro-magnetic radiation round the bend of the earth which involve reflection are also valid.

These theories, however plausible they may appear, have not yet been proved, and at the present day cannot be said to be universally accepted. Some further material evidence, one way or the other, would be of the greatest value; and this the writer believes can be provided by the radiation from an open top Bellini-Tosi Aerial.

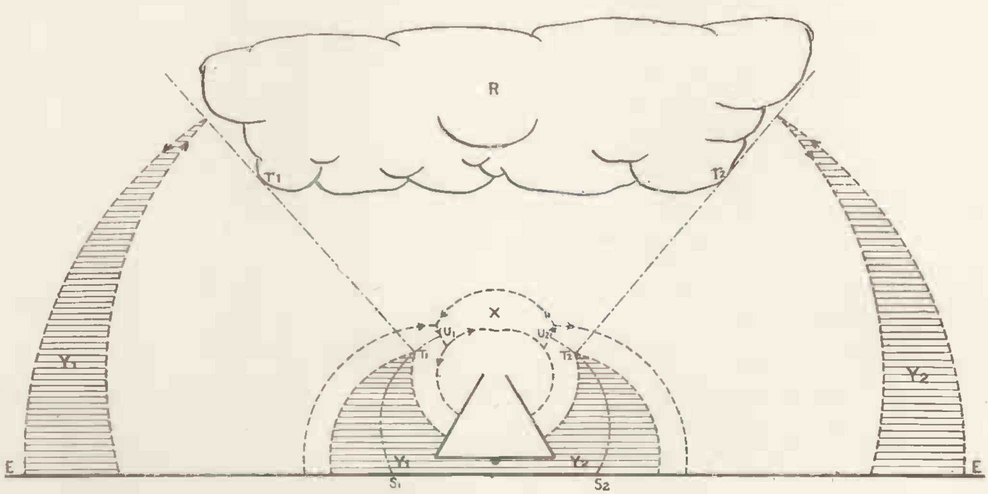
What has already been said as to the effect of a conducting cloud above such an aerial applies equally well to any conducting belt at a higher elevation in space, the only difference being that the actual length of path to be taken by the discharging ionic current would be greater; but this should be countered by the greater conductivity of a less dense atmosphere.

Then if a continuous conducting layer exists of an intensity sufficient to reflect electro-magnetic radiation, we should expect it to set a definite limit to the transmission of signals by an open top Bellini-Tosi Aerial; for it would only be a question of time and distance before all the essential part of the remaining radiation Y_1Y_2 will have expanded into the conducting belt and been dissipated.

Good transmission by day and night is said to have taken place between Dieppe and Barfleur—a distance of 106 miles. Then it is safe to say, that, on the occasion of these tests and in the neighbourhood of these stations, no continuous conducting layer as already described could have been within an elevation of 106 miles above the earth.

And we have further evidence :—

A Bellini-Tosi installation was erected at Boulogne in 1910, and transmitted at night to Marseilles and to Algiers.



The writer has been informed by Dr. Bellini* that the strength of signals varied much, but they were generally clear—the power used was only 500 watts—and signals

* British Association, Sydney, 1914.

* See also *Bulletin de la Société Internationale des Electriciens*, No. 93, March, 1910.

from an ordinary earthed aerial, which at a distance of a few miles from Boulogne were normally weaker than from the directed aerial, *showed the same relative weakness at Algiers*.

What conclusion can we come to?

The distance from Boulogne to Algiers is 995 miles. If a Heaviside Layer existed within that distance above the earth—even if it were so high up as not to wipe out entirely the Bellini-Tosi radiation—its effect would be to weaken it, and at the same time—if we accept present theory—to strengthen the radiation from the ordinary earthed aerial, so that the relative strengths at Algiers should *be the reverse* of the relative strengths at short distance. No such effect has been noticed.

What evidence from wireless telegraphy have we that there is a continuous conducting layer of great intensity in the upper atmosphere?

NOTES FROM NEW ZEALAND.

The December 21st issue of *The Katipo*, the official organ of the New Zealand P. and T. Officers' Association, came recently to hand, and contains much interesting matter. In the account of the *Emden* capture, which figures in this number, we read: "Now that the details are dribbling through, our service can throw its chest out in very aggressive style." The narrative goes on to describe the good work done by Sapper W. C. Falconer, of the Eltham Staff, who was the first to pick up the messages from Cocos Island on November 9th. It would appear that the *Emden* tried to block the message by continuous interruption, but by altering the tune of his receiver the operator continued to read the Cocos Island message, and duly reported it to the Naval Transport Officer. The result we all know, the *Sydney* went in hot pursuit of the *Emden* and destroyed her. This stirring story our contemporary ends with the words, "All honour to Sapper Falconer for a fine piece of work for the Empire." A further page of the same issue contains some amusing examples of reporting under Censor difficulties in war time. We are edified by the information that certain gentlemen are "acting as wireless operators on the ——, the ——, and the ——, respectively." Talk about anonymous heroes!—the wireless telegraphic service is full of them just now!

AN ELECTROLYTIC DETECTOR

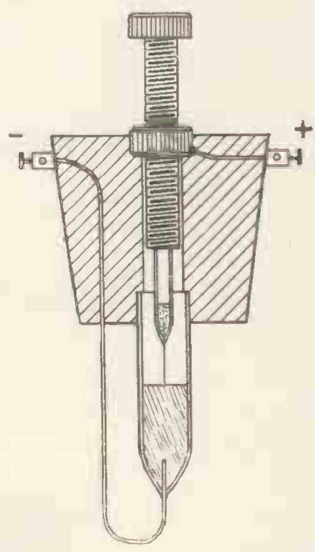
By R. DE BLONAY.

THIS detector is based on the principle of the Taulergne detector, and is very sensitive.

Take a glass tube about 2 cms. long and 2 mm. diameter, drawn out at one end.

Fix a platinum wire $\frac{1}{50}$ cm. diameter in the drawn-out end, and projecting about 5 mm.

Take a screw provided with a nut, which works up and down it. At the end of the thread the screw is turned down to a small spindle, which exactly fits the glass tube; put some mercury in the tube to make contact between the screw and platinum wire, and fix the two together with shellac. This completes the positive electrode, which should then be fixed into an india-rubber or ordinary cork.



The positive electrode is put into a glass tube of a little larger diameter, which contains some sulphuric acid (10 per cent. solution) and the negative electrode of lead.

Once the point has been adjusted, the capillary effect will maintain the level for quite a long time. A bottle makes a very good support.

The Heaviside Layer

Some Correspondence on a Fascinating Subject

OUR esteemed contemporary the *Electrician* has recently been publishing some interesting correspondence on the subject of the Heaviside Layer, and in view of the fact that Mr. Dowsett is dealing with the subject in this issue (*vide* "Aerials and their Radiation Wave-forms," page 760) we venture to "lift" their letters, and shall be pleased to receive further communications on the subject from correspondents whose attention has been directed to the problem.

Mr. W. H. F. Murdoch "set the ball rolling" in the issue of January 15th, in which he stated that, "generally speaking, this 'layer' in the upper atmosphere is supposed to account for long-distance wireless telegraphy at night time, when the lower atmosphere is clear of ionic clouds. It is assumed that reflection occurs, and so the wave gets round the bend of the earth. Further, it is hinted at least that the layer probably coincides in height with the region in which auroral displays occur. It must consequently be at a great height, between 200 and 300 miles.

"Assuming the existence of this layer, are we also to assume that it exerts selective reflection on electric waves? For instance, we receive from the sunlight waves (which are very short) and heat waves (which are relatively long), and it is not clear why these are not reflected off by the layer on its upper surface. Again, are we to suppose if 'wireless' waves were of approximately the same wave-length as light waves that they would be reflected, or would they pass through as light waves certainly do? The matter does not seem clear, since apparently at night time all wave-lengths in wireless work appear to be equally effective (*vide* Eccles, *Proc. R.S.* (A.), vol. lxxxvii, 1912, 'On the Diurnal Variations of the Electric Waves occurring in Nature, and on the Propagation of Electric Waves round the Bend of the Earth.' On p. 95 he states: 'As for the night signals, both long and short waves are propagated . . . through the lower and middle atmosphere to great heights, and reflected at the Heaviside Layer, and then they descend to earth again. . .') The fact that the origin of 'strays' or natural electric waves is doubtful (whether terrestrial or extra-terrestrial) seems to admit the possibility of their passing through the layer from the outside. Is the layer, then, only active on one side (that nearest the earth), or does it exert some kind of selective reflection?"

Dr. Eccles replied in the *Electrician* of January 22nd that "Heaviside pointed out more than ten years ago the possibility that a conducting layer in the upper atmosphere might co-operate with the surface of the sea to guide long electric waves round appreciable arcs of the globe. It is known that ionised rarefied gases may be given an electrical conductivity as great as that of sea water, and thus it is reasonable to assume that a layer of such gas may, like water, be a good reflector of telegraphic waves, and yet very transparent to light and heat waves. It should be noted that the 'short' waves of radio-telegraphy are about twenty million times as long as the longest known heat waves. In 1911 (says Dr. Eccles) I came across the (merely mathematical) result that when the length of electric waves is large compared with the free paths of the ions, they travel faster in an ionised rare gas than in the same gas not ionised. This introduces the possibility of the phenomenon of 'total internal reflection' of telegraphic waves at the under surface of a sharply marked Heaviside Layer. This in turn leads to the theorem that waves of all lengths should be obliquely reflected with equal ease—*i.e.* that reflection is not selective. This seems to be confirmed in a broad way by actual experience of night signalling. Further, in all cases of transmission across the boundary between two media in which the wave velocities are different, it is easier in general for the waves to traverse the boundary in one direction than the other; in other words, reflection is more complete on one side than the other at corresponding angles of incidence. We may therefore suppose that electric waves of the lengths common in radio-telegraphy will travel inwards more easily than outwards. There is very little evidence other than that obtained by radio-telegraphy at night of the existence of a permanently ionised upper layer. Auroræ, which have been observed as low as 40 km., show that the upper air is strongly ionised on occasion; and Prof. Schuster's explanation of certain variations of the magnetic elements demands considerable conductivity in the upper atmosphere."

Mr. W. H. F. Murdoch replied by thanking Dr. Eccles for his lucid reply, and continued: "I notice now that the Heaviside Layer has the properties of Kelvin's 'wiggler,' and perfect reflecting power for 'wireless' waves. Let us consider this for a moment. During the day the lower atmosphere is full of ions generated by ultra-violet light. These ions only refract, they do not form Heaviside layers in the lower atmosphere; at sunset they disappear as rapidly as they came at sunrise. All the time during the day the Heaviside layer is in existence, and the 'ions' composing it (which are presumably due to ultra-violet light also) do not disintegrate or disappear at night. The layer only reflects. It is difficult to understand why one set of ions should have properties so different from the other set. It is shown in physical treatises that the time taken for the number of ions in a gas to fall to half their value is

$$T = 1/n_0 a$$

(a is independent of pressure), and for air containing dust the time is more rapid than for dust-free air. A free ion lasts for a time $1/an$, and even in the upper strata its life cannot differ greatly from that found by experiments. If there is a Heaviside layer, there must be some source of ionisation other than ultra-violet light."

In the following issue Mr. J. E. Taylor said: "It seems necessary to question seriously the exaggerated notions which have got afloat in regard to the conductivity of the rarefied upper regions of the atmosphere and its influence on transmission of wireless signals. The argument commonly used implies that a conductivity at least comparable with that of sea water is involved. Where is the authority for such a statement? So far as I am able to find, such conductivity has only been observed when the degree of ionisation is that associated with a comparatively high degree of luminosity, due to the application of large electrical stresses and a constant state of vigorous electrical action in a rarefied gas. It is open to very serious doubt whether anything remotely approaching such conductivity can exist in the earth's atmosphere under normal conditions."

WAR NOTES.

(By Our Irresponsible Expert.)

We don't mind the Germans telling wireless lies. It Hertz them more than it does us.

* * *

HORRIBLE WARNING TO AMATEURS.

It is rumoured that under the Defence of the Realm Act an old gentleman on the East Coast has been sentenced for having a hole in his garden into which a mast could be put for the purpose of carrying an aerial

* * *

This reminds us of how careful we must be. If you see a strange man on a cliff rhythmically stroking a cat's back in the wrong direction shoot him at sight. He's probably signalling by the sparks.

* * *

However hard we try to catch spies, it doesn't seem to McKenna difference.

* * *

Explanation of the preceding joke, twopence, post free.

* * *

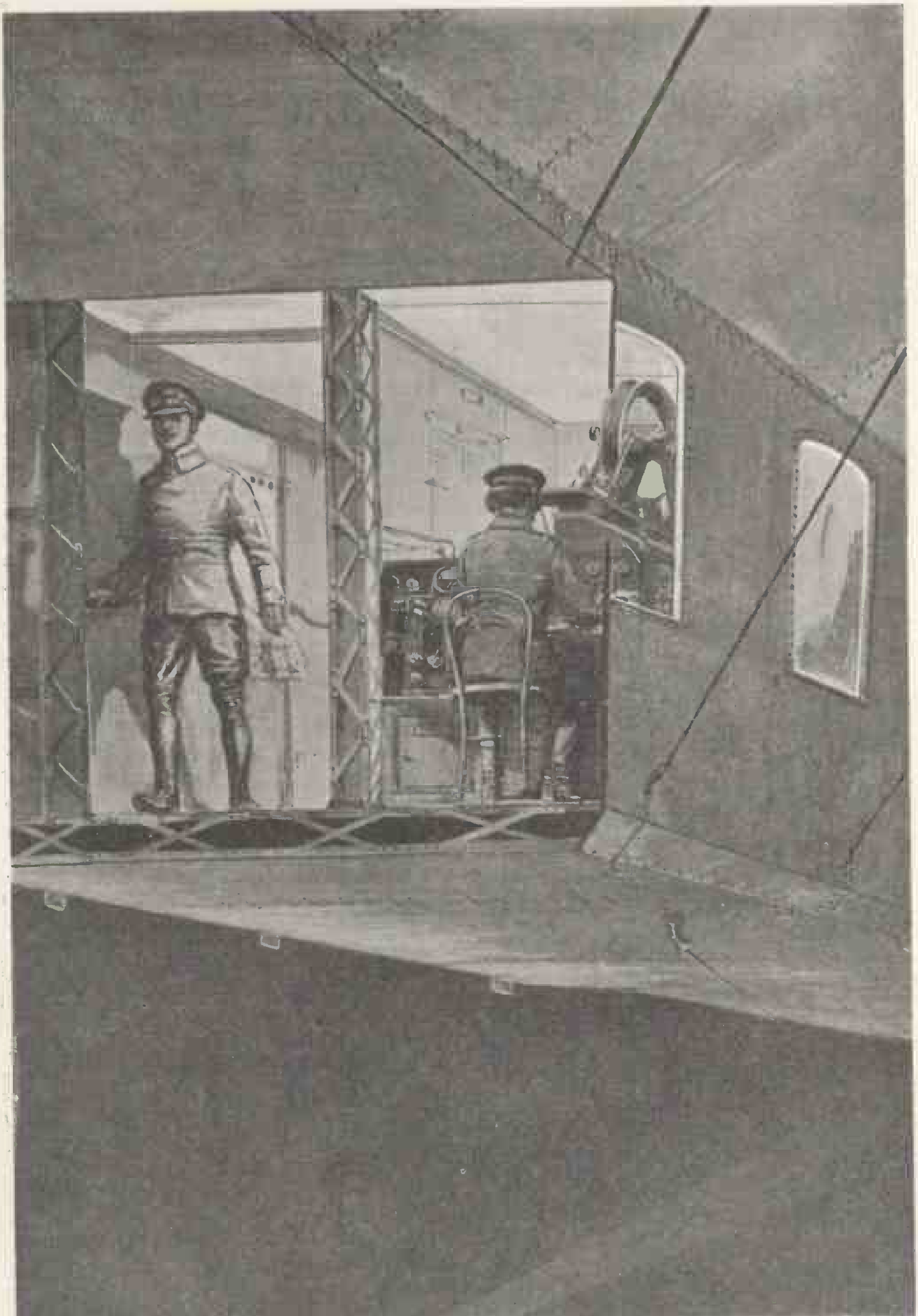
Love's Labour Lost: Listening for signals with the Magnetic Detector stopped.

* * *

German official circles are reported to be in a high state of indignation. They state they have undoubted proof that the English are using girls as wireless operators. No fewer than three spies report that they heard an operator state that his Maggy wouldn't work properly.

* * *

After the war Germany will have to use the Remorse Code.



The illustration above is reproduced from a drawing by Mr. Horace Dewis, of the "Sphere," and shows a section of the wireless cabin on one of the monster craft.

The Falkland Islands Naval Engagement

By W. D. Lacey

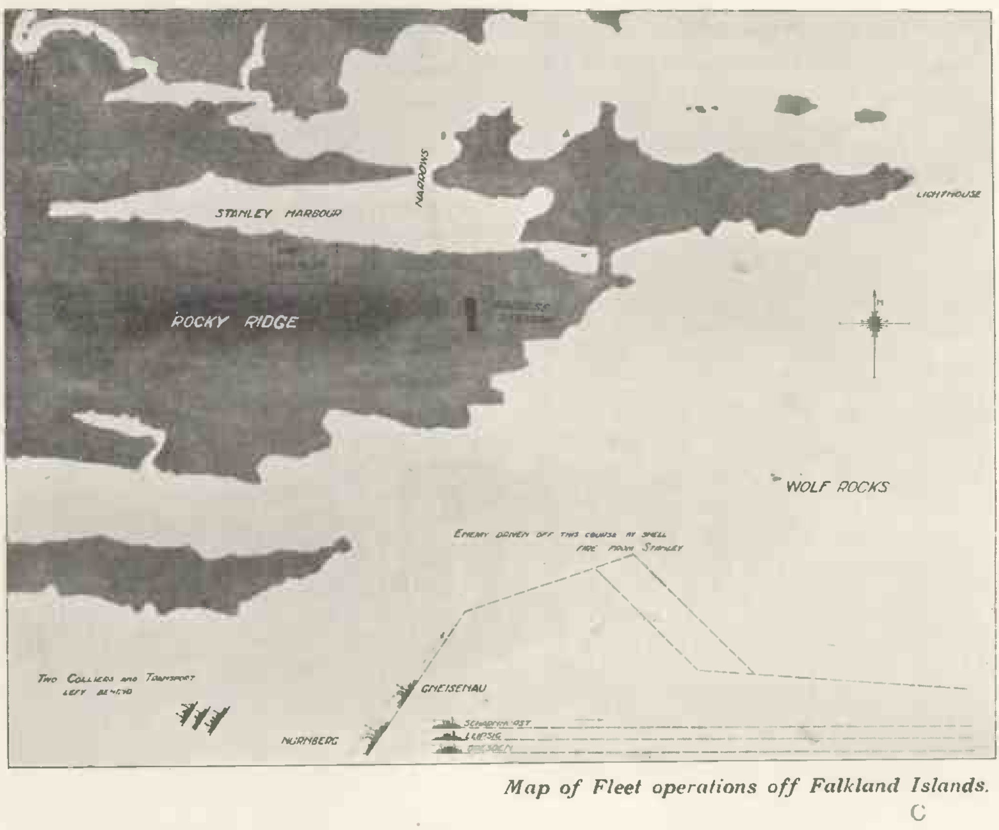
IT may be of interest to your readers to learn of the uses wireless telegraphy has been put to in far distant "Outposts of Empire" during the present war. The station in the Falkland Islands, since war was declared, has dealt with many thousands of words over distances exceeding 1,000 miles. As communication with the mainland is wholly night work, and atmospheric conditions usually troublesome it speaks volumes for the efficiency of the station. A description of the station and plant will be found in our May, 1914, number. On many nights over 1,500 words have been received, some messages exceeding 700 words in length, code and cypher. The

Falkland Island Irregular Horse.

outgoing traffic has not been so heavy, but over 1,000 words have been dealt with in a single night. Apart from the wireless work we (Lacey and Ball), both have found time to enlist in the Falkland Islands Defence Force as a military hobby—well, just in case. An armed guard is stationed here, and the station has taken on a military aspect with sentries posted at the approaches, one of whom is detailed to keep watch seaward. The power house has the appearance of an armoury, and a troop of horses is stationed here for patrol duties. The photograph shows a party of mounted volunteers at drill. Other outposts are stationed at points of vantage around the coast. The Germans were well aware of the utility of the station, as a determined attempt was made to destroy it on December 8th. This day must have been especially set apart by the meteorological deity (?) in charge of Falkland Islands weather, for contrary to our usual leaden skies and high winds, the day was perfect. Scarcely a ripple on the sea and a clear-cut horizon were both helpful factors to our outposts in sighting the enemy, and to our ships in the engagement which followed. At 7.30 a.m. smoke was sighted to the southward, which materialised into two enemy cruisers, and later the smoke of three others was seen. The first two—*Gneisenau* and *Nurnberg*—headed straight for the station, until they were about 4 miles off, when they presented their broadsides to us, and trained their guns on the power house. Their movements were clearly visible through glasses. Orders were given to abandon the station (not from the Germans, but from our Governor), which we did, retiring about 250 yards west, taking shelter behind rocks and having a clear view of the proceedings. As soon as we were clear the guard-ship in Stanley Harbour "let go" two 12-inch shells at the foremost German cruiser, and considering the enemy were not visible from the harbour the shooting was admirable. The shells fell one just forrard, and one just aft of the *Gneisenau*. The next two were better, one hit the water right abeam of the *Gneisenau*, ricocheted and landed aboard. The firing was directed from an observatory. The enemy didn't appear to like being shot at from an invisible battery which outranged their guns, and turned south-east to get out of range without firing a single shot at us. A parting greeting landed alongside the *Gneisenau*, who was by this time "stern on." Survivors state that Admiral von Spee, who went down with his ship, was at a loss to know where those shells dropped from. In the meanwhile our cruisers were forcing steam, and put to sea before the Germans were lost to sight, a fast British cruiser preceding for scouting work. We reoccupied the station and started the engine for power working with our ships. Immediately we touched the key all the Germans pressed their keys, making indiscribable noises by altering their spark frequencies rapidly. It has never been my lot to receive through such jingle before, and I trust never again. Our signalling continued without interruption despite their efforts. For about two hours pandemonium reigned in the ether. After all orders had been given by wireless, working ceased until the Germans tried to communicate with each other, and our fleet returned the compliment by jamming them, with what success we do not know. The Germans disappeared in a south-easterly direction, with our cruisers in hot pursuit. It was a never-to-be-forgotten sight to see our magnificent ships steaming away in single line ahead at 27 knots, each emitting dense volumes of black smoke and looking like a number of volcanoes joined in series. Even before they were lost to sight it was evident to all watchers that the distance between them and the enemy was appreciably lessened. Each unit of our fleet had white ensigns and Union Jacks hoisted at every available point, four and five ensigns on one halyard. At 1.50 p.m. the first gun fire was heard, which increased to a cannonade by 2.45 p.m., and continued until 4 p.m. Wireless working was quiet after noon. At 3 p.m. Admiral Sturdee made a signal which would have warmed Nelson's heart, and one which should be recorded in the annals of British Admiralty:

"GOD SAVE THE KING."

The signal was taken up and flung far and wide through space by each of the fleet in turn, until it seemed as though it would never cease. I consider it a privilege to have been one of the few to hear the signal. Had wireless been in vogue in Nelson's day



Map of Fleet operations off Falkland Islands.

C

no doubt his memorable signal would have been "Marconied." At 4 p.m. the flagship signalled "*Scharnhorst* and *Gneisenau* sunk; where are the others."

Immediately the news was received a wild cheer went up from the small band assembled in the power house, and we felt justified in drinking "To the King." No further wireless work was done until about 6 p.m., when the *Leipsig* was reported on fire fore and aft, but still fighting. No news was received of the *Nürnberg's* fate in consequence of the aerial being shot away on our cruiser which engaged her. Her luck was nevertheless no better than that of the others. Long reports were transmitted to the Admiralty on the same night and following evening.

From accounts of the survivors, the fighting was terrific. The Germans fought magnificently, firing every round in their ships, even

Guardship in Port Stanley.

to the dummy target practice rounds. Their ships were simply riddled with holes and torn to pieces. The *Scharnhorst* sank suddenly in thirty seconds by turning turtle. A shell from our flagship struck the *Gneisenau's* forrard turret, knocking it overboard complete. A visit to our cruisers after the action proved extremely interesting. There was ample evidence of the severity of the action. In one case a 4-in. gun was struck by a shell. The shell struck downwards, penetrated three decks, and finished its career in a pantry. It was found afterwards to have been a target dummy. Another shell struck the forrard turret of the flagship, fairly between the guns, leaving a scarcely visible dent in the armour. The superstructure of the flagship is perforated by shell splinters. Not a man was even wounded on board, and our total casualties in the action were 7 killed and about 12 wounded.

The enemy's losses for the day were 4 cruisers and 2 colliers sunk, 1 cruiser (*Dresden*) and 1 transport escaped. Wireless continues its uninterrupted course in the South Atlantic, and the VPC spark is still to be heard doing its small share towards the maintenance of the unity of the Empire.

AMATEURS IN THE ANTIPODES

About four years ago a number of wireless enthusiasts in New South Wales gathered together for the purpose of interchanging ideas concerning wireless telegraphy. The outcome of this was the formation, in 1910, of the "Wireless Institute of New South Wales," which claims to be the first amateur wireless body to be established in the British Empire. As far as we are aware, this claim is justified, for we have not heard of the existence of a wireless society in any part of the Empire prior to 1910. We are informed by the hon. secretary, Mr. Malcolm Perry, that there are about 400 experimenters in New South Wales and that wireless is going ahead wonderfully there. New South Wales amateurs claim to cover longer distances than amateurs in England. Mr. Perry states in his letter to us that "Our amateurs here seem to do very long distances as compared with what we read about the amateurs of England. It is a common occurrence for them to do thirty miles overland with a half-inch motor coil. We tune our stations with a Marconi wavemeter, which we find very efficient." The New South Wales Institute would like to enter into correspondence with wireless societies of Great Britain. The address of the hon. secretary is Box 2, King Street, Sydney, N.S.W.

* * *

In Perth, Western Australia, there is an "Amateur Wireless and Scientific Society," which has a membership of 30. The education authorities have placed the use of the science rooms adjoining the Perth Boys' School at the disposal of the members, who meet fortnightly for the discussion of wireless and kindred problems and Morse practice. The Society has the use of a complete portable set, with a range of 10 miles, as well as some high-class instruments. Licences granted by the Commonwealth Postmaster-General allow the use of a maximum of $\frac{1}{4}$ kw. by amateurs. The Secretary of the Society is Mr. G. Dean, Railway Operating Room, Perth, who will be pleased to correspond with amateur societies in England.

Some "Sane" Remarks on My Set

By FRED CATHERY

CONTRARY to (I believe) general opinion, I have found "galena" to be an extremely good detector, though admitting that a sensitive crystal takes some finding.

This, I fancy, may be the reason many experimenters fail with it. To get a really first-rate crystal necessitates going through ounces of material, breaking up into small pieces (say $\frac{1}{8}$ inch), and then—patience.

When the "gems" are found get them into oil with as little delay as possible, after the new surfaces have been exposed, storing them thus till required for "setting."

The time and trouble expended are amply repaid by a detector more sensitive (when fitted as mentioned below) than any other crystal I have tried, "standing up" to transmission equally as well as "permanite."

My method of fixing is as follows: the crystal is first set with soft metal in the customary brass cup, to which has previously been soldered a length of fine (28 S.W.G.) copper wire.

The cup is now dropped into a glass tube about 3 inches high and of a diameter that will take it easily.

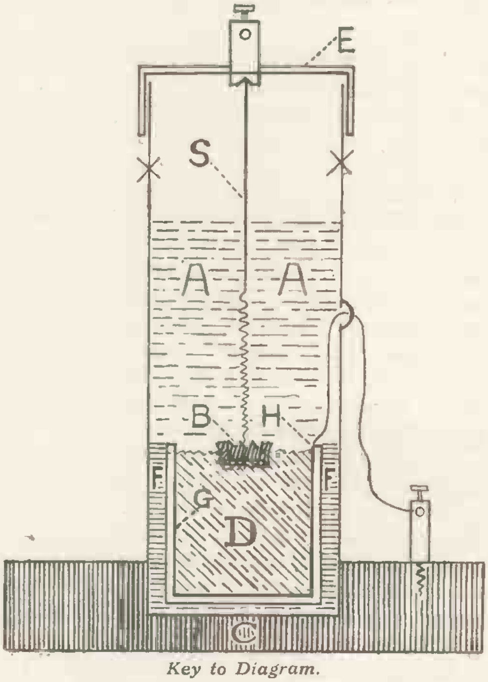
These tubes with metal "push-on" lids can be obtained for the modest sum of one penny at most chemists'.

A small "nick" must be filed about the centre, through which the wire from "cup" is passed (sealing with beeswax), and thence to terminal on base, finally making all secure inside by pouring in melted wax to nearly level of crystal. Reference to diagram will make this clear.

Now fill up to within $\frac{1}{2}$ inch of top with pure vegetable oil, thus keeping "crystal" free from dust and air, the arch enemies of galena.

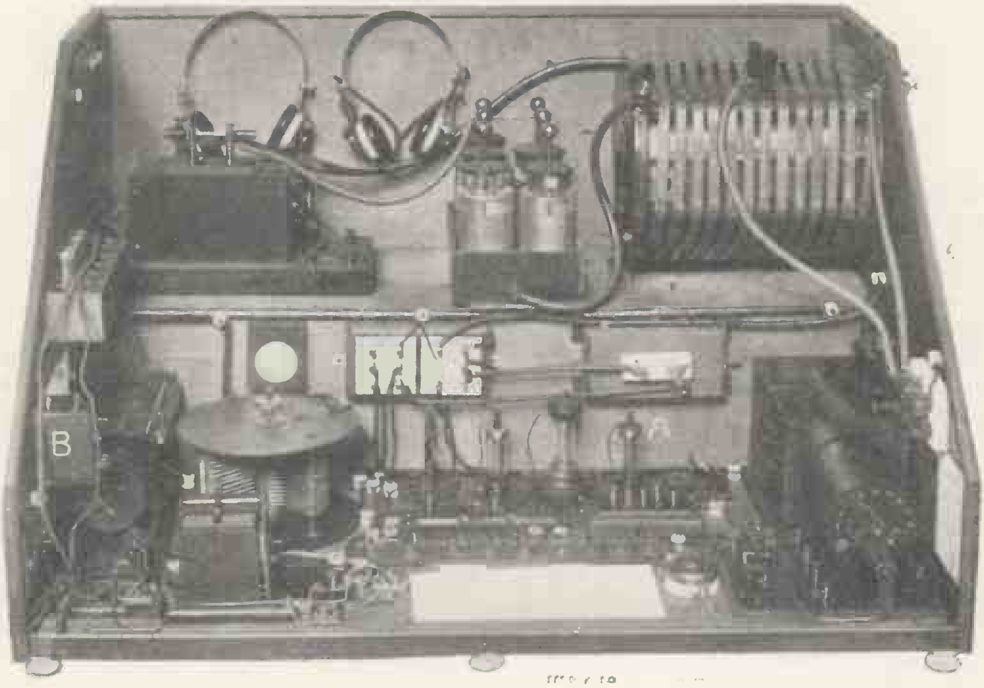
The metal cup is now pierced to take a terminal, to the base of which is soldered about 1 inch of No. 18 S.W.G. copper wire, fixing on this the customary helix of copper wire (40 S.W.G.), a slight turn of the cap giving a very sensitive adjustment. I have used "detectors" (marked A in photograph) as described, without readjustment for weeks at a time, and this with transmitting going on.

Before leaving the subject of crystal setting, I may say that I find a cheap and good substitute for "Wood's" metal can be made by mixing one part mercury with three parts ordinary tinman's solder, pour-



Key to Diagram.

A A—Oil.
B—Crystal.
C—Ebonite.
D—Woods Metal.
F F—Beeswax.
G—Brass Cup.
X X—Glass Tube.
S—Support and Helix.
H—Wire from cup.



ing the melted solder into the mercury, same time stirring well.

A greater proportion of mercury may be used, but, though fusing with less heat, is more liable to crumble.

Variable and rotary condensers have been well to the front lately in the "Amateur Handyman's" page, but I have not noticed the use of old gramophone records in connection with same. They make ideal "tops and bottoms" both in efficiency and appearance. The "tunes" may be readily rubbed out with methy. and polished with a little vaseline, giving to your "home-made" quite a commercial appearance.

Phonograph records, by the way, make excellent bases for winding small coils.

Coils! I have wound miles of wire from 18 S.W.G. to 48 S.W.G. on drums varying in diameter from inches to feet. I have come to the conclusion small coils and fine wire (averaging from 28 S.W.G. to 32 S.W.G.) give the most effective results.

One little coil I have is a "peach"; it cost me sixpence (inductive coupling)—B in photograph.

I can get the general run of stations on it, but its one outstanding feature is that I can listen to my amateur friends, no other stations getting a look in. This I have never been able to do with any other size. It also gives ship stations more distinct and with greater "selectiveness" than my larger coils. Here are the details:

One penny sample jam-jar (glass) 2 in. by $1\frac{1}{4}$ in., wound with 150 turns 32 S.W.G. copper wire as primary; 150 turns same size wire wound on ebonite tubing $1\frac{3}{4}$ in. by 1 in. as secondary. Primary tapped off every 15 turns, secondary ditto. Size over all is about 2 in. by 2 in. by $1\frac{1}{2}$ in. As a final, short lengths of old celluloid bicycle pumps, with the necessary quantity of tinfoil interleaved with paraffined wax paper, rolled to size and filled in with beeswax, make extremely neat blocking condensers, also plenty of ebonite, and twisted flex in connecting up make for efficiency.

Whatever people may say, German wireless is a great invention.

* * *

The Turks have a wireless station at Constantinople. It is situated at a place called Ok Meidan. After the Allies have finished with it its name will probably be Knok Medown.

Library Table

AND NOTES ON WIRELESS LITERATURE.

"PRACTICAL AND EXPERIMENTAL WIRELESS TELEGRAPHY." By W. J. Shaw. London: E. & F. N. Spon, Ltd.

This little book doubtless contains much information on the construction of simple apparatus that will be useful to the amateur, and the data concerning stations whose signals the amateur may expect to "pick up" should be very useful.

The author has perhaps in some places sacrificed a little too much to brevity and simplicity of language, the result being that he has defeated his own ends and, by the lack of a few qualifying words, left the reader in doubt; while in other places over-description has had a similar result.

For instance, we read (p. 12) "The length (of the waves) is governed by the strength of aerial, number of wires, and amount of inductance and capacity. They also have a certain periodicity." It seems to us that the young amateur might deduce from this that inductance and capacity were not qualities to be found in the aerial. To say that waves of a definite length have a "certain periodicity" is, we think, to discount the intelligence of the amateur, who, reading further, might be led to believe that the periodicity and wave-length were not controlled by the same factors, and that they were governed by the "speed of the 'break' and the length of the spark-gap." Also, we cannot agree that "undamped waves are only emitted from an arc," nor that (p. 13) "a plain aerial is of necessity a bad radiator."

Apart from a few of such slight slips, which doubtless a future edition will see corrected, the book, as we have said, contains much valuable information, and might be found very useful by the beginner desirous of making his own apparatus.

The arrangement of the matter dealt with is systematic and the format of the book, as well as its general illustration and "get-up," strikes us as well suited to its subject.

"ALL ABOUT ENGINEERING."

Messrs. Cassell & Co. have been responsible for the publication of many books which have proved of extraordinary interest to boys. Yet another case in point is constituted by the volume before us. A somewhat boyish disregard of proportion figures even in the title, a feature which is, perhaps, not inappropriate under the circumstances. We find a glorious irresponsibility about Mr. Knox's implied claim of being able to compress *all* points of interest in engineering, even for boys, into a single volume of 366 pages. The scope of the book does not err on the side of compressiveness, nor, we may add, of comprehension either, for the matter dealt with is very clearly set out. A great deal has been written by a numerous band of "scribblers" about the Panama Canal, and many of the accounts are doubtless very interesting to professed engineers and to people whose attention has already been attracted to the subject, but from acquaintance with a large number of them the present writer is bound to confess that their perusal is a "weariness to the flesh" and unstimulating to the imagination. The author under review is crisp and convincing, and writes in just the style that suits his *clientèle*. The statement that the length of the Canal is "more than twice the distance between Dover and Calais" strikes home at once where mere figures are meaningless. We think the chapter devoted to "Harnessing the Nile" deals with a subject which, curiously enough, is usually found "dry." By dint of avoiding elaborate "word-painting" and using good illustrations and plain language, most boys would be able to get from this account a very fair idea of the leading features of the mighty work. Our own opinion is that Mr. Knox has been a little unfair to the ancients, but it is for antiquaries to look after their own subject. Perhaps the most instructive of all the chapters is No. V., which deals with power and its source. Necessarily sketchy, this chapter by itself is likely to lead lads on to further study of a most fascinating and practical subject.

In view of the fact that Chapter XVII. deals with cables and cable laying, we not unnaturally turned to it with special attention. The account—all too brief—is good as far as it goes, and the difficulties of the early cable layers have been well described. But the author might have brought the matter more up to date by showing that a good many of the difficulties encountered by the earlier labourers in this field have been solved by the introduction of wireless telegraphy on all the more important cable ships. Much has already been written about the benefits of wireless telegraphy, but much remains yet to be dealt with, and we are not sure whether one of the most fascinating sides of the new industry is not the multitude of knotty problems solved by it, and the way in which this has been effected.

It would be possible to go on taking all the matter seriatim, but space will not allow us to do so. The making of roads and planning of towns, the principles and general practice of concrete construction, agricultural machinery and the difficulties it has to overcome, mining, bridge building, tunnelling, cable laying, and the like, are all dealt with in the various chapters, but the author has, by the use of coloured illustrations, denoted that his "star" subjects are to be found in Chapters II. and XIII., the former of which we have already referred to, whilst the latter deals with the most technical subject in the book—namely, examples of "Testing" by the various methods employed at the National Physical Laboratory, Bushey House, Teddington. Of course, when an attempt is made to compress a subject like the engineering problems of London into sixteen pages, the result becomes sketchy to an almost undesirable extent, even in a book of this character. Some of the principal problems are not even mentioned, and we are not sure that Mr. Knox would not have done well to reserve this study, so fascinating to London boys, for a subsequent volume.

BATTLEFIELD SURGERY.

Locating Bullets by Telephone.

IT is only natural that the use of X-rays for the location of foreign bodies in the flesh should have received renewed prominence by the war. Every military hospital now possesses its radiographic department, and according to reports from France these departments are being worked to their utmost capacity.

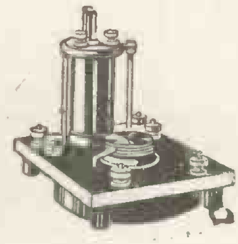
Judging from correspondence that has arisen in the medical and lay Press, there is still room for a rapid and certain method of localising the exact position of foreign metallic bodies revealed by the rays. The X-ray image as shown upon the fluorescent screen or photographic plate is only a shadowgraph, and gives no clue as to the relative position of any foreign matter and its surrounding structures.

A means for localisation which, owing to its simplicity, seems particularly suitable for battlefield purposes has been described recently by Sir James Mackenzie Davidson. This has interest for wireless enthusiasts, inasmuch as it employs a telephone with double receivers similar to those used for receiving purposes. One end of the telephone wire is attached to a piece of platinum and the other to a sterilised silver thread. This thread is brought into electrical contact with a probe or some other instrument suitable for locating objects in the flesh.

The piece of platinum attached to the telephone is moistened with salt water and bound in position near the injured spot. The surgeon or an assistant wears the telephone receivers on his ears while another probes in the direction indicated by the X-rays. Directly the instruments touch the piece of metal embedded in the flesh a distinct grating noise is heard within the receivers.

The above method of localising foreign metallic bodies surely offers to the War Office an excellent opportunity for utilising the services of many amateur wireless operators who are now "aching for a job."

The ENGINEERS Note Book



[Under this heading we propose to publish each month communications from our readers dealing with genera engineering matters of various kinds in their application to wireless telegraphy, and we would welcome criticisms, remarks and questions relating to the matter published under this heading. We do not hold ourselves responsible for the opinions and statements of our contributors.]

Radiators.

The chief experience on the subject of radiators has been gained by their use on motor-cars or vehicles, but this is not a duty which is of much assistance in arriving at the requirements for stationary purposes. In many instances it is not only cheaper, but, on account of space and portability, almost essential to fit stationary engines with some form of cooling apparatus of a less bulky nature than the ordinary cooling tanks. For all such equipments a fan is essential, as otherwise the air does not carry off the heat with sufficient rapidity, and it is also equally important to circulate the water rapidly by means of an efficient pump. Radiators and fans are probably the most compact for portable or light stationary equipments, but for large powers or heavy duties various forms of coolers are found convenient. These may be divided into two classes: first, the cooling tower, in which the water is distributed through troughs and allowed to descend into a sump in the form of rain, the natural updraught of air removing the heat. Coolers of the mechanical type usually consist of rotary drums so arranged that a thin film of water is exposed to a current of air induced by a fan. For tropical duties or for use on high mountains, etc., the latter is an excellent type, but the essential in all forms of cooling is that it should be adequate, for if the cylinders are allowed to become overheated difficulties may be anticipated with lubrication, which may result in the gumming of the pistons.

Engine Maintenance.

It would naturally be impossible in a series of notes of this nature to give anything like exact details on the subject of maintenance, but a word of warning may prove of service. It is this. When running internal-combustion engines take every possible precaution to keep them thoroughly adjusted and in tip-top working condition, never allowing apparently minor details to be neglected. With these engines it is the little things that count and comfortable running can only be attained by care in this direction. Just as an instance we will repeat what has already been said on the subject of adjusting the make and break on a low-tension multi-cylinder engine. To the uninitiated it would seem only necessary to ensure the contact being made at approximately the correct moment for ignition, but an expert knows that in order to attain that rhythm which is a delight to his practised ear the amount of break—*i.e.*, space between the hammer lever and its fixed contact—should be exactly the same on all cylinders, even to the extent of setting them by a distance gauge.

In like manner the care of the bearings, particularly big ends of the connecting rods, is very important. They must not knock: on the other hand, any tightness will inevitably result in loss of power, difficult starting, and quite possibly burnt-out ends. One method of ensuring just that sufficient clearness which goes for sweet running is to tighten up the nuts hard with a spanner, in order to make sure the bearings are really in contact with the pin; then slack off and tighten the nut nearest the cap finger-tight only. Run on the lock-nut until it also is finger-tight on the main nut; then take hold of each nut with the spanner, hold the lock-nut steady and tighten back the main nut on to it. This will leave a minute clearance, and the result should be only sufficient slackness in the bearing to allow perfectly free action without any perceptible shake.

Flywheel Keys.

The position of keying on of flywheels is far more important with internal-combustion engines, which necessitate extra heavy controlling effect for smooth running, than is the case with reciprocating steam-engines, and as the power is only generated in the form of impulses occurring at fairly lengthy intervals it is necessary to prevent any undue strains, such as that which might arise from a loose flywheel key. Not only should the flywheel be placed as near as convenient to a bearing, but the key itself must be thoroughly and carefully fitted and then driven home until it rings solid with the wheel and shaft. A key so fitted would naturally seize, and it should, therefore, be thoroughly greased before driving in or trouble may be experienced should it become necessary to remove the wheel. It is astonishing how little play is necessary to produce a knock on the flywheel key; just that fraction represented by the key being driven home another ½ in. would be sufficient to give the impression of the big end being loose, for, strangely enough, the noise is almost always manifested as though it were proceeding from a loose gudgeon pin or slack big-end bearing. For marine work flywheels are now frequently mounted on a spigot and flanged solid on the shaft head by neat-fitting bolts, the wheel really being jammed between the faces of the two half couplings, and this is an ideal method, as it allows the wheel to be easily removed, which was almost impossible when wheels were keyed on and had become a bit rusty.

Fuel Mixtures.

Not only will an incorrect timing of the ignition result in coughing, or, as some call it, back-firing, but satisfactory running cannot be attained until the engine is brought into normal firing position. Back-firing is a misnomer, as the conditions are really due to a species of pre-ignition in the induction pipe or valve passage, resulting from an attenuated charge, the obvious cure with a gas or spirit engine being the readjustment of the fuel and air supply, but this coughing may take place in an oil-engine from a third reason—viz., through the vaporiser being too cold. We may here say it is not particularly easy to re-establish the correct heat merely by fuel adjustments; time will generally be saved if the vaporiser is heated up again properly by the use of the lamp.

Circulating Water.

There are three chief methods of cooling the circulating water for the cylinder jackets. First, that of thermo-syphon; secondly, forced lubrication by a pump; and, thirdly, the use of either of the above in combination with a radiator or cooler.

The thermo-syphon, being the simplest, will be considered first, and it may be wise to point out it is more generally adopted for slow-running horizontal engines than for verticals, although it may be used for the latter if the engine itself is not too high a speed and the water-pipes are of large size. The principle is founded upon the fact that hot water tends to rise to the highest point in a circuit, and, naturally, cold water flows to take up its place, but it is very essential the pipe rising from the cylinder jacket top should have a steady and ample rise throughout its length without any dips or pockets; also that it should be thoroughly submerged where it is joined to the water-tank. It is wise never to have less than 6 in. of water above this pipe, and it should, therefore, be placed about 8 in. or 10 in. below the top of the water-tank or even more if the tank does not fill. The return pipe from the bottom or lower portion of the tank to the lower part of the cylinder jacket can be carried down and up if desired, as it is practically impossible to create a pocket in this pipe, which will interfere with the circulation. It should be the aim of the user to keep his cylinder jacket at a heat not greater than can be borne with the back of the hand, and if a cylinder jacket becomes blistering hot it will be wise to take steps to ensure a more rapid circulation of the water, and possibly to enlarge the size of the pipe service.

Pump Circulation.

Any form of pump which will keep the water in continual circulation may be considered satisfactory, and a service of this type is almost essential for a high-speed multi-cylinder engine unless the water passages are of great size and have few restrictions. Rapidity of flow assists in conveying away the unused heat, but as a plunger pump gives its best results at a comparatively slow speed it is best to follow the usual practice of circulating the water by some simple form of cog or other rotary type. It is also wise to provide a sufficient capacity to allow for the extra heat units which may have to be dealt with due to water-jacketing of the silencer or exhaust trunk. For the guidance of those who wish to have a rough-and-ready rule, the heat value of the fuel may be divided into three parts, one of which will be used in effective work, another absorbed by the water-jacket, and the other discharged through the exhaust valve, which will explain why a greater capacity is necessary for engines having the exhaust trunk jacketed.

THE AMENITIES OF LIFE AT LONELY RADIO-STATIONS.

By A. H. MORSE.

IT is undeniable that a certain glamour accrues to the occupation of the radio-telegraphist on board ship, and it is only natural that, by comparison, the life of his *confrère* ashore should be assumed to be dull and uninteresting. But the operator who is either a bookish man, a nature student, or a man of action, may find at the average "Wireless" station, whatever its location may be, many amenities to offset or mitigate the effects of the usual loneliness.

Take, for example, the conditions in Alaska.

The accompanying snapshot shows the operator of the Cordova, Alaska, station enjoying a little skating with his wife.

The Operator and his Wife with the Aerial over the expert's right shoulder.

Over his right shoulder may be seen the "wireless" mast, while on his left is the station which is alongside the railway track, in the background of the next illustration. This railway, incidentally, is the Copper River Railroad, and runs about a hundred miles inland, past the world-famed Miles Glacier, to a copper mine, the importance of which may be judged from the obvious expense incurred in connecting it with the sea.

The surrounding country is rich in fur and, in roaming through the woods, one may come across the hut of a lonely trapper. Bears, mink, marten, red-fox, lynx, ermine and musk-rat are all plentiful, as are mountain-sheep, mountain-goat and deer.

In the "fall" of the year one may witness, in the stretch of water over which the railway is seen to pass, that mysterious and depressing sight which terminates the annual salmon "run." Here, after having spawned, hundreds of thousands of salmon come to die. The water assumes a yellowish-grey appearance with the dead and dying fish, which no longer have that lustrous sheen of the healthy salmon. Overhead hover numerous eagles, ravens and gulls assembled for the yearly festival, while in the remoter creeks the harmless black bear may occasionally be seen stacking up a pile of decrepit fish which fall an easy prey to his dexterous paw. Every fourth year the "run" is great, out of all proportion to that of intervening years, the reasons for which are enveloped in that mystery which characterises the salmon tribe.

Should the operator be of a mining bent he may do a little prospecting. He is reasonably certain to find "colours" in any Alaskan creek, and may strike "pay-dirt" at any time. Apart from gold, the fact that the district is rich in copper, coal and mineral oil, gives a spice of romance to every little ramble.

In these latitudes on a still night one may not only see, but hear the Aurora Borealis, the noise being like the faint rustling of silk. Perhaps it was under the influence of some such phenomenon that the "sourdough" poet wrote:

"How doth the little glacier worm delight
to bark and bite,
It gathers ice-bergs, day by day, and
eats them up at night."

The Cordova station was established for working with ships and for providing the only means of telegraphic communication with Katalla, a place of much potential importance as the outlet of the extensive Behring Oil and Coal-fields. The Katalla station is on an island covering an area of about one square mile, connected with the mainland by a high wooden bridge and telephonically in communication with the "town" office shown in the illustration. It will be noted that, at the time the latter was taken, the service was operated by the United Wireless Telegraph Co., which has since been absorbed by the American Marconi Co.

A long straight road through miles of lonely pine woods.

The Log Cabin Station.

A detailed description of the new station in Alaska will follow in a later issue of the WIRELESS WORLD.

The Hamilton Radio Association.

THE Hamilton Radio Association (Ohio) held its first meeting on December 1st. Officers were elected as follows: President, Hughes Beeler; vice-president, Arthur Letherby; secretary, S. D. Doron; treasurer, Cecil Hopkins, and chief operator, S. W. Doron. Plans for the ensuing year were discussed. At this meeting thirty members were present, and it was reported that the number of stations of members in operation totalled 41. It is said that the Hamilton Radio Association has the most powerful station in that section of the country at their disposal. The range is well over 500 miles. The average power of other stations in the city is $\frac{1}{4}$ kw.

The association will be pleased to hear from other clubs and organisations interested in radio-communication. All correspondence should be addressed to the secretary at 329 N.C. Street, Hamilton, Ohio.

Wireless in Fiction

By E. BLAKE

An outline of the possibilities of this "modern scientific marvel" as depicted by up-to-date "Story Tellers"

CHAPTER I.

WIRELESS telegraphy is not an unmixed blessing. It has lengthened the arm of the law so that it is very difficult for a repentant absconder to make a fresh start "across the water." Even your tailor can importune you in mid-ocean. That is almost the limit. Since the popularisation of "wireless," story-writers have seized the idea and tried to tone up the jaded appetites of magazine readers with a mixture of ships, "wireless," and love. That is the absolute edge.

Kipling wrote a story which he entitled "Wireless," and as a description of that art in use in the year 18— it is a fine, though somewhat discursive, piece of writing, dealing, as it does, with Keats, cough-mixtures and

There stood the captain playing at cat's-cradle with the wireless operator.

Alf took his tuning instrument on his lap to search for the missing spark.

an amateur poet far gone in consumption. It is the only story, out of dozens I have read, which has got anywhere near the truth regarding "wireless." It is strange that discriminating editors (there are at least four within the confines of Fleet Street) will accept stories about ships and "wireless" written by people whose qualifications for writing about these subjects are, to judge by their productions, nil. As to ships and the sea, some of these writers' ideas would cause Clark Russell to shiver his timbers, whilst the "wireless" instruments which play such an important part in the plot must have been evolved from the inner consciousness of a mad inventor.

This is how a story about wireless ought to be written:

Night had fallen and all was dark. Or *vice versa*; there is no hard-and-fast rule about it. Beneath the moon (and a little to the left of it) the great liner *Osram*, of 19,999 tons burthen ("Have another ton and chance it. We are short of 9's"—Printer), ploughed her stately way through the placid waters of the North Atlantic. Her sharp end was pointed towards New York. She was what sailors call a "happy ship." Even the engineers were contented. Upon the navigating bridge stood the captain playing at cat's-cradle with the wireless operator, one hand resting idly on the poop lanthorn (*see page* 777). His tame parrot clung to his shoulder.

Suddenly—quicker than that—the wireless coherer flickered fitfully at the masthead. The captain paled and his monocle dropped from his eye-socket. "Alf," he began. But the operator had vanished, leaving half a Bass behind him. On seeing this the captain recovered slightly.

CHAPTER II.

High up in the wireless cabin the operator sat at work. Before him were strange coils and tubes, beneath him was a chair, behind him was a medley of batteries, dynamos and switches. Above his head, on the ceiling, were fly-spots. A weird place in truth! It was wire, wire all the way. Presently, between two balls connected to the patent log, a stabbing spark spat and flickered. A versatile spark, that! It was a message that had been flashed across thousands and thousands of miles of space. He seized a pencil and began to write. "Z-U-G Z-U-G is that the osram dot dash dot everybody's doing it lat. 13n by the deep nine sunk all hands took to ye longboat barquentine sally longitude 3 east dot dash rats."

A ship in distress! He switched on the battery and put on the soft pedal like a flash. Then he threw over his range-key—or tried to—but in his haste he threw it under and had to start again. Then he rattled his sender till its teeth shook, straining his ears at the detectors clamped to them. The overhead wires barked their etheric message and hastily throwing them a bone he called into space: "CQ CQ got you osram coming full speed how long can you hold out?" No answer. Not a fitful flicker from the coherer or a bark from the air-wires. With a muttered exclamation Alf took his tuning instrument on his lap and began a search for the missing spark. He tuned in all sorts of stations, but never that which had

" From thence to the bridge was but a single bound."

just emitted the tragic cry of distress. He heard the hoarse note of the high-power station at Killiebreeches as it delivered itself of time-signals in Scotch, and the kultured screech of Norddeich telling the world that the German navy had shelled Hythe, killing a flatfooted tax-collector and five babies, " three of whom are confidently believed to have been twins. The Fatherland will rejoice," &c., &c. Scraps of messages from a hundred vessels flashed over the receiving-tape as he tuned for every wave-length from a yard upwards, but never sign nor signal of the ill-fated barquentine. Had her dynamos lodged a formal protest ? Had the operator pawned the emergency battery ?

Hastily writing a twelve-page report, Alf switched off the tri-polar oscillometer and sprang into the lee-scuppers. From thence to the bridge was but a single bound. Before qualifying as a wireless operator he had played the part of the kangaroo's hind legs in a pantomime.

The night was mild ; in fact, balmy, and the Southern Cross swung high overhead, narrowly missing the Twins. In a few words Alf explained the matter to the captain, who, on realising its gravity, swore so fluently that the parrot, who fancied itself as a linguist, fell dead in a fit of jealousy and the first mate, a Methodist, groaned in the most approved style.

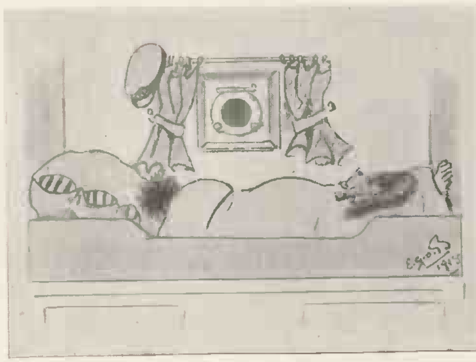
" Heave me to ! " cried the skipper. " But that makes my dream come true. Says you to me, you says, now here's a craft what's gone to Jones, and brings me up all standing, as the saying is, mister. Now, in a manner of speaking, we'll prick her off on the chart and go to her sucker, as you might say."

He stepped to the telegraph, rang the engines to full speed, and then entered the chart-room, closely followed by Alfred. Together they pored and pawed over a chart until the captain, with a grunt of triumph, jabbed the point of the compass-leg into Alfred's thumb and exclaimed, "There she be." Before the victim could frame a fitting reply the skipper had sprung outside and was heading the ship for the scene of the disaster. Alf followed and prepared to leave the bridge. Turning at the top of the companion-ladder he removed the punctured thumb from his mouth and said with dignity, "Sir, I shall immediately inform the barquentine of our accelerated velocity, our new course and imminent arrival in the vicinity of the longboat." The skipper glared. "Why this meretricious persiflage?" he snapped. "Have the goodness to clap your college-talk under hatches and apply your abnormal cerebration to the task of expediting the telegraphic dissemination of news anent the wreck. Mind, I want a good crowd there, including the *Ruritania*. Meanwhile you might lend me one of your collars. I refuse to appear in the *Daily Mirror* without one. People might take me for a Russian dancer or Mr. Lloyd George playing golf at Crikkyswith. Mr. Mate, find a boat which is not hopelessly stuck to its chocks with paint, and which has a bottom, and overhaul it. Also send an extra hand to the crow's-nest and another forrard. They can keep their mouths shut, or bang goes their Sunday's pudden. If any old ladies ask questions, tell 'em we are making a deechure in order to avoid possible eventualities. If the young ones ask—er—send 'em to me. Steward, bring my medicine. (*Sotto voce*) Not so much water with it as you gave me before dinner. Mister Mate, let me warn you against drug-taking. 'Only those who brave its dangers comprehend its mystery.' That's a bit of poetry. Carry on, there."

CHAPTER III.

Our hero hastened to his cabin, where he at once pulled over the lever of the turbinated Smogski-Pfchff switch, bringing into play the powerful thermo-capillitator. A purple odour began to pervade the cabin, mingled with the unmistakable ozone-tint which bore witness to the presence of the wonderful π^2 rays. With a final glance round he cautiously coupled on the battery and pressed a button. . . . A waiter appeared and took his order.

The great blue sparks boomed and crashed. He was searching space, probing the depths and the heights. Alone. At night. * * * Passengers asleep far down the starboard alleyway smiled and dreamed that it was a porter toying with milk-cans at Clapham Junction. The fo'c'sl was startled into a blaring nocturne of snores. The whole ship quivered with the magic of the troubled ether. The second saloon cat, who had been stationed for eight hours at the end of a hosepipe, under the firm impression that she had found the rathole of her wildest dreams, flew along the main deck sparking like a Catherine-wheel. The night-watchman, sauntering dreamily round a corner after the manner of his kind, met her and became a religious man on the spot.



Alf turned in (see page 781).

Alf advertised his shipwreck with an ability completely outclassing that of the Selfridge *literati* who supply those delightfully uncommercial columns to the daily Press. He interrupted the *Ruritania*, who was exchanging repartee with Cape Race, and invited her to share in the work of rescue. "But—suffering Job!" was the reply. "You say she's sunk! How in the name of *Emden* could she call S-O-S? Is her longboat fitted with a trawler-set or have you been celebrating birthdays aboard your packet?" (Wireless operators at sea invariably talk like that. They foam at the fingers. The Government encourages it.) "Got her as clearly as I get you. Clearer—'cos your spark sounds like a mishap to a piece of calico. Why don't you straighten out the shaft of your alternator sometimes? Report to the bridge, please, and let me know what your old man intends to do." In a few minutes came the *Ruritania's* call. "Well, I've told him and he nearly chewed the rims off his binoculars. Anyway, he's going to look up your precious longboat. Says he's three wrecks behind the *Lithutania* and can't afford to take any chances with his reputation. Ring off and let me clear my traffic. You've hopelessly spoilt our sweepstakes on the run this trip."

"For the love of Mike, don't argue. Think of the shuddering survivors, you cast-off cable-puncher. They may be getting wet. . . ."

Alf got the *Olympic* and the *Cedric,* too. He netted two cattle-boats and a Chilian gunboat. An unlucky oil-tanker whose operator was hopefully "listening in" on the chance of getting traffic—an occurrence so rare as to be stupefying—was electrified to receive an invitation on the grounds that some oil might be useful to calm the roaring main. Two Hamburg-Amerika boats promised to look in, as also did several small fry with an eye to compensation. Then Alf turned in, quite forgetting that Poldhu was sending out thrilling extracts from the *Times* and *Le Temps*. What mattered that? He was making history himself.

CHAPTER IV.

The grey dawn disclosed as fine a collection of steamers as ever gathered together on the Atlantic. The sea, ruffled by the dawn-wind, was in that region innocent of longboats, barquentines or wreckage. There was not even a hencoop—and no shipwreck is complete without a floating hencoop surmounted by a sodden seaman. The *Ruritania,* nosing about on the port beam of the *Osram,* became suspicious and rapped out

The grey dawn disclosed as fine a collection of steamers as ever gathered together on the Atlantic (the story ends in "Wireless Smoke," see page 782).

curt inquiries. Alf, not a bit dismayed, but bolstered up with thoughts of his twelve-page report, settled himself to the task of sending and receiving a series of messages couched in excoriating language, between his skipper and the monarch of the *Ruritania*. The cattle-boats jeered openly, and the Germans lay like wallowing hogs, their zealous operators scribbling reports with Teutonic thoroughness and veracity. The last message which poor Alfred handed to the captain read as follows: "Sec Bompas' *Nautical Record* page 57 stop my company will present bill in due course stop advise your operator vanish New York."

With a snarl the captain dived for his Bompas, and in a moment reappeared, turning its pages with the desperation of a new choir-boy searching for Epiphany in the Prayer-book. At length he found what he sought, read, and silently thrust the book under Alfred's nose. Then he cast his monocle into the sea.

Alfred read: "1763 Barquentine *Sally* foundered lat. — long. —. Crew took to longboat but all hands lost in gale except Matthew Moon, cook, who clung to hencoop and was picked up by H.M. Frigate *Thisbe*."

. . . . . .

"And ye tell me that a sperrit can do wireless, ye gumph?" said the captain.

"Why not?" protested Alfred. "When you come to think, that's just what you would expect a ghost to shine at."

A blur of smoke on the horizon showed where the oil-tanker, slow but perfectly reliable, was coming up to keep the tryst.

GENERAL NOTES.

Censorship Relaxed—At a recent conference between the officials of the Navy Department and the Marconi Wireless Telegraph Company, the Government restrictions against coded wireless messages between the United States and the Hawaiian Islands were removed, placing that service on the same basis as cable and wireless service on the Atlantic. The authorised codes are Western Union, Lieber's, A B C (5th Edition), Bentley's, Broomhall's, Atlantic Cotton and Scott's.

* * *

Royal Scottish Society of Arts.—On February 22nd, at 8 p.m., in the Society's Hall at No. 117, George Street, Edinburgh, a lecture was given by Dr. J. Erskine Murray on "Electric Waves and the Principles of Wireless Telegraphy and Telephony." This forms one of the series of "Keith" lectures for 1915.

* * *

The Institution of Post Office Electrical Engineers, London Centre.—A Paper was read by Mr. L. B. Turner on "Wireless Call Devices." The meeting started at 6 p.m., and the lecture was followed by an interesting demonstration.

* * *

The Tuckerton Wireless Station.—A petition has been filed in the New Jersey Court of Chancery at Trenton by the Compagnie Universelle de Télégraphie et de Téléphonie Sans Fil, of Paris, France, against the United States Service Corporation, the Hochfrequenz-Maschinen Aktiengesellschaft für Drahtlose Telegrapfie, Rudolph Goldschmidt, of Charlottenburg, Prussia, and Emil F. Mayer, of Tuckerton, N.J., to determine the question whether the Tuckerton station belongs to the French or the German corporation. The French company submits that the German firm is now in control of the station, but that a contract was entered into some months ago for the sale of the plant and all patent rights for use in any part of the world except the German Empire. The French company serves notice not only that it is seeking to obtain the property, but that it will expect to receive the money that has been collected by the United States Government from the time the navy was placed in charge to enforce American neutrality.

* * *

Mr. Lewis MacConnach, for many years an executive clerk for the Postal Telegraph Cable Company, New York, has accepted the position of secretary to Vice-President John Bottomley, of the Marconi Wireless Telegraph Company of America.

MORE DIABOLICAL INGENUITY OF THE ENEMY.

It is stated that the German trenches are being protected by barbed wireless. Terrible havoc has been wrought through our troops marching into it without seeing.

NOTES OF THE MONTH

THE New York correspondent of the *Times* announces the fact that the telephone line between New York and Denver, about two thousand miles—already a record—has been extended to San Francisco. This gives it a total length of three thousand miles, and, other lines having been joined up experimentally, speech was transmitted over five thousand miles. Whilst there may not be a limit to the distance over which speech can be transmitted on "loaded" lines, this achievement would hardly appear to justify the prognostication made by the New York correspondent of the *Times* of transatlantic telephones. It is true that the only real difficulty in such a matter is the question of cost, but this appears unlikely to be overcome before the advent of commercial wireless telephony, which has already progressed beyond the experimental stage.

* * *

The special advantages of wireless telegraphy compared with other means of communication is again being demonstrated in connection with the Trans-Australian Railway. This remarkable piece of engineering will, when completed, enable passengers to travel from Fremantle right across Central Australia and round the coast to the north of Queensland. As the track has to be laid through more than a thousand miles of wholly unoccupied territory, the problem of communication between the workers at the widely separated centres of activity appeared likely seriously to handicap the early stages of the enterprise. Recognising this the experts concerned have persuaded the Federal Government to establish wireless stations along the proposed rail route, and it has now been decided to construct four of these. The stations, adapted for radio-telegraphy, have been designed by Mr. Balsillie, the Commonwealth engineer, and the very practical assistance they will afford is assured by the fact that each will have a range of a thousand miles.

* * *

Some confusion seems to have arisen between the International Electrical Congress, which it was proposed to hold in San Francisco in September, 1915, and the International Engineering Congress, which is to be held during the same month. Owing to the unfortunate situation existing in Europe, and the impossibility of convening the International Electrotechnical Commission, under whose authorisation the Electrical Congress was to have been held, it has been decided by the governing body of the American Institute of Electrical Engineers to indefinitely postpone the holding of the Electrical Congress. We are informed, however, that this does not affect the International Engineering Congress, which goes ahead as originally planned.

* * *

Wireless enthusiasts of a sporting frame of mind will be interested in the report that one of His Majesty's two-year-old colts has been christened Marconi. The pedigree is equally interesting, for it is by Radium out of Witch of the Air. If this colt has anything of the celerity of the telegraphic system associated with his name the racing of the next year or two should be particularly uninteresting to other owners.

* * *

In view of several points raised in Professor Marchant's paper, which we reproduce on pages 748 to 754 of this issue, readers may be interested in the results obtained by the wireless operator of the ss. *Zeelandia*, of the Dutch Lloyd Line, in connection with the reception of time signals.

During a recent voyage covering the end of December and most of January, the *Zeelandia* was able to receive the Arlington time signals on five successive nights at distances of over 3,000 miles, on one occasion the distance being 3,413 miles. On Thursday, January 14th, at 11.49 p.m., the signals were received from Eiffel Tower, and four hours later from Arlington.

The reception of time signals from both sides of the Atlantic on the same night is an interesting demonstration of the present degree of perfection attained by the International Wireless Time Service. The results were obtained on the Marconi Universal Crystal Receiver by Mr. J. H. A. Lendorf, Marconi operator in charge.

* * *

At the time when the *Endurance*, bearing Captain Shackleton's Antarctic Expedition, started on its Polar exploration voyage, some of the British newspapers stated that the wireless receiving set with which the steamer was furnished formed the gift of the Argentine Government. Now it is perfectly true that the Argentine Government has been exceedingly kind in granting all sorts of facilities to our English explorer and his companions, and all honour is due to them for their generous spirit. But, with regard to this particular item, they have been credited with what is not altogether their due, the wireless set in question having formed a free loan to the expedition from Marconi's Wireless Telegraph Company located in Buenos Aires. Even a paper usually so well informed as *Nature*, in its issue of November 5th, ascribes the gift to the Argentine Government. There can be no doubt about the matter; because we have before us as we write the receipt given to the Marconi Company at Buenos Aires by Mr. R. W. James, physicist to the Expedition, together with a note of the fittings of the apparatus by the Marconi expert on the spot. The latter remarks that he had found some difficulty in obtaining a good "earth," owing to the fact of the steamer being entirely constructed of wood.

The issue of the *Monthly Weather Review* dated December 15th, 1914, and published by the U.S. Department of Agriculture, has recently come into our hands. It deals with the month of September last and contains (amongst other interesting matter, tables, diagrams and flags) an article on the "Influence of Terrestrial Rotation on the Condition of the Atmosphere and Ocean," by J. W. Sandström, of Stockholm; an interesting note by General H. M. Chittenden on "Rainfall after Battle"; and "The Function of the Atmosphere in Wireless Transmission," by Dr. J. Erskine Murray, the latter of which they did us the honour of "lifting" from our Wireless Year-Book.

* * *

American army and navy officers have been studying trials of the wireless-controlled torpedo-boat *Natalia*. There are rumours that the American Government will purchase the invention for exclusive use. The craft is designed to move over the water's surface with no one on board, the engine and steering gear being controlled by a wireless apparatus from shore. The boat is described as "a huge torpedo directed from a wireless station by Hertzian waves." A load of explosives totalling 4,000 lb. can, it is said, be carried.

* * *

We regret to have to announce the death, in Brussels, on February 18th, of General Albert Thys. He was a reserve officer of the General Headquarters Staff of the Belgian Army, and has been termed, not unjustly, the "Cecil Rhodes of Belgium." Some thirty years ago he made his name when, under his supervision, the railway was run from the west coast of Africa, up through Belgian Congo, to Léopoldville, whence the whole of the interior is opened out by river communication. He was the founder of the Banque d'Outremer, and has also been closely associated with a very large number of colonial and industrial concerns, amongst which mention may be made of the Compagnie du Katanga, the Chinese Engineering and Mining Company, and the Shanghai Construction Company. General Thys has closely identified himself with wireless telegraphy ever since it was first demonstrated as a commercial

The late General Albert Thys.

possibility, and his great influence, financial resources, and untiring industry contributed in no slight degree to its early establishment not only on the Continent, but in "lands beyond the sea." Up to the day of his death General Thys presided as chairman over the Compagnie de Télégraphie Sans Fil, at Brussels, besides holding the position of a director of Marconi's Wireless Telegraph Co., Ltd., and of the Deutsche Betriebs Gesellschaft für Drahtlose Telegrafie m.b.H.

THE WIRELESS-CONTROLLED PROJECTILE.

We have seen demonstrations of Wireless-controlled Airships and Torpedoes; and why not Wireless-controlled Projectiles?

Wireless Telegraphy in the War

A résumé of the work which is being accomplished both on land and sea.

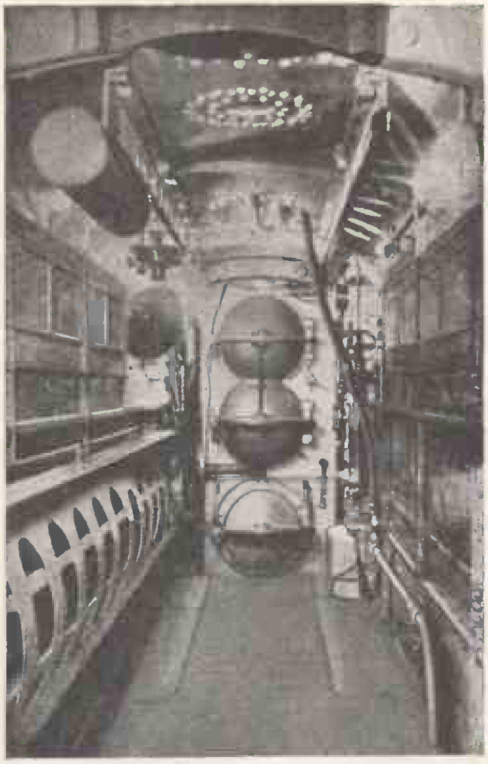
WE wrote in the Editorial of our last issue that after the war is over the public will *begin* to understand the part played therein by wireless. Apropos of our statement, the *Liverpool Journal of Commerce*, under the date of February 4th, contains the following paragraphs which, as they have passed the Censor, may be worth extracting as indicating some of the directions in which wireless comes to the rescue of a difficult situation:

"The appearance of one or more of the enemy's submarines on the west coast so far north as Fleetwood is a matter which cannot be dismissed lightly. Of course, the material loss we have suffered in this instance is comparatively small, while, at the same time, we can draw some comforting lessons from the fact that the enemy have obviously found our surface ships a too elusive quarry, and have therefore decided to turn their attention to other matters.

"It would be a comparatively simple matter to greatly increase the risks run by the enemy, and incidentally prepare for the future. Some of our merchantmen have succeeded, by good steaming and manœuvring, in eluding their pursuers, while others have only given in after a chase. *If these ships had been fitted with wireless apparatus* they would have been able to communicate with our watchful torpedo destroyers, and thereby possibly make the enemy pay dearly for his intrepidity. The cost of such a scheme would be very small, while its advantages are quite obvious, for, with the added incentive of the Government bonus, every merchantman carrying the British flag would become an additional scout capable of communicating any information instantly to the proper quarter."

* * *

A great deal of attention has deservedly been attracted by the public-spirited offer of our esteemed contemporary the *Syren and Shipping*, of £500 to the master and crew of the first non-armed merchant ship which destroys a German submarine. This attention has by no means been confined to the public of this country. The German official wireless news, which comes over daily at all hours of the day and night, was full of it at once, and incidentally showed, by its immediate reference to the offer, how perfect the Teutonic spy system is. Their facilities for obtaining information respecting anything that goes on are little short of marvellous. Here we have yet another instance of the extent to which *wireless is being made use of by all combatants*. Our enemies do not at all appreciate the situation thus fairly forced upon them by the *Syren and Shipping*. One German



Interior of a modern German Submarine Pirate.

organ even goes so far as to call it "a reversion to privateering," as if this were not the proper answer to piracy!

We may say that our contemporary informs us that they have received numerous communications from masters of British merchantmen, stating their intention of "making a bid" for the prize. The Britisher is always a sportsman, and this "Novel Form of Marine Sport," which does not lack the spice of a little danger, is sure to appeal widely. We think February 18th is likely to prove more fatal to German submarines than to English merchantmen.

* * *

The amount of bluff exhibited by the Germans during the present war has been tremendous. If wind could do it, Great Britain and her Allies would have been blown to perdition long ago. Despite all the infringements of neutrality proved against them with regard to wireless stations in different parts of the world, the Germans had the audacity in January last to lodge a protest with the little republic of San Marino, stating that the wireless station of Mont de Titano was being used for the purpose of espionage in favour of France, with the result that French warships in the Adriatic were sending news to Paris through its intermediary. They actually demanded facilities for sending a German Commission to inspect the wireless station. Now this tiny State, the smallest independent piece of territory in Europe, situated on the eastern spurs of the Appenines, possesses an army of but 950 militiamen! No doubt the Big Bully, whose favourite occupation consists of killing babies and preying upon the weak and defenceless, imagined that Germany would frighten the Council of Twelve, who formed the Executive of the Republic, into acquiescence in their demand. They failed, however, completely. The San Marinians refused to consent to any visit from any Commission except one despatched by the King of Italy!

The Castle of Mont Titano in the Little Republic of San Marino.

Our esteemed contemporary the *Outlook*, in the issue of January 30th, has published a handsome compliment to our organisation, which we take this opportunity of acknowledging. It takes the shape of an article under the title of "The Boon of Wireless," written by its well-known contributor, Mr. F. G. Aflalo, and deals particularly with the news messages received on ocean steamers during the present period of strain under war conditions. He administers a rebuke to passengers who, missing the huge sheets which are known ashore as "news" papers, refuse to pay tribute to the "human miracle by which they are able to get any news at all." It is not possible to quote in full all the kind things which Mr. Aflalo says about us, but we cannot refrain from extracting his final paragraph, which states :

"There is an aspect of this skeleton news "service worth noting, and I will call it, "for want of a better description, inde- "pendence of interpretation. We get, that "is to say, only the barest summary of "official news. We are immune not only "from rumour, from the lying jade who "has sported of late with all manner of "surprises, from Cossacks to Zeppelins, but "also from editorial leaders and the too "ample riders added by 'Our Special "'Correspondent at the Front.' For this "relief the ocean traveller should, if he "knows when he is well off, give much "thanks. No longer is he thrall to self- "appointed interpreters of official com- "muniqués that he is well qualified to "understand without such extraneous aid. "A long-suffering public can, after six "months of such suzerainty, scarcely ap- "preciate the blessing of emancipation, but "it is almost worth making a sea voyage "to win it. Marconi gives us the news and "leaves us to make our own comments. "The newspaper that would dare do the "same would go straight to the public "heart."

* * *

We have already had occasion to make frequent reference in our pages to the important part played by wireless apparatus on aircraft generally in this present war, and in this connection we believe that readers of THE WIRELESS WORLD will be interested in a photograph

England's Naval Champion of the Air.

of Commander Samson, who may be looked upon as the British champion in this sphere of operations.

* * *

We have referred to the fact that Germany had herself made plentiful use of wireless information from stations situated on neutral territory. Whilst in course of writing, the following extract from *Indian Engineering*, a Calcutta journal, was placed in our hands, and we reprint it in order to "dot our i's and cross our t's":

"WIRELESS TELEGRAPHY.—It is now generally understood that the *Emden* used to receive information regarding the movement of vessels in the Bay of Bengal from aerial establishments in the Dutch East Indies. The system established in the Dutch East Indies is that known as the "Telefunken," a German patent worked by German operators, so that it was easy for the captain to receive through his compatriots news received by them from India. Germany had not the same facilities as England to establish a wireless chain throughout the world because she had not the possessions necessary. She therefore used foreign and friendly territory for her purpose, making such haste to complete her chain that she was ready with it long before England, though it was from England she got the hint. The difficulty of interfering with installations on neutral territory has prevented England from taking any steps in

Sumatra and other Dutch territory which really belong to Germany. These have thus stood Germany in good stead during the war."

* * *

The present week has seen two very notable examples of the direct usefulness of the power supplied by wireless telegraphy in ensuring the safety of vessels by imparting information to them in the course of the voyage. We are referring to the cases of the English liner *Lusitania* and the ss. *Champagne* of the Compagnie Générale Transatlantique. In the former case, passengers who arrived at Birmingham after performing their transatlantic voyage from the United States by the great Cunarder stated that when off the coast of Ireland they received a wireless message from the British Admiralty instructing them to hoist the American flag. This precaution was taken in view of the piratical proclamation recently issued by the German Government, which has been responsible for so many of the recent caricatures of the Kaiser as Captain Kidd of the Black Flag and Cross-Bones. There can be little doubt that any German submarine in a position to act in accordance with these "counsels of despair" would have been only too delighted to have singled out the *Lusitania* for destruction.

In the case of the *Champagne* we learn that, on January 19th, during the course of her voyage to Mexico, the captain received a wireless warning to the effect that amongst his passengers was a German commissioned to blow up the vessel. Now on all ocean liners it is the invariable rule that the wireless operator acts strictly under the orders of the captain, and they alone, therefore, on board that ship knew of the information which had come to hand in this silent and effective manner. The captain caused careful and secret search to be made, and it was doubtless intensely to the surprise of the infamous miscreant that five dynamite bombs were discovered, and he himself was placed out of power of doing further mischief by being put in irons. This case recalls, in some respects, the famous instance of the discovery of Crippen and Ethel le Neve. In the latter case the passengers on the ship were not in danger from the companionship of the accused persons, while in the former instance the life of every soul on board was at the mercy of one who, at the best, must be put down as a misguided fanatic.

* * *

A Wireless Operator on the "Canopus."

Mr. Arthur Bolton, who is now engaged as wireless operator on H.M.S. *Canopus*—the first vessel engaged in conflict with German vessels—has written home a number of interesting letters, from which we are privileged to give extracts.

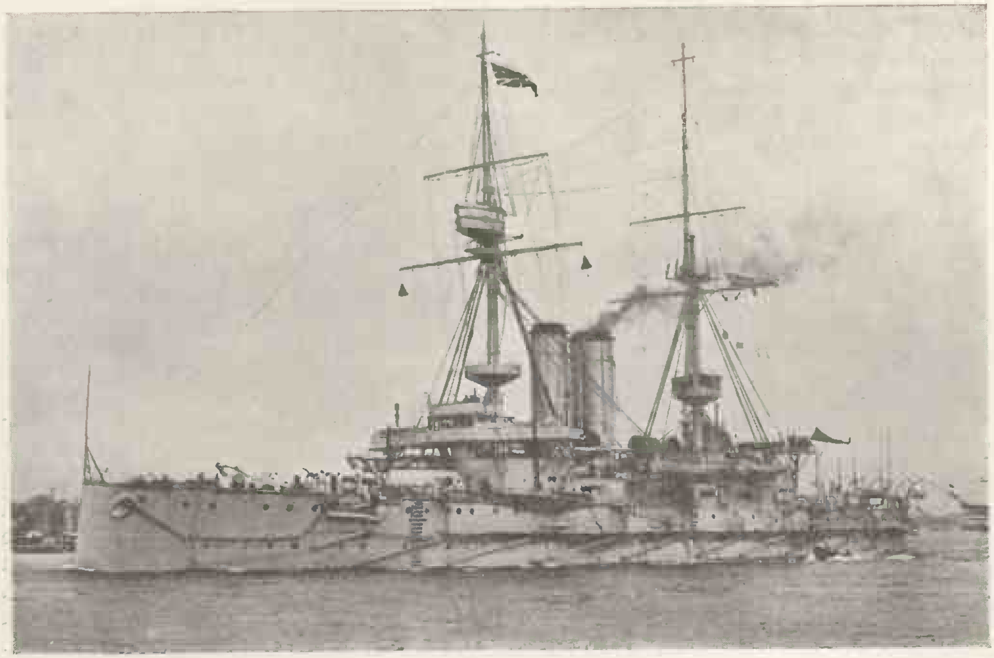
Mr. Bolton was a telegraph clerk at the Midland Railway Station, Skipton, and subsequently moved to Heysham, and was one of the wireless operators engaged there when the Midland Railway Company took up the system. He volunteered for service as a wireless operator shortly before the war, and was called up almost immediately hostilities commenced. He has for some time been attached to the *Canopus*, and his relatives were somewhat anxious during the period when word came that his ship failed to arrive in time to assist the *Monmouth* and the *Good Hope* in their fight with German cruisers carrying heavier metal in the Pacific.

Writing from the Falkland Islands on December 11th, Mr. Bolton says :—

"You hope we are giving the Germans 'paddy-whack.' Well, we have had some excitement, which I expect you will have heard all about ere this. We had much excitement on November 1st, when the *Good Hope* and *Monmouth* were sunk, but we will say no more about that, and about what we have been doing since. Now, December 8th is a day never to be forgotten. I suppose you have read all about it, but I will tell you my little bit. I had just had breakfast and was finishing my smoke when 'action' was sounded. Of course every man nips to his post like lightning when this is sounded on the bugle. In a few minutes we learned that five German cruisers were coming up, so we knew there was going to be something doing. They little knew what was waiting for them, as our fleet had joined up to us only the day before. Lucky for us! However, as soon as they came within range, our ship opened fire on them, and I think several shots struck them. It was a surprise for them, as they had not seen us. They immediately steamed away, and this gave our cruisers a chance to get out of harbour. It was a sight to see them steam out and chase the German ships.

"We did not go out as, of course, it was not our duty, as we were guard ship, but we were ready for doing so, should we be required. We were at high tension all day, and very busy. Just after tea-time we got word that our ships had sunk the *Scharnhorst* and *Gneisenau,* two of the largest of the five Germans. You should have heard the cheer. Shortly after we heard they had sunk the *Leipzig*, and the following morning we learned from one of our ships, which came in with her wireless shot away, that she had sunk the *Nürnberg*. Also that another of ours had captured two of their ships laden with coal, and that our cruisers were chasing the *Dresden*—a fast German cruiser. And to think that we had only seven men killed, and all our ships afloat! Although we were not in the worst of the action we have the satisfaction of knowing we were the first ship to open fire and make them turn, thus enabling our cruisers to get out of harbour, and our long-range guns prevented them from doing any damage to the town and wireless station. It was a great victory, and something never to be forgotten, and good compensation for the loss of the *Good Hope* and *Monmouth* on November 1st."

The *Swindon Advertiser* published a letter at the end of last month from Mr. Chas. E. Gould, wireless operator on H.M.S. *Good Hope*, who describes his rescue from a lonely island in the Pacific. He states that he was in rags, but "just in the pink of condition," and continues thus: "Since the war started I have had some terrible hardships. Days and nights with no sleep—out in the open on some mountain or hill as observation party for the squadron—sometimes sleeping (or rather resting) on rushes, bushes or fern leaves, digging a hole in the ground and living like a penguin. But I am all right now. I am stationed ashore at a lighthouse in the Falklands."



H.M.S. "Canopus."

Among the Wireless Societies

Wireless Society of London.—Mr. A. A. Campbell Swinton inaugurated his second term of office as President of the Wireless Society of London on Tuesday, January 26th, by the delivery in the lecture theatre of the Institute of Electrical Engineers of an experimental discourse on "Some Electrical Phenomena." Few men are better able than Professor Swinton to speak on such a subject in connection with wireless work.

The lecturer explained that, but for the war, a new President would have been chosen It was, however, the unanimous wish of the Committee that he should continue in office for another year, and the war having made the position of the society, in some respects, a difficult one, he had acceded to this request. So far no information was available upon which to base an opinion as to the use of wireless in the war, but the war had had a great effect upon all the members of the society. Wireless working or experimenting was not permitted by the authorities, and not a few individuals had suffered severely for not strictly obeying the law in this respect. He was at one with the authorities in this matter, as any possibility of wireless spying must be prevented at all costs. The safety of the people was the highest law. As President of the society, he had been able, in some cases, not only in London, but in the provinces, to assist in obtaining an alleviation of the rather excessive penalties that had been incurred by law, where the offence was obviously technical. His own apparatus had not only been dismantled, but he agreed to its being taken away altogether by the Post Office authorities, and he hoped every member of the society would, by now, have followed that example. He was acquainted with the many difficulties with which the authorities are at present confronted, and this was not the time to put additional difficulties in their way. During the past few months the society had been of some use to the authorities, and a number of operators had been supplied to the Post Office : not perhaps so many as might have been desired, but the standard set was a very high one. The society had also been working in other directions, for which he had received the written thanks of the Post Office, not only on behalf of that department, but also on behalf of the Home Office. At present he could not say more, as we did not wish the enemy to know too much. As no private aerials were allowed at present, it would be impossible to give an address illustrated by experiments of the character carried out on the occasion of his last address. They could not, for instance, receive messages from the Eiffel Tower, but Commandant Ferrié (now Colonel) had not forgotten them and had sent a fraternal message, notwithstanding the demands made upon his time by his military duties. To this he proposed to send a suitable reply, incidentally congratulating Colonel Ferrié upon his advancement in rank.

Debarred from demonstrating anything approaching actual wireless, continued Mr. Campbell Swinton, he had thought of some of the old experiments, of 20 years ago, which really laid the foundations of wireless. The first experiment demonstrated how an electromagnet would hold a ring of aluminium suspended in the air. Thus the principle of the so-called levitated railway had been demonstrated 20 years ago. There was nothing new in it, but the daily papers got hold of it and made a great fuss. The spinning effect produced upon a metal ball or an egg filled with iron filings was next shown, as also was the way in which the direction of the spin reverses with a reversal of the alternating current. The history of the Leyden jar and the subsequent experiments of Tesla, Elihu Thomson and Lord Kelvin was next recounted briefly. The various effects of induction were shown in a very interesting manner, such as a lamp, fixed to a copper ring, being lighted when brought into proximity to another ring, charged with current, notwithstanding that there is no metallic connection between the two rings and the fact that the demonstrator's body was interposed between them. It was also shown experimentally how, on dealing with high-frequency currents, the length of the path the current has to travel is more important than the resistance owing to self-induction. From this the lecturer passed to a description of the well-known phenomena with high-frequency currents at high pressures, and showed lantern slides of discharges. Demonstrations were also given of actual discharges and of the Duddell musical arc as modified by Poulsen. Among other experiments, a number of Crookes's tubes effects were demonstrated, and a tube containing neon, the property of Professor Fleming, was made use of in a similar way. Much of the apparatus used in these experiments had required a considerable amount of attention, having been laid aside for so many. In addition to Professor Fleming's, apparatus was also lent by Professor S. P. Thompson, whilst Mr. W. Duddell assisted in carrying out some of the experiments. To the majority of the audience, of course, the experiments were more or less familiar, but none the less welcome. There were a large number of ladies present, and to these the experiments were highly interesting. A hearty vote of thanks was accorded Mr. Swinton at the close.

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Liverpool Wireless Association.—The annual general meeting of the above association was held at the Creamery Café, 56 Whitechapel, Liverpool, on Tuesday, January 19th. The financial position was explained by the Secretary, and it was decided that the subscription for the year 1915 should be reduced from 5s. to 2s. 6d., and that business meetings should be held every first Tuesday in the month, the initial meeting under this arrangement taking place on Tuesday, February 2nd.

It was decided to ask Mr. F. Shaw, Junr., and Mr. W. Rathbone, Junr. (both of whom are serving with His Majesty's Forces), to continue to act as President and Vice-President respectively. Mr. J. T. Mathews, of Chester, was also elected as Chairman of Committee, and the following gentlemen were re-elected as members of Committee: Messrs. Coulton, Hyde, Irvine, Forshaw, and Constable. Mr. S. Frith, 6 Cambridge Road, Crosby, Liverpool, was re-elected as Hon. Secretary and Treasurer, and Mr. J. Bolton (at present serving with H.M. Forces) was also re-elected as Assistant Hon. Secretary and Treasurer.

Meetings are held at Creamery Café, 56 Whitechapel, Liverpool, on alternate Thursdays, at 8 p.m.: February 4th and 18th, March 4th and 18th, April 1st, 15th, and 29th. Free classes in "Electricity and Magnetism" and "Ordinary and Wireless Telegraphy." Speed practice classes have been arranged.

* * *

Newcastle Wireless Association.—At the monthly meeting of the above association on December 3rd Mr. N. M. Drysdale continued his excellent course of instruction on "Wireless Telephony." The various types of microphones, hydraulic and otherwise, speaking arcs, the use of light infra red and ultra violet rays, and other methods of wireless transmission of speech were described.

Rhumer's researches in light telephony were exhaustively dealt with. The construction and action of monochromatic selenium cells were explained in detail. Specimens of selenium were exhibited, after which "Multiplex Wireless Telephony," employing one beam of light composed of various colours, was fully gone into, the lecturer showing clearly how the various colours were picked out by the cells designed to respond to the particular colours blended in the beam.

Before concluding his lecture, Mr. Drysdale, with the aid of the blackboard, described in detail the construction of a novel microphone suitable for experiments of wireless telephony.

A spirited discussion followed, after which Mr. Drysdale was thanked by the chairman on behalf of the members. Mr. Drysdale replied, and the meeting—the last for 1914—ended. The club sends greetings to all old members at home and abroad.

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Wireless Association of Central Penna, Harrisburg, Pa., U.S.A.—It may be of interest to our readers to know that the following gentlemen form the executive of the above association: *President*—L. W. Barnhart, Harrisburg; *Secretary*—D. Harvey Zorger, Junr., Harrisburg; *Wireless Engineer*—Paul H. Nisley, c/o The Association, 409 Kelker Street.

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Glasgow and District Radio Club.—Owing to the large percentage of members and officials of the above club who are now serving under the colours, active proceedings are in the meantime suspended, but will be resumed at the conclusion of the war.

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Barnsley Amateur Wireless Association.—The last monthly meeting of the above association was held on February 3rd, when the usual programme was drawn up. During the month of January two special papers were read by two of the members—one, by Mr. T. W. Hibbert, entitled, "The General Principles of Wireless Telegraphy, with Simple Explanations in Phenomena Involved"; and the other, by Mr. T. Crossley, entitled, "Magnetism and Electricity as Applicable to Wireless Telegraphy." During the present month (February) Mr. Harding (the chairman of the society) is giving a series of demonstrations in the use of heliographs, a pair of which instruments, made by himself, he has presented to the association. Several new members have joined the association, and affairs are most satisfactory.

Information may be obtained from the Secretary, Mr. G. W. Wigglesworth, 2 Blenheim Grove, Barnsley, and the headquarters of the society are at the Y.M.C.A., Eldon Street, Barnsley.

* * *

Edinburgh Wireless Club.—Owing to the large number of members of the above club who are now serving in the King's Forces or as wireless telegraphists it has been decided not to carry on the club during the war. It has been suggested that the club shall be reinstated some time this year, and that it will be assisted as before by the management and staff of the North British Wireless Schools, Ltd., Edinburgh. All members will be duly notified if this suggestion is acted upon.

Digest of Wireless Literature

ABSTRACTS OF IMPORTANT ORIGINAL ARTICLES DEALING WITH WIRELESS TELEGRAPHY AND COMMUNICATIONS READ BEFORE SCIENTIFIC SOCIETIES.

Institution of Electrical Engineers.—The Paper on "Variations in Strength of Wireless Signals," read before the Institution of Electrical Engineers on February 11th, by Professor E. W. Marchant, is reprinted in pages 748 to 754 of this issue. It was followed by a long and interesting discussion in which much attention was given to the supposition of the existence of ionised layers of air in the upper atmosphere, and the various theories which are being advanced to account for the differences in signal strengths. Mr. Vyvyan, of Marconi's Wireless Telegraph Co., who first apologised for Mr. Marconi's absence owing to another important engagement, mentioned that recent experiments between the Letterfrack station, near Clifden, and Glace Bay rather tended to support the argument that the differences in strength of signals may be due to purely local circumstances at the transmitting station and not to the variations in the conditions in between the two stations. It was clear, he said, that until some organised system of observation was carried out it would be difficult to come to a definite conclusion. With regard to the so-called "freak" signals, it had been noted that ships in the neighbourhood of South Australia, a distance of 2,500 miles from Cocos Island, were frequently able to communicate with the latter at night. He believed this was a record for a 1½ k.w. station. Admiral Jackson also spoke of the long distances over which signals were received in the Pacific, and this part of the world would,

This Paper was also read on February 9th at Liverpool, by Professor E. W. Marchant, in the laboratories attached to the University there.

he thought, be quite the best for carrying out organised observations, as there were an enormous number of small islands where a perfect earth could be obtained. Dr. W. H. Eccles gave some further interesting figures as to distances over which signals had been received. He did not altogether regard them as "freak" signals, as in some parts it was a matter of regular communication over such distances. In summer he had known of signals up to 2,500 miles, and in winter 3,000 miles. At Samoa last summer they could hear quite small ships off the coast of Alaska, Mexico, and not far from the coast of Chili. He also was inclined to think that in the case of the Liverpool-Paris signals the upper levels of the atmosphere probably had nothing to do with the strength of the signals, the distance between these two places being quite small compared with the distances he had mentioned.

Prof. G. W. O. Howe and Mr. J. E. Taylor supported those speakers who were not inclined to place too much reliance upon the theory of the effect of the upper layers of the atmosphere. Prof. Howe pointed out that all high-frequency work abounds in pitfalls and what was wanted was a standard aerial removed away from all buildings. At present everybody was at the mercy not only of atmospherics, but every other station that was sending, and, in London, the Admiralty station was worse than any atmospheric. We were rather drifting towards using the theory of the ionisation of the atmosphere as a means of explaining everything according to the views of the particular individual. If the signals were weak, then, according to one, it was due to ionised atmosphere; if they were strong, another person would say that was due to ionised atmosphere, and so on. Mr. J. E. Taylor went even further. His faith in any of the speculative theories yet put forward was very faint. Of all the irresponsible theories, that of a heavily ionised upper atmosphere seemed to have claimed the most adherents. He, however, did not think it feasible that these huge banks of ionised air could vary with sufficient rapidity to produce the variations in the strength of the signals that have been observed. His own theory was that in the atmosphere there is normally a very considerable potential gradient due to the atmospheric electric charge. Due to this, the exposed antenna had an appreciable field, and upon which it was superposed. The atmospheric potential gradient had, in effect, the property of greatly increasing the spread of the electric field from the antenna in an upward direction, and it might be that in this way the variations were, as Mr. Vyvyan suggested, local.

Mr. W. Duddell questioned whether the Einthoven galvanometer was the best to use, and drew attention to recent improvements by M. Abraham, of Paris, who had, he said, constructed a moving coil galvanometer which was as sensitive as the Einthoven and had many other advantages as well. Mr. A. A. Campbell Swinton commented upon the use of the crystal detector by Professor Marchant, having regard to its well-known want of uniformity, and expressed a hope that an instrument would be devised which would enable experimenters to work without the crystal detector—*i.e.*, to be able to measure the oscillations without having to have them rectified. Mr. P. R. Coursey gave an account of some similar observations which Professor J. A. Fleming has been carrying out at University College and of the desire to carry them on simultaneously with Professor Marchant. The signals in this case were also received on an Einthoven galvanometer through the usual form of tuner, and the monthly chart was of very much the same character as that of Professor Marchant's. From this chart it appears that the greatest falling off in the signal strength occurs when it is clouded both in Paris and London, but it was not suggested that any generalisation can be drawn from charts of this kind extending over so short a period of time. In the observations so far taken by Professor Marchant and himself, Professor Fleming admits there is nothing to show definitely whether these variations in signal strength are due to something happening in Paris, London, or Liverpool, or in the region between. It was, of course, due to Professor Fleming that the British Association Committee for Radiotelegraphic Investigation was appointed three years ago, and under Dr. Eccles much good work has been done. It is, however, interrupted by the war.

In reply, Professor Marchant mentioned

that he experienced his greatest difficulties in carrying on the observations from the operations of the Liverpool amateur operators.

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The Institution of Mechanical Engineers.—At a meeting of the above institution, on Friday, January 22nd, a most interesting and instructive paper was read by Mr. John Dewrance, member, of London. The subject dealt with was the "Standardisation of Pipe Flanges and Flanged Fittings," a matter of considerable importance to both manufacturers and to users. It was pointed out that it was especially desirable to arrive at such standards as would, on the one hand, ensure efficient joints, and, on the other, avoid undue weight; while it was also necessary that the standards arrived at should be such as would be suitable for stocking in quantities by the makers of pipes, valves, etc. The following points were dealt with separately in the paper: (1) Diameters of flanges and bolt-hole circles; (2) Number of bolts; (3) Thickness of flanges; (4) Jointing materials. The subject was handled by a practical man in an eminently practical manner.

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The Institution of Electrical Engineers, Victoria Embankment, London, announce the following meetings of their Students' section for March, the meetings in each case commencing at 7.45 p.m.:

March 3rd.—*Subject*: "Discussion on the Application of Electrical Engineering to Warfare."

(*a*) Communications, Wireless, etc. (opened by P. R. Coursey).

(*b*) The Laying and Firing of Mines (opened by S. G. Killingback).

(*c*) Searchlights and Projectors (opened by E. L. M. Emtage).

March 17th.—*Subject*: "Some Experiments on the Induction Generator," by W. H. Date.

March 31st.—*Subject*: "Some Notes on High-tension Overhead Transmission Lines," by E. T. Driver.

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We have received a cutting from the *Montreal Gazette*, under date of January 21st, giving an account of a contract that has been arranged by the officials of McGill University for the erection of a wireless receiving equipment which will give the university one of the highest and longest aerials in Canada.

In a future issue we purpose giving a detailed account of this important equipment illustrated by photographs.

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A paper by Emil J. Simon and Lester L. Israel on the operating characteristics of a three-phase, 500-cycle quenched-spark transmitter was read before the Institute of Radio Engineers in September last. The attempt to produce a nearly continuous radiation of energy and high-tone frequencies by the use of polyphase transmitters is historically considered. The work of Eisenstein and Seibt is described. Experiments were made with two-phase and three-phase transmitters. It was found that the wave trains produced by successive discharges in adjacent phases overlapped in the antenna, thereby causing unmusical tones in the receiver and a diminution of transmitter efficiency. This decrease in efficiency is attributable to the increased reaction of the antenna on the closed oscillating circuits and the consequent disturbance of the regularly spaced spark discharges of the transmitter of each phase. By increasing the antenna damping, thereby lessening the overlapping of successive wave trains, the musical quality of the tone was improved and the transmitter efficiency markedly increased. Tests on dummy antennas and actual long-distance tests were made. The production of practically sustained radiation, susceptible of reception by the use of the tikker or analogous devices and produced by polyphase transmitters, is favourably considered. The limitation of quenched transmitter efficiency by the overlapping of rapidly successive wave trains is discussed

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The December proceedings of the Institute of Radio Engineers, New York, contains a list of the officers, past-presidents and committees of the Institute, and papers as follows: "The 'Hytone' Radio Telegraph Transmitter," by Melville Eastham; "Radio Traffic," by David Sarnoff; "The Resistance of the Spark and its Effect on the Oscillations of Electrical Oscillators," by John Stone Stone.

THE AMATEUR HANDYMAN.

DIRECT COUPLED RECEIVING SET.

By F. CLARK.

THE set described here was designed with the view of using all the apparatus either collectively, as a complete set, or individually, as separate parts of apparatus (see circuit, Fig. 1).

The size of the outside containing case is 7½ in. by 7½ in. by 4⅜ in., and all the apparatus is fixed to the top of the set, which is of ebonite,there by ensuring good insulation and facilitating any necessary repairs.

The inductance is wound on a 6 in. diameter tube 4 in. deep, which is fixed to the top by means of four small brackets. It is wound with 220 turns of 0·010 enamelled

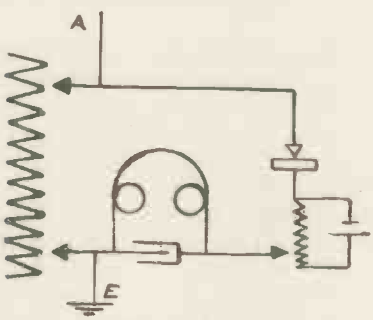


FIG 1

covered copper wire. The method of winding is as follows: the end of the wire was first fixed to the top stud on the right-hand side. Two turns were then wound, and a hole punched in the tube, through which the wire was drawn. Next, the insulation was scraped off the wire for a short distance, and the wire was then hooked over a tag secured to the stud by means of a nut, holding the stud in its place. The tag can either be made from small loops of copper wire, bent pins or a small chain obtainable from any ironmonger, which makes excellent tags when the links are separated, at the cost of about sixpence for 200. The wire was then pulled tight, and a further two turns made, when the process was repeated until complete, all connections then being soldered; the right-hand arm being 10 studs of 2 turns, and the left-hand arm being 20 turns to each stud, the left-hand arm giving coarse adjustment, and the right-hand arm fine.

A carborundum detector was used in view of its adaptability to a set of this nature, and it has given very satisfactory results. The detector consists of two German silver springs, with two small brass cups fastened to the ends, the crystal being held in position by the pressure of both springs.

The use of carborundum, however, made it necessary to have a potentiometer, the correct adjustment of which is easily found. Move the arm on the right-hand stud until a position is found at which the movement either way decreases the strength of the signals. This is, of course, the best position.

The potentiometer is the centre arm, and has a resistance of 100 ohms, each stud giving a variation of 10^{w}. This is equally simple to wind, the resistance wire being fastened to the first tag, threaded through a hole made in the tube, back to the next tag, and so on until complete. A few inches of a suitable size of resistance wire will give the necessary resistance.

The blocking condenser is of much smaller capacity than the usual type of condenser. I made my first condenser while listening to signals, and found that 8 sheets of tinfoil 2½ in. by 1½ in., separated by very thin waxed paper, gave the best results. After making one it can, of course, be easily duplicated. It does not necessarily follow, however, that the capacity suitable for one pair of telephones will suit all.

The pivot on which the arms rotate is of easy construction, and consists of a screw (screwed to the head) of any suitable diameter and long enough to go well through the ebonite. Under the screw is a washer, the arm, another washer, and lastly

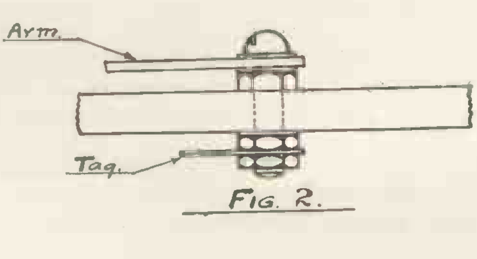


FIG. 2.

a nut, which is screwed up to give the necessary friction to the arm. On the under side of the ebonite another washer and nut are required. By holding the top nut with a spanner and getting someone else to hold the screw the bottom nut can be tightened, a tag fitted and another nut screwed up tight for connection purposes. As an alternative, the wire may be soldered direct to the screw, as shown in Fig. 2.

The arms are of German silver spring, and have a small ebonite handle fitted to the end for insulation purposes and ease of operation.

The top right-hand terminal is aerial; the top left-hand terminal earth; the bottom right-hand terminals battery for potentiometer, and the bottom left-hand terminals telephones.

AN EASILY ERECTED AERIAL MAST.

By W. A. BRADY.

IN this case I have made use of two 14-ft bamboos which have been continuously in use for practically four years and two spare odd lengths of scaffold pole, the length of lighter piece being about 7 ft. 8in. and heavier piece about 8 ft. 8 in. A single section of mast of sufficient height could be used, providing same is not too heavy.

Allowing for joins, the height is approximately 38 ft., and the need of digging a hole for mast is obviated in the following way: Obtain two lengths of old gas pipe, the outside diameter of mine being about $\frac{7}{8}$ in. and the length 7 ft. 6 in. Select position and hammer pipes into ground about 3 ft. deep until firm; they should be placed at a distance apart to allow thickest part of mast to easily fit between them.

The bamboos are bound together in the following way: Make one turn and fasten, leaving a length of string which will be covered and eventually fastened to end of binding (see illustration, Fig. 1). Continue binding until there is a sufficient length left for tying. I used thick tarred string and gave all joins and bindings several coats of varnish.

The same method can be used in joining bamboo to scaffold pole, but the diameter of bamboo being less than that of scaffold, the

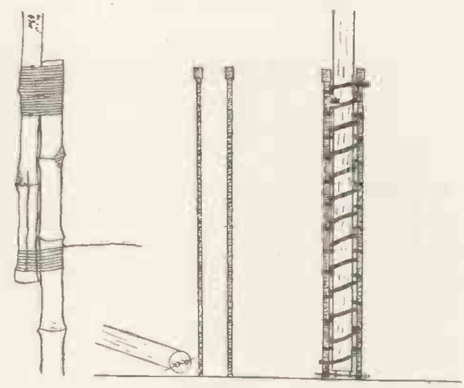


Fig. 1 Fig. 2 Fig. 3

bindings will probably need plugging with pieces of wood. If plugs are used, they should be driven in bindings in a downward direction to prevent them from working out should bindings stretch in very dry weather.

The two lengths of scaffolding I bolted together.

Lay out completed mast with bottom near gas pipes; screw two stout screw-hooks into bottom of mast, placing through hooks a strong metal rod and fasten same by means of copper wire to pipes, as close to ground as possible (see sketch, Figs. 2 and 3).

Attach suitable guy ropes and the mast is easily raised by one person, using the hooks and rod as a pivot. A turn or two round mast and pipes will be sufficient to hold mast until the rope binding is complete and guys tightened.

The bottom part of mast should have previously been given a coat of tar or paint.

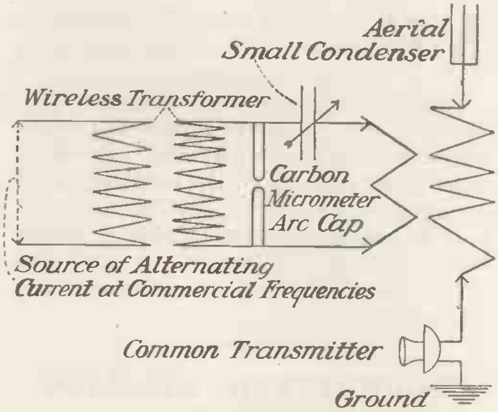
I used a method of weighted aerial halyard, but this was similar to that described in a recent number of THE WIRELESS WORLD.

HOW TO CONVERT YOUR WIRELESS TELEGRAPH INTO A WIRELESS TELEPHONE.

By EARL C. HANSON.

THE following is a description of a simple and inexpensive wireless telephone that can be made by those owning a wireless station.

It is not necessary to use direct current or high cycle generators to produce a rapid train of almost undamped oscillations for wireless telephony.



Instead of using a spark gap with metal electrodes, take two hard carbons and place them a micrometer distance apart. Disconnect all but a few plates of condenser. Place a common telephone transmitter in series with the ground wire, or in the closed radiating circuit, and you have a simple, reliable wireless telephone station. It may be well to state here that a number of transmitters can be connected in parallel or multiple series and connected to a common mouthpiece, thereby allowing more power to be used. Again, very little insulation will be required, as the arc gap, being of a micrometer size, eliminates high potentials.

Due to the fact that a micrometer arc gap is placed across the terminals of a transformer and the condenser used is small, a high-frequency current is produced thousands of times higher than the initial low cycle supplied to the primary of the step-up transformer.

The gap does not require cooling, and since any commercial frequency can be used, it makes the ideal type of a wireless telephone for the experimenter.

SOME WIRELESS APPARATUS.

By "GIBSOR."

THE manufacture of a variable condenser of the rotary type for receiving seems to be taboo with many amateurs, but the task is not so formidable as might appear, and my own experience should encourage others to make this apparatus for themselves. Economy being an essential consideration, I was not unnecessarily extravagant in the use of materials, and the total cost of my apparatus was about 7s.

From a piece of sheet zinc, $\frac{1}{64}$-in. thick, I cut out squares 6 in. × 6 in., which were subsequently rounded and cut up.

In all 24 squares were used, giving 24 fixed and 24 moving plates. The measurements given are suitable to commence with, as the B plates have to be cut down slightly when they are fitted in with those fixed. The A plates were clamped together, and the three holes, $\frac{3}{16}$ in. diameter, drilled. The hole in the B plates was also drilled to the same size.

It was found advisable to use one B plate as a template, and to work on the baseboard a suitable position for three $\frac{3}{16}$-in. brass rods, each 5 in. long.

These rods were screwed at each end, and fixed in position on the base.

Next, 24 circles of leatheroid, 6 in. diameter, were cut, and a circle of leatheroid bent round each A plate.

An A plate and leatheroid were then placed on the three upright rods, and pushed down to the bottom.

Three $\frac{1}{16}$-in. thick washers were placed on each rod, and another plate and its leatheroid casing slipped on. This was repeated till all 24 plates were fixed.

The position for the central rod, the length of which should be about 8 in. long (depending upon the size of the handle to be fitted) was next located. A nut was put on, and I found it better to put various numbers of washers on, the best number being determined by the position of the moving B plate.

When all the B plates were fitted a nut was put on to keep them tight and in position.

The top board was drilled and held in position by the three rods going through the fixed plates and two distance rods.

By the way, the operators on the interned ships don't seem to have a spark of enthusiasm.

* * *

Names of Belgian towns are to be included in the next Burn List.

E

MY STATION.

By C. W. GREENE.

A BRIEF account of my station may be of interest. The aerial is of the inverted type and consists of two single strands phosphor-bronze wires, 6 ft. apart and 135 ft. long. It is 38 ft. high at one end and 28 ft. at the other. The down-leads are taken from the higher end and enter the house through a glass tube fixed in the frame of the bedroom window.

The transmitting gear consists of an 8-volt 50-amp.-hour accumulator, a 1-in. spark coil, two Leyden jars, helix and key. The Leyden jars are half-pint size and are connected in parallel, and the helix consists of 12 turns of No. 10 aluminium wire wrapped on a 9-in. frame.

The receiving set is made up of the following: an oscillation transformer, the primary of which is tuned by means of a slide, and the secondary by means of tappings, silicon and carborundum detectors, two variable condensers, potentiometer, and 2,000 ohm phones. I have also a direct-coupled receiving set which may be connected up to the detector and phones by means of three switches.

A VARIABLE CONDENSER.

MR. N. J. DE WAARD suggests the following method for making a variable condenser :—

Take two test tubes such as are used by chemists, one fitting easily into the other, and both being filled with water. Spirals of copper wire reaching to the bottoms should be placed in each tube, that in the latter being of such diameter as to allow a smaller tube to slide up and down it. According to Mr. de Waard, mercury does not give better results than water.

SHIPWRECKED WIRELESS OPERATORS.

Paul Kreiger and William Miller, wireless operators living in New York, were shipwrecked recently off Shipwash Sands, Essex, England, whilst serving as members of the crew of the Norwegian steamship *Obidense*. They applied to and received from the American Consulate transportation back to the United States.

RAPID WIRELESS SERVICE.

On the last trip of the Cunard steamer *Franconia*, when the boat was sixty miles off New York, a passenger sent a marconigram via the Western Union to San Diego, Cal., prepaying the reply. The message was sent through the Marconi station at Sea Gate and, to the astonishment of the passenger, the reply was delivered to him in fifty-five minutes. This is probably a record-breaker on sending a wireless message from a ship at sea across the continent and delivering reply on board ship.

WAR NOTES.

By Our Irresponsible Expert.

DEVILISH INGENUITY OF OUR ENEMIES.

A correspondent, who is perfectly untrustworthy, states that he has it on good authority that Germany is building submarine Zeppelins which will drop bombs upwards.

* * *

WORRIES OF WARTIME.

Operator in aeroplane: "Bother, I've dropped my pencil!" (*Left volplaning.*)

INSTRUCTION IN WIRELESS TELEGRAPHY

(Second Course)

(VIII.) The Receiving Circuit.

[The article in the March (1914) number completed the first course of instruction. The present is the eighthof a new series of articles, which will deal chiefly with the application of the principles of wireless telegraphy. Those who have not studied that series are advised to obtain a copy of "The Elementary Principles of Wireless Telegraphy," which is now published, price 1s. net, and to master the contents before taking up the course of instruction. An announcement concerning the second examination appeared on page 333 of the August number of THE WIRELESS WORLD.]

743.—The detection of electric waves sent out from a distant station involves the use of two appliances:

1. An aerial to collect energy from the electromagnetic waves travelling through the ether, and to convert this energy into high-frequency alternating current, and

2. A detector to render this current apparent.

These two appliances are connected by the receiving instrument, of which there are many designs, which differ according to the nature of the detector and to the amount to which the signals required are sifted out or tuned from amongst all those which are affecting the aerial at the time.

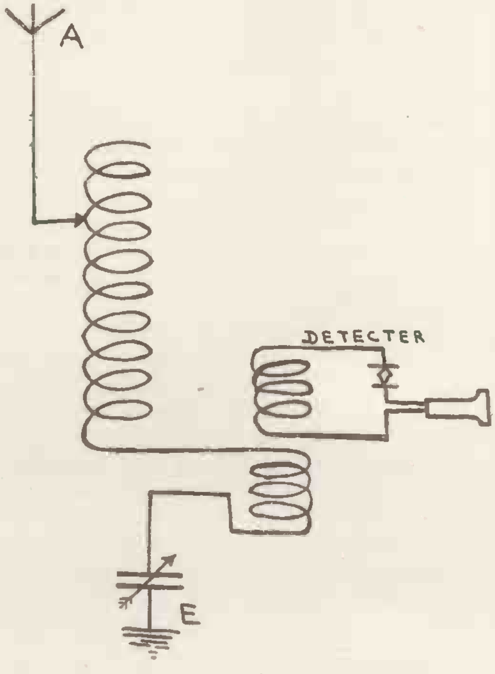


Fig. 1.

The following are the most usual arrangements used for connecting the detector and aerial:

1. Certain detectors can be connected in series with the aerial.

2. The detector is connected in shunt with an inductance in the aerial circuit.

3. The detector is connected in shunt to an inductance which is inductively coupled to the aerial circuit.

4. The circuit is similar to the above, but a tuning condenser is connected in parallel with the inductance to tune the circuit to the wave-length of the signals.

5. The circuit is similar to the above, but the detector circuit and aerial circuit are coupled by means of one or more intermediate circuits which are tuned to the wave-length of the signals.

The first necessity in the receiving apparatus is for the aerial to be tuned to the wave-length of the signals. When the wave-length of the signals is greater than the natural wave-length of the aerial an inductance is connected, and when it is shorter a condenser is connected in series between the aerial and earth. For receivers intended for long and short waves both inductance and condenser should be provided.

Design of Aerial Tuning Inductance.

744.—The amount of inductance required depends on the maximum wave-length it is desired to receive and the capacity of the aerial. Except for short waves, the inductance of the aerial itself may usually be neglected.

The capacity of the aerial can be either measured or calculated from the formula and curves given in Professor Howe's article, which appeared in the last three numbers of

THE WIRELESS WORLD. Having obtained this capacity, we apply the usual formula to calculate the inductance required in exactly the same way as was done for the transmitting inductance in paragraph 738 in last month's issue. From this value must be deducted the inductance of the coupling coil if a coupled receiver is contemplated, and also, if necessary, the inductance of the aerial itself.

The dimensions of the coil to give this value of inductance can now be calculated. A formula suitable for this purpose appeared in paragraphs 739 to 740, and in a subsequent article other formulæ will be given.

The gauge of wire used is of some importance, since a coil wound with fine wire will have a higher resistance than one wound with thicker wire, and this resistance will reduce the strength of signals. Large inductances for tuning to long waves should therefore be wound with thicker wire than small ones for shorter waves.

Where single wire is used the wire should not be finer than, say, No. 26 S.W.G., nor is it advisable to use heavier wire than No. 16 or 14 S.W.G. If wire of less resistance than these are required, it is better to use stranded wire, each strand being separately insulated.

Hence, in designing the inductance, the size of former or the space which is available for it should be determined, and the largest gauge of wire selected which will give the required number of turns in the space.

In order that various wave-lengths may be tuned with one inductance coil it is usually provided with tappings, which are brought to terminals or contacts, so that the aerial can be connected to any one of them as required. A method largely used, which is very convenient, is to wind the coil with enamelled wire, and to provide a slider which makes rubbing contact with the wire along a line where the enamel has been removed.

745.—It is not advisable to attempt to tune both long and short waves with the same coil, since, as has been pointed out before, each coil has a capacity from one turn to the next. This capacity confers a definite wave-length on the coil, and if only a small part of it be in circuit the conditions may be such that the idle part of the coil may interfere with the rest of the circuit, reducing signals.

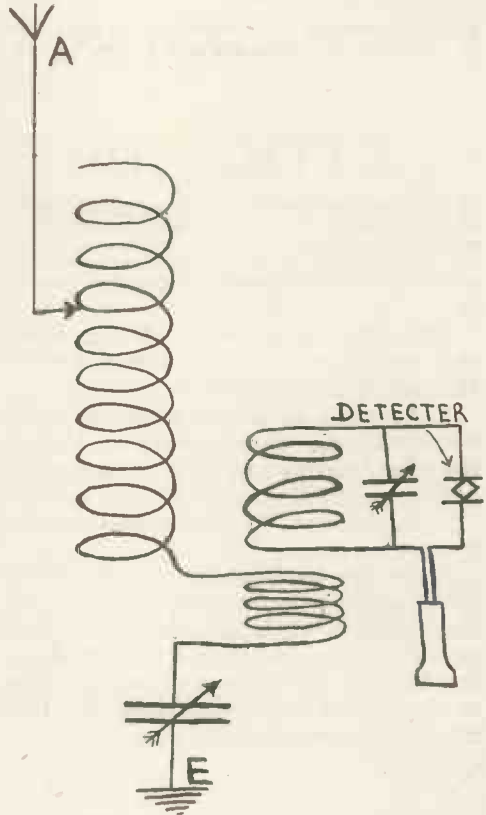


Fig. 2.

Another point to be noted is that no part of the coil should be short-circuited, whether it is in circuit or idle. The short-circuited coil will absorb energy from the rest of the circuit, and the effect is greatest when the ratio of short-circuited coil to the part in use is large—*e.g.*, when only one or two turns are short-circuited.

An article on this subject by Dr. L. Cohen appeared in THE WIRELESS WORLD for January, 1914, with several examples worked out showing the reduction in current-strength which takes place.

Hence, when designing an inductance with sliding contact the contact must not be a broad one.

For reception of very long waves on short aerials the amount of inductance required for tuning becomes very large, and it is desirable to ascertain whether any other method is available.

It is known that if an aerial tuning

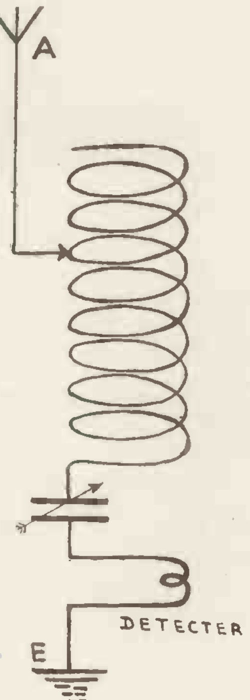


Fig. 3.

inductance be shunted by a condenser, then longer waves can be tuned to than by the inductance alone.

The strength of signals received is less than if the aerial be tuned by inductance alone, unless a high resistance is thereby used, and rapidly falls as the capacity of the condenser is made larger. The method should therefore be used only when sufficient inductance to tune is not available.

For an inductance provided with tapping the most convenient arrangement is to space the tappings further apart as the amount of inductance in circuit is increased. An example will make this clear.

Suppose a certain aerial requires 280 microhenries to tune to 1,000 metres, then, in round figures, the inductance required for other wave-lengths is :

1,120	microhenries for	2,000 metres.
2,500	,,	3,000 ,,
4,500	,,	4,000 ,,
10,000	,,	6,000 ,,
18,000	,,	8,000 ,,

The inductance of a coil is roughly proportional to the square of the number of turns in it ; and hence, if 100 turns were required for 280 microhenries, 200 turns would approximately be required for 1,120 microhenries, and 300 turns for 2,500 microhenries, and so on, or the number of turns required is roughly proportional to the wavelength. But for good tuning we require as many tappings for wave-lengths between 1,000 and 2,000 metres as between 2,000 and 4,000 and 4,000 and 8,000 metres, so that if there are 4 tappings between 400 and 800 turns we require as many between 200 and 400 and between 100 and 200 turns for the best results.

746.—Having designed the aerial tuning inductance, further consideration of the receiver depends on which of the five classes enumerated above it resembles most.

For the first class, in which the detector is placed in series with the aerial, we have in the inductance and a variable condenser in series for short waves everything necessary to tune the aerial to the signals.

A magnetic detector may be used in this manner, and also a thermo-galvanometer, the latter being more of a measuring device than a detector.

In order that any detector may be used in this way it must be of low resistance compared with the aerial and its associated inductance, since otherwise an inefficient receiving arrangement will result. For the second arrangement it is only necessary to provide the inductance with switches or sliding contacts for connecting the detector and telephones for a complete receiver to be made.

We now come to the inductively coupled receivers. If we have two coils of wire which are close together, or even one inside the other, then for high-frequency currents the amount of energy which the secondary, with the detecting devices associated with it, can absorb from the primary depends on the potential induced between its ends by the primary. This potential depends principally on two factors, the degree of coupling between the circuit, and the extent to which the circuits are in tune with the signals ; and these factors are correlated in such a way that the tighter the coupling the less close need the tuning be in order to obtain the same strength of signals through the detector. If the coupling be very tight, as when one coil completely encloses the other, the range of wave-lengths which can affect the detector without tuning will become very great, and the receiver gives flat tuning or is said to be aperiodic. For some special purposes this is advantageous, although in general it is not.

Since, as has been previously pointed out, every coil has a capacity of its own, it has a definite natural wave-length, and signals on this wave-length will be received better than those on wave-lengths which differ greatly from it. Hence no circuit can be strictly aperiodic, and the term is merely a relative one.

If the coupling between the coils be made weaker, or looser as it is sometimes termed, then tuning becomes closer, and when the coils are wound in single layers will become quite sharp, but if the coil be in several layers its capacity will be greater in proportion, and the tuning is not so sharp.

Receivers on this principle, in which the secondary has three or four tappings for different wave-length ranges, are used in some systems of wireless telegraphy.

747.—The addition of a condenser in parallel with the inductance greatly increases the usefulness of the receiver, which now falls under class 4 of the above list.

The most efficient circuit will be obtained when this condenser is of very small capacity, or even zero, but this means a separate coil for every wave-length to be received, and is not practicable in a universal receiver. The maximum capacity which can be usefully used for tuning an inductance to various wave-lengths depends on the particular detector in use.

High-resistance detectors like the Fleming valve and carborundum work best when the potential between the ends of the secondary coil to which they are connected is large, which occurs when the secondary itself is of large inductance. Therefore for these detectors only a small capacity condenser should be used.

Low-resistance detectors, as galena and zincite, however, work best with smaller inductances for the same wave-length, or a larger value of capacity may be used. Suitable values for these capacities are: High-resistance detectors, ·0002 to ·0004 mfds. max.; low-resistance detectors, ·0004 to ·0015 mfds. max.

The capacity of the inductance has been referred to several times. This is often called the distributed capacity of the winding, and includes (1) the capacity between the various turns due to the potential differences between them. If the turns were of bare wire, spaced from each other, and not supported on any former or only touching the former, this factor could be calculated, although as far as we are aware no formulæ for the purpose have yet been published. (2) If the coil, instead of being constructed as above, is wound of insulated wire, of which the turns touch and the whole lie on the surface of a former, as is generally the case, the above capacity will be increased by an amount proportional to the dielectric constant of the insulating material in use. Since the coil presents a large surface of thin insulating material to the atmosphere, a certain amount of moisture will be absorbed by it, according to the hygrometric state of the atmosphere, and this will alter the dielectric constant and vary the capacity accordingly. (3) If the

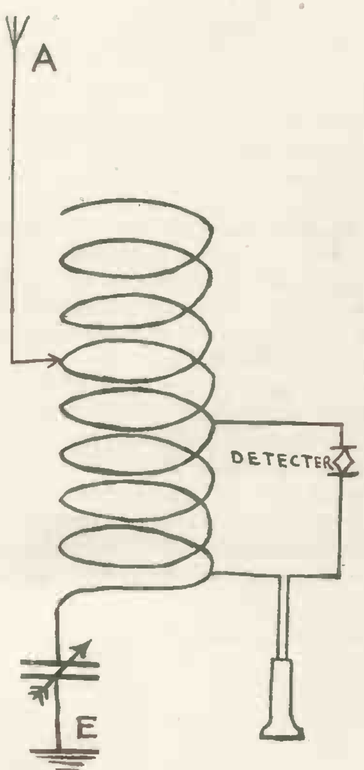


Fig. 4.

former on which the coil is wound be in the form of a tube, then any conducting material which may be present on the inner wall of the tube will form a condenser with the wire on the outer wall.

This extra capacity due to moisture in the insulation or conducting material inside the former is harmful, since it is a source of loss of energy which can be avoided.

Before winding a coil the inside and outside of the former should be examined, and if necessary cleaned. Wooden formers are sometimes used in place of the more expensive ebonite or fibre tubes. These should be of dry wood (mahogany is a suitable material), and thoroughly impregnated with hot paraffin wax to prevent moisture penetrating the walls in course of time. Paraffin wax being non-hygroscopic, is a good material for protecting the windings from damp.

THE AIRMAN, THE WIRELESS, AND THE BIG GUN.

How They Work in Unison.

A TELLING description of the way in which the aeroplane, the wireless telegraph, and the telephone assist our gunners to obtain the wonderful results they have achieved is given by Dispatch Rider Relf Gurney, son of a Hereford Alderman, and quoted in the *St. Andrew's Citizen.*

"I'm sitting in a little hole," he writes, "with the wireless operator and the telephonist. On our right, in a field under the shelter of an old barn, is the big gun. It is sheltered and screened with branches, straw, etc., and to hostile aircraft it would be very hard to detect. The wireless man removes his cigarette from his lips, carefully puts it out, and places it behind his ear, and bends over his instrument. He then starts to scribble on his message pad.

"I lean over and read the words, 'Just leaving. Shall be with you in four minutes.' The telephonist transmits the message to the gun, and almost immediately a white speck appears on the sky, and the drone of a powerful engine is heard. The operators adjust their instruments for the last time, and fit their ear-pieces more firmly on their heads.

"'Prepare for action,' writes the wireless man. The message is duly transmitted, and I stuff cotton wool into my ears. The aeroplane soars over our heads, and mounts higher and higher over the German lines. 'He will get it in a minute,' mutters the telephonist; and, sure enough, as he speaks, a huge white ball of smoke appears to the left of our machine.

"The flying man makes a graceful detour with his machine, and then takes up his original course once more. The wireless man stiffens again, stoops and writes; this time a jumble of figures and numbers, or so it appears to me, and as they are transmitted the huge barrel of the gun moves slowly, and at length comes to rest. The gun team stand clear, the lanyard is pulled, and the gun runs back 'midst a huge cloud of dirty smoke. It is immediately followed by a deafening roar, whilst the projectile is heard screaming away over the enemy's lines.

"While the gun is being resighted for a second shot we in the 'dug-out' anxiously await the wireless message from the skies, telling us the effect of the shot. 'Fifty yards short,' says the operator. 'Fifty yards short,' repeats the telephonist. With great care the gun-sighting is corrected, and again a shell is sent hurtling towards the target. The anxious wait follows: our wireless man taps impatiently with his pencil; I light a cigarette to while away the seconds. 'Good!' the operator exclaims, 'direct hit; fire six shots more.' Thus he writes down the message from our aircraft. And as the gun is again resighted its smoking muzzle seems to smile at the sheer pleasure of the gunners at their wonderful work."

MORE WAR NOTES.

Germany's Lament About America.

W ith Wireless Waves We Wrong the World,
I niquitous our bluff,
R egardless of the slightest truth,
E ach Eve we send the stuff.
L ong Lamentable Lies they are,
E ach Earns a further smile,
S ince Simple as he Seems to be,
S am Sternly Shuns that Style.

* * *

Eiffel Tower to Norddeich (singing): "You take the high note and I'll take the low note, and we'll jamb the rest till the morn——ing!"

Wireless in the Courts

Heavy Fines for Law-breakers

PRIVATE owners of wireless apparatus continue to pay penalties for contravention of the Defence of the Realm Consolidation Act, 1914. It is evident that there are still a few whose enthusiasm for their hobby has blinded them to the gravity of their position under this Act. What the position really is, is clearly set forth in this month's Editorial Note on page 745.

It is hardly conceivable that the campaign against suspects (a campaign with which all true patriots must be in entire sympathy) will be extended to the possessors of metallic clothes-lines, but the position is an extremely uncomfortable one for persons owning an induction coil, a Morse sounder, or even a flag-pole, for these can all be construed as important parts of an equipment by an astute counsel. Would-be students of electrical phenomena will be discreet if they suspend all experimental work and the manufacture of parts, and (in the event of the possession of even individual parts) state their case to the postal authorities without further delay. Six prosecutions at least have been made since the beginning of the year. Of these four have resulted in stiff fines, with the alternative of imprisonment extending from one to six months. One charge was the subject of a court-martial, but in this instance the accused was found not guilty, and discharged.

MANCHESTER COURT-MARTIAL.

The case in question was the prosecution of Frederick Goddard, of 14 Nether Street, Ardwick, a member of the staff of an important Manchester daily paper. Originally there were two charges against Goddard: one, that without lawful authority he was in the possession of apparatus for tapping messages sent by wireless telegraphy; and the other that, without permission of the Postmaster-General, he had in his possession apparatus, or component parts of apparatus, for transmitting wireless messages. These charges were subsequently amended, as it was found that they had been laid under an Act of Parliament passed after the alleged offences were committed. The accused was detained in custody for fifteen days previous to the opening of the court-martial. The revised charges were substantially of the same character.

Evidence showed that Goddard had a complete set of apparatus for receiving wireless signals, for which he held the licence of the Postmaster-General, but that he had two sets of aerials, one outside and the other in a bedroom. On the outbreak of war the postal authorities dismantled the outside aerial, but did not touch the one inside, or seal up the instruments. The detectives who visited the house admitted that the instruments were not connected with the indoors aerial.

The Post Office expert, asked if the apparatus found in Goddard's possession could be used for signalling, replied that the apparatus included part of a receiving set, and part of a sending set. The instruments were intended for the receipt of messages by wireless telegraphy. Questioned by the Military Prosecutor whether they could have been used for any other purpose, such, for instance, as "boiling potatoes," he suggested that the sparking coil might have been used for ignition purposes on a motor car. Goddard in defence stated that he did not erect his indoor aerial until six months after he received the Post Office licence, and that when a Post Office official made the annual inspection in June he was told of the indoor aerial, "but did not examine it or say anything about his having it."

The evidence for the defence and prosecution respectively assumed the usual form, the only incident of unusual interest being the suggestion made by Lieutenant Greenwood that the accused, having been connected with a newspaper, might have picked up any information floating about in the air, and that it might have been very useful to him indeed in the way of pin money. This suggestion was made in spite of the fact that the accused had pointed out that the equipment had not helped him in business, the terms of the licence imposing secrecy. The Court required one and a half hours to consider their decision, but returned a verdict of not guilty on all charges. The Military Prosecutor shook hands with Goddard when he left the court.

TWO RAMSGATE PROSECUTIONS.

Ramsgate had the double excitement of two charges within seven days. The first case was preferred against Richard Softley, of 48 Addington Street, Ramsgate, for the possession of apparatus, etc., without the permission of the Postmaster-General. The apparatus was reported to consist of one tuner, one detector, three coils of insulated wire, one telephone receiver, and three testing buzzers. The defendant claimed that the equipment had been used to train Boy Scouts. The most interesting witness in this case was Warrant Telegraphist Harford, who admitted that there had been frequent interruptions to wireless messages that had been received at the Navy Office. It was impossible to say where the interruptions came from, but messages could be transmitted about four or five miles by the defendant's apparatus.

Then followed a cross-examination.

DEFENDANT: Do you consider my pole—two broomsticks—sufficient to take an aerial?

WITNESS: Yes.

DEFENDANT: Could you wire that apparatus in four hours?

WITNESS: It is quite possible.

DEFENDANT: How long have you been a wireless authority?

WITNESS: About three years.

DEFENDANT: Then you have wasted your time.

Defendant, in his defence, stated that when he commenced to make his apparatus he applied for a licence, but his finances were such that he could not continue the apparatus, which he put on one side. The Chairman of the Bench suggested that the Bench was willing to believe that the defendant had no ill intentions, but that it was his duty to keep himself informed as to his position under the regulations. Under the circumstances the case would be met by a fine of £15, or six months' imprisonment.

The second Ramsgate case involved a well-known local smackowner, Mr. Henry Summers, Junr., of 28 Grove Road, Ramsgate. The usual charge of having apparatus without written permission was preferred, and the solicitor for the defence pointed out that the defendant purchased the equipment from the Trinity Brethren in May, 1913, for the sum of £9 9s. It came from one of the Ramsgate light vessels, and he intended it for the use of his son, who was a wireless operator, but who had not been home for two years. He knew nothing whatever about wireless, and the apparatus was stored in a prominent position in his office. He did not know that he had to report the possession of the apparatus, as he did not use it and it was not put together.

The only other interesting feature of the trial, if we except the fine of £10 (alternative one month's imprisonment) and the demanded forfeiture of the apparatus, was the evidence of a witness who, after deploring the fact that his occupation was that of a smackowner, admitted he knew nothing about wireless yet, but "he was going to learn."

Two instances were also brought to light of North Country tradesmen possessing wireless outfits without the necessary licence. One of these occurred near Chester-le-Street, and the other at Durham. Convictions were secured in each case, and heavy fines imposed.

The first of these, which occurred in January, concerned a Newcastle woollen merchant named Stobo, of Eighton Villa, Wrekenton. According to the prosecutor, the wireless apparatus had been traced from Rochdale and Rhyl. Mr. Stobo, in defence, stated that he purchased the apparatus very cheap from a man who was evidently a foreigner, but who could not now be found. He had not used the apparatus. A fine of £10 was imposed in addition to the expenses of two witnesses from London and the confiscation of the apparatus.

A £20 FINE.

The second instance was recorded in Durham early last month, when John Bell, a young draper of Castle Eden, near by, was the subject of the usual charge. The only feature of the evidence was the defence that the outfit was home-made and incomplete, and that a licence had not been considered necessary. It was also pointed out that the owner showed his apparatus to a local policeman shortly after war was declared. The constable admitted that he did not report it. The magistrates, in imposing a fine of £20 and costs, with an alternative of two months' imprisonment, suggested that but for the fact that some member of the police force had known of the apparatus for some time, the Bench "would have gone to the extreme limit."

What was locally termed an "Enfield sensation" occupied the attention of the Enfield Petty Sessions on February 8th, when Stanley Warren White, aged 17, the son of a local draper, described as a wireless student, of 47 and 49 Church Street, Enfield, was charged with having a complete wireless installation without the permission of the Postmaster-General and contrary to the Defence of the Realm Act. According to the police evidence, the apparatus was discovered through the suspicious movements of a man on the roof of several houses adjacent to the Enfield telephone exchange on the night of January 29th. The man subsequently proved to be the accused.

For his defence the prisoner stated emphatically that he had not received nor transmitted any messages (the Post Office evidence was to the effect that the aerial was nearly new), but he admitted that he could receive and transmit 18 words a minute correctly. He was a student at the East London Wireless College, and had erected the aerial to get buzzing effects, which he had not been able to secure before.

The case for the Post Office, as reported, was to the effect that White's apparatus was almost complete and was capable of receiving and transmitting messages. "It was possible by means of the machine produced to intercept, receive, or transmit messages to and from Germany and the Admiralty stations. If the prisoner could read at the rate of 12 words a minute and understood the Morse Code, he could take down the messages."

Before Col. Bowles, the Chief Magistrate, announced that the prisoner would be fined £7 with £3 3s. special costs, White and his father took the opportunity of dispelling a local rumour that they had relatives and friends in Germany.

WHY A RAID TOOK PLACE.

Perhaps the most peculiar case of the recent series was that heard at Hove Petty Sessions on the same day, February 8th, when George Gordon Wiles, assistant counter clerk and telegraphist at a sub-office at his mother's address, 38 Cowper Street, was summoned for contravening the Wireless Telegraph Act. The summons during the hearing was altered to one of "being in charge of any apparatus intended to be used as a component part of apparatus for receiving messages."

The defendant insisted that his apparatus was absolutely incomplete, and that he was not aware that he was contravening the law in keeping it. A reason why he did not report the matter was that on September 8th the Postmaster-General issued an instruction to Post Office servants as follows :

"It will not be necessary to report cases in which a person is known to possess wireless apparatus, unless there is some reason to think that an attempt is being made to use it."

Asked why a raid was found necessary, if the defendant was willing to give up his apparatus for a receipt, Capt. Edward Duke, Provost-Marshal of the 24th Division, stated that this was not the only case of people having wireless apparatus in their possession. He was instructed by General Ramsay to inquire into the matter, and if he reported favourably no further action was to be taken. But owing to the fact that this man concealed everything, and gave such a lot of trouble, he had considerable doubt whether the man was acting honestly.

The defendant's explanation of his action was that after agreeing to part with the apparatus on receipt of an acknowledgment from the Post Office, he was visited by a local detective, and then "raided" on the busiest day in the week, when he was occupied in paying out separation allowances.

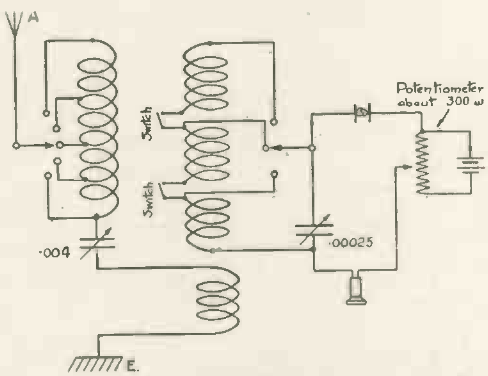
The Magistrates found the defendant guilty of a technical offence, which was serious, and fined him £5 inclusive, with the alternative of one month's imprisonment. The forfeiture of the apparatus was ordered.

QUESTIONS AND ANSWERS

Readers are invited to send questions on technical and general problems that arise in the course of their work or in their study to the Editor, THE WIRELESS WORLD, *Marconi House, Strand, London, W.C. Such questions must be accompanied by the name and address of the writer, otherwise they will remain unanswered.*

C. F. Watford (Ontario, Canada) gives the following description of his wireless outfit, and asks for answers to his various difficulties. He writes: "My jigger has a primary 6 inches in diameter and a secondary of 5½ inches. The primary, which is wound with No. 22 D.C.C., B and S gauge, is tapped off in 12 sections of 15 turns each. It has two switches, one which varies the inductance one turn at a time up to 15 turns, the other cuts in 15 turns for every stud. The secondary is 10 inches long wound with No. 28 D.C.C. tapped in a similar way to the primary, but each switch has 8 studs. One varies the inductance every seventh turn, while the other approximately every fortieth turn. As I have read from your Questions and Answers that there is a certain loss caused by the long unused winding, I have provided two switches on the secondary dividing the winding into three sections. I might say that the leads to the studs are soldered to the wire convolutions, which are continuous. The forms on which the wire is wound are thoroughly varnished and baked several times. The condensers used consist of two in series. The detector has a sensitive piece of galena with a fine German silver wire contact. The 'phones are the best I could obtain at 2,000 ohms resistance. My aerial consists of four No. 14 bare copper wires, each 150 feet long and 4 feet apart. Each end is insulated by 6 cleats in series, and the lead-in is soldered to the main part. It has four No. 14 wires down to the roof, then two into my room. The aerial is 60 feet above the ground at each end. All the brace wires are broken with insulators at intervals. The earth connection is composed of discarded pails with the connecting wire soldered to them. I should like to know what would be the approximate wave-length of my aerial (which is open at the far end, and is of an inverted L type). I find that 300 metres comes in plain with about 20 turns more or less to different stations. But what puzzles me is that the 200 metres amateurs in U.S. comes in with exactly the same wave. To lessen the inductance weakens them in proportion. Also I tried the dead-end effect on weak stations, but could not detect any difference in their strength. I should be greatly obliged if you would tell me the approximate maximum wave-length I could receive, also the natural period of my aerial. How would a variable condenser help matters, when would it be best used, and what should be its maximum capacity? How many turns of the same wire as on jigger primary core of same diameter should be used as a load-coil in series with it to get waves up to and including 3,000 metres?

Answer.—Your aerial appears good, but your earth would be much improved if you spaced out your pails, connected them all together with wire, and buried the lot, bringing a lead above ground to connect your instruments to. From the figures given, the natural wave-length of your aerial should be about 260 metres. Your receiver is not at all good. If you can get a variable condenser of, say, 0.004 mfd. capacity to put in series with the aerial tuning inductance, the aerial circuit will be much improved, and you will get the 200 metre stations much better. Your detector circuit is curious, and probably accounts for the curious results you have been getting on short waves. From your figures the inductance of the secondary of your jigger is about 11,000 microhenries. If now you can get another variable condenser of, say, 0.00025 mfd. capacity, your detector will easily tune to 3,000 metres. If you use this method you can knock out most of those contacts and tappings on the jigger secondary, but it would be advisable to retain one 3-way switch as shown and tap off at ⅓, ½, and the whole length; you might also keep in your section switches. This will help you with the short waves. The telephones are good enough, and all that you now want is a potentiometer. Try a carborundum crystal. A good specimen takes a lot of beating, and is very robust. With regard to the extra coil you propose to put in your primary to bring up the aerial circuit wave-length to 3,000 metres, you do not give us enough information regarding the existing coil to enable us to give you an estimate for the size of the extra coil, so this had better be found by trial, or if you like to send us fuller details we will be able to give you an answer. Your circuits had best be arranged as shown here.



If you have a copy of THE WIRELESS WORLD for November, 1913, you will find much help in the instructional article on Receivers.

G. L. (Dukinfield), Manchester, sends some information concerning his receiver, and asks questions regarding the wave-lengths, etc., of some stations he has been unable to get.

Answer.—You do not send us much information about your station. As your aerial is very low, and as you say in the midst of houses, it would be much improved if you increased the height as much as possible. Information regarding the length, type, and number of wires of your aerial would help us to form a much better idea of its capabilities. The main reason you get the station you mention, and not the others is on account of the power used by these stations, the one you get being very much higher powered than the four that you do not get. There is no reason why you should not get good results with a suitably designed "direct coupled" set, although an inductively coupled one has advantages in tuning out jamming stations. We would suggest that you have a further look at the article you quote, as some of your questions are already answered in it. With regard to wave-lengths, powers of stations, and working distances, you should get a copy of *The Year Book of Wireless Telegraphy and Telephony*, published by the Marconi Press Agency, Ltd., at half a crown. This book has tables of land and ship stations, their wave-lengths, call signals, geographical positions, normal range, nature and hours of service, etc. The three stations you mention have the following wave-lengths: first, 4,500 metres, the other two 600 metres.

A. R. D. (Woking) sends drawings of two circuits taken from J. C. Hawkhead's book, and asks how the two should be placed together in order to get a complete circuit for transmitting and receiving combined.

(1) Is the circuit as drawn correct ?

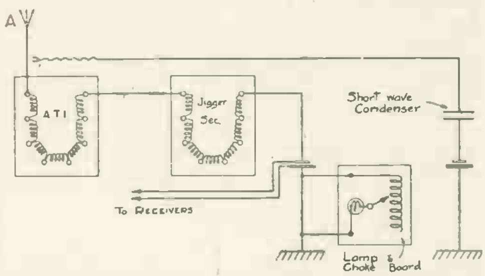
(2) What advantage is gained by running a rotary converter clockwise or anti-clockwise ?

(3) Could you recommend me a book or books which clearly state meanings and values of Inductance and Capacity ?

(4) What is meant by the "ratio of transformation" ?

(5) What is meant by the phrase "inversely proportional and directly proportional" ?

Answers.—(1) The circuit should be as shown here :—



(2) There is no advantage to be gained by reversing the direction of rotation of the converter. The makers design them to run in a certain direction, and as long as they are only used as converters they are best left alone.

(3) Any good book on Electricity and Magnetism will give a clear definition of the terms "Capacity" and "Inductance," but as the values of these can be between very wide limits you will not get a book which will give you the table you seem to expect.

(4) "Ratio of transformation" is a term used to denote the relation between the primary and secondary voltage of a transformer.

(5) You had better get an elementary book on Mathematics, as these question columns can hardly be expected to deal with queries of the nature of your last question.

R. E. L. (Paris) asks :

(1) Is it possible to find out by a formula the length and diameter of wire to tune, as exactly as possible, a thousand metres wave ? If so, how is it done ?

(2) Is it dangerous in any way to use a water-pipe as an earth connection, especially during thunderstorms ?

(3) Is it possible to send messages twenty miles by day with the following apparatus : two wires inverted, aerial 55 ft. long and 30 ft. high (as in diagram given).

Answers.—(1) To calculate the value of inductance required to tune an aerial to a wave-length of 1,000 metres it is necessary to know the capacity of the aerial. You will find, in the reply to J. A. W. in the January number, full information as to the calculations for the inductance.

(2) Although a water pipe makes a very good earth connection for an aerial circuit it is not advisable to connect an aerial to such a pipe inside a house during a thunderstorm. Either connect the aerial to an earth out of doors, or, in the case of a small aerial, it could be lowered to the ground.

(3) The aerial and transmitting apparatus you describe should be able to send twenty miles.

R. E. L. (Paris) also asks for suitable values for the inductance and capacity of a wavemeter to measure up to 4,000 metres, and also for the ratio between the value of an inductance and the wave-length it can tune, and if aluminium vanes and mica plates are suitable for a variable condenser.

Answer.—For a wavemeter it is desirable to have a variable condenser of large capacity with a correspondingly smaller inductance. This is because the crystal used to detect the oscillations has a small capacity of its own, and since different crystals may be used at different times they would cause an error in the calibration of the wavemeter unless their capacities are negligible in comparison.

A condenser with a maximum capacity of ·01 mfds. is the best, and this requires an inductance of 450 microhenries. The inductance can be wound on a former 6-in. diameter or a square former of 6-in side. If the complete range of wave-lengths from, say, 300 to 4,000 metres is required, it is best to make several inductances with different number of turns—*e.g.*, 3, 6, 12, 24, 48 turns, as otherwise the short waves will be crowded together on the condenser scale. In order to find the maximum wave-length an inductance will tune to the capacity of your aerial must be known.

An approximate value can be obtained by the curves in Prof. Howe's article in the January number, if you consider the actual aerial to be equivalent to one of five wires spaced apart the mean distance between the actual wires—*i.e.*, 64 inches, and at a uniform height of 62 feet above the ground.

For No. 16 S.W.G. $\frac{d}{R} = 1{,}000$ $\therefore$ capacity is approximately $4{\cdot}6 \times 118 \times 10^{-6}$ microfarads $= 00054$ mfds.

Your calculation of your inductance is wrong. An inductance 14 in. long, 4 in. diameter will only give 3,000 microhenries if wound with No. 21 single silk-covered wire or enamelled wire. If wound with cotton-covered wire the inductance will be less still, as there will not be so many turns of wire on it.

Taking the above figures for capacity and inductance $\lambda = 1885 \sqrt{3000 \times 00054} = 760$ metres.

The inductance of the aerial can be neglected in comparison, as it will only be a few microhenries.

Aluminium is quite suitable for the vanes of a variable condenser. Clear, clean-cut mica sheets may be quite satisfactory, but there is a possibility of the edges splitting and causing the condenser to work badly and vary in capacity.

XANIA (Sköien) states that his aerial is 90 ft. long and 30 ft. high and the primary of his receiver is 9 in. long and 4½ in. diameter, wound at ten turns per cm. He states that the primary with an inductance in series has nearly the same adjustment for all waves from 1,600 to 3,000 metres.

From the dimensions given your primary appears to be only large enough to tune to 1,600 metres, and as you do not state the dimensions of the inductance in series we are unable to say whether it is sufficient to tune to 3,000 metres. Its inductance should be nearly three times that of the primary for this to be the case. If you make one of this value your present instrument should be quite suitable for waves to 3,000 metres.

The instrument to which you refer should tune to 3,000 metres with a suitable variable condenser across the secondary, but the primary would require an additional inductance in series. It is not essential for the ratio of length to diameter of a coil to be 4/10. This is only the best ratio for obtaining an inductance with a minimum resistance. Coils with ratios greatly different from this value are quite suitable for most purposes.

The dielectric constant (specific inductive capacity) of paraffined paper is approximately 2.

You appear to have misread the formula in our reply to J. A. W. The upper line is D/L—*i.e.*, ratio of diameter to length, and not diameter alone.

F. F. R. (Edgbaston) enquires whether a serviceable pair of telephones for wireless purposes could be made by rewinding two ordinary telephone receivers to a higher resistance.

Answers.—(1) There is no reason why telephones so constructed should not be quite suitable, provided the receivers are of good design to begin with and care be exercised in rewinding them to see that the wire is put on in even layers and the insulation, which is, of course, very thin, is not damaged. The wire should fill the same space as that previously on the receivers.

(2) If you write to the Secretary of the local Wireless Association, he will inform you whether you are old enough to join.

Your suggestions that an article giving a list of technical terms and their meaning, and that all articles by amateurs describing their apparatus should be accompanied by clearly drawn diagrams of connections, are good. You will find, however, that in text-books intended for those who are commencing the study of wireless telegraphy, such as Bangay's *Elementary Principles*, the various terms used are clearly defined.

J. P. asks advice as to the necessary requirements, height and length of aerial, etc., and approximate price of putting up a wireless apparatus for communications between himself and a friend living two miles away. He further asks if a certain series of articles describes an installation.

Answer.—You will find described in back numbers of THE WIRELESS WORLD a large number of installations from which you will be able to choose the one most suitable for your requirements. The cost of an installation depends largely on the skill used to adapt materials which are to hand for the various parts.

If by "this series of articles" you refer to the Technical Instruction articles, they will not actually describe the construction of an installation, as they are intended to point out the theoretical considerations which are necessary for good results.

A letter in the following terms has been received from Mr. W. L. Kelly, of 39, Mill Lane, Liscard, Cheshire :—

"Before the war I owned a wireless station and held the Postmaster-General's licence for amateurs. I have, of course, been obliged to give it all up, and half my outfit went to the Post Office and the rest to the local police station. The first thing they asked me at the police station was whether I had brought my buzzer. As it happened, I did not have one for my wireless set.

"A friend of mine is coming to live near me, and I should like to know if I should be running any risk if I were to put up a single-wire telegraph, 25 feet high, with an earth return, between his house and mine, using a buzzer and tapping key at each end as well as the necessary batteries for working the same. The houses are about 100 feet apart. Would the police, who have instructions to watch previous wireless amateurs, take this new wire to be a fresh aerial ?

Answer.—Our advice will be found on p. 745, and the fruits of not following such instructions appears on p. 806 ; *verb. sap.* Mr. Kelly !

Trade Notes.

There are two maxims which every engineer does well to bear in mind, because upon the application of them depends the successful running and endurance of his engines. These two maxims are : (1) Nothing but the best oil should be used on engines or motors of any kind ; (2) Having chosen the best brand, stick to it. Most engineers of experience observe in the main our maxim number one, but some of them seem less aware of our number two. We have been requested by the famous old firm of Edward Joy & Sons, Leeds, to point out to oil users that the brand sold by them is the result of 107 years of experience in filling the requirements of engineers, and that it is only by careful adherence to the advice given above that the best results are obtainable from their products. They point out with justifiable pride that the Royal Automobile Club has never used any other oil but their "Filtrate Brand" ever since they first tested it twelve years ago. They point with pride to a long list of other users of their various brands, a list too long for us to print, but which includes such firms as the Wolseley Motors, the Ford Motor Company, and others.

In these days the British public has at last awakened to the fact that they have for many years been neglecting their own manufacturers with over a century's experience, and whose goods are thoroughly up-to-date, in favour of inferior foreign productions. It gives us, therefore, much pleasure to remind oil users of the claims to their custom possessed by Messrs. Edward Joy & Sons.

* * *

The Central Wireless Company's School, at 182 Monument Road, Birmingham, has been equipped with a modern transmitting and receiving set specially designed for instructional purposes. There is also a field station to work in connection with it from outside.

A speciality has been made of the workshop and laboratory, which is equipped with all the necessary materials and tools for building and repairing wireless apparatus, while in the class rooms there are one or two fresh and very interesting new departures in the way of instructional apparatus. Among the outstanding features is the Graham and Latham automorse instructional instrument which can be worked at any speed from 5 to 35 words per minute, and the note can be altered so as to give the effect of receiving messages from a number of stations. The Automorse system is expected to reduce the time at present spent in key thumping by about 50 per cent.

The school is also equipped for instructing candidates for the Post Office Telegraph service, and arrangements have been made for holding P.M.G. examinations in wireless on the premises.

* * *

Order, so we are given to understand, is the first law, and if precedence is established amongst statutes by the difficulty of fulfilment, it should certainly take the foremost place. The only way that the business of to-day, with its infinite ramifications can be conducted on a satisfactory scale is by the adoption of some or other system of filing.

The Amberg File and Index Company have reduced such systems to an art. Every species of cabinet for every purpose under the sun has been devised by them to meet each particular need, and their illustrated catalogue is quite a noteworthy handbook on the subject. We suggest that any reader who wishes to save both his public and his private time and at the same time to be able to put his hand on any of his correspondence or manuscripts at a moment's notice should pay this company a visit at their offices at 27 Little Britain, London, E.C., where he is sure to find something which will completely satisfy his needs.

Personal.

Mr. W. D. Lacey, the wireless operator stationed at Port Stanley, Falkland Islands, whose photograph we append, entered the service a few years ago, and has been stationed in this "farthest south" British possession for some time. His article on the recent glorious British naval victory in this quarter appears on pages 766 to 768, and

Mr. W. D. Lacey.

was communicated in a personal letter to Mr. W. R. Cross, Traffic Manager of the Marconi International Marine Communications Company, Limited, to whose kind consideration we owe the pleasure of publishing it. In these stirring times wireless operators not infrequently have the opportunity of narrating interesting incidents, and (subject to Censor's approval) we are always happy to publish suitable communications from them.

Mr. R. H. Klein, Hon. Sec. of the Wireless Society of London, desires mention to be made in THE WIRELESS WORLD of the fact that although his name has a somewhat Germanic sound, he is actually a Belgian, and a naturalised British subject, also a Licentiate in Consular Sciences of Antwerp.

Mr. P. L. Outred and a comrade-in-arms.

The accompanying photograph of Mr. P. L. Outred was taken on Christmas Eve. Before the outbreak of war Mr. Outred was a member of the 4th "Queen's" Royal West Surrey Regiment (Territorials), and was in camp on Salisbury Plain for his annual training when hostilities commenced. He was at once recalled, and after being stationed for a few weeks at Canterbury, his regiment was sent out to Secunderabad, India, to replace regular troops which were being sent to France.

Lieut. P. H. Flood-Page wishes to send his compliments to all membeis of the Engineering Staff. of M.W.T.C. now serving with His Majesty's Forces.

R.M.S.P.

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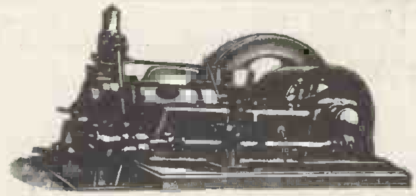

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The Editor will be pleased to receive contributions; and Illustrated Articles will be particularly welcomed. All such as are accepted will be paid for.

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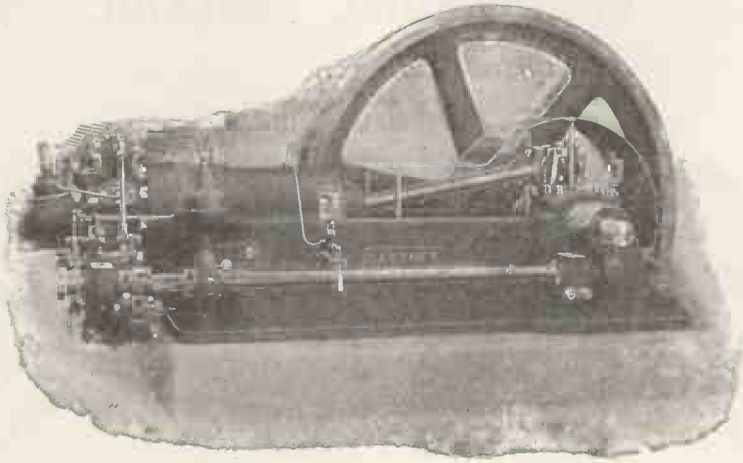

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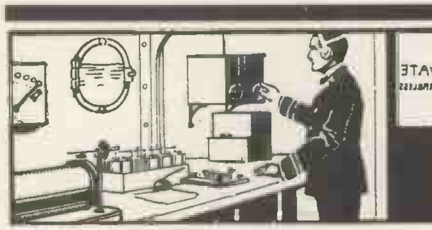

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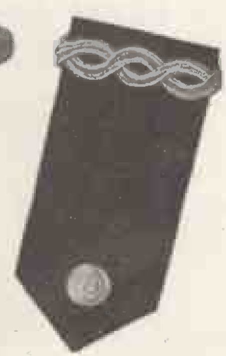

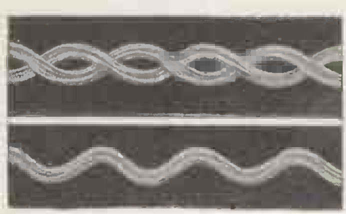

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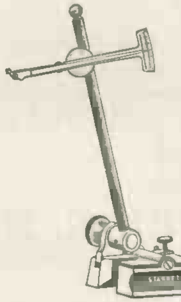

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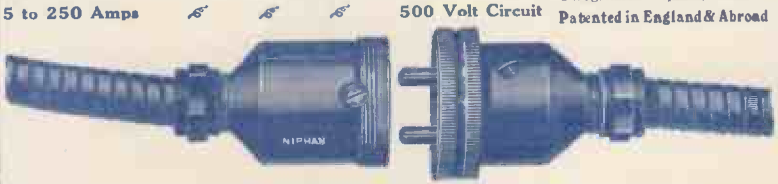

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