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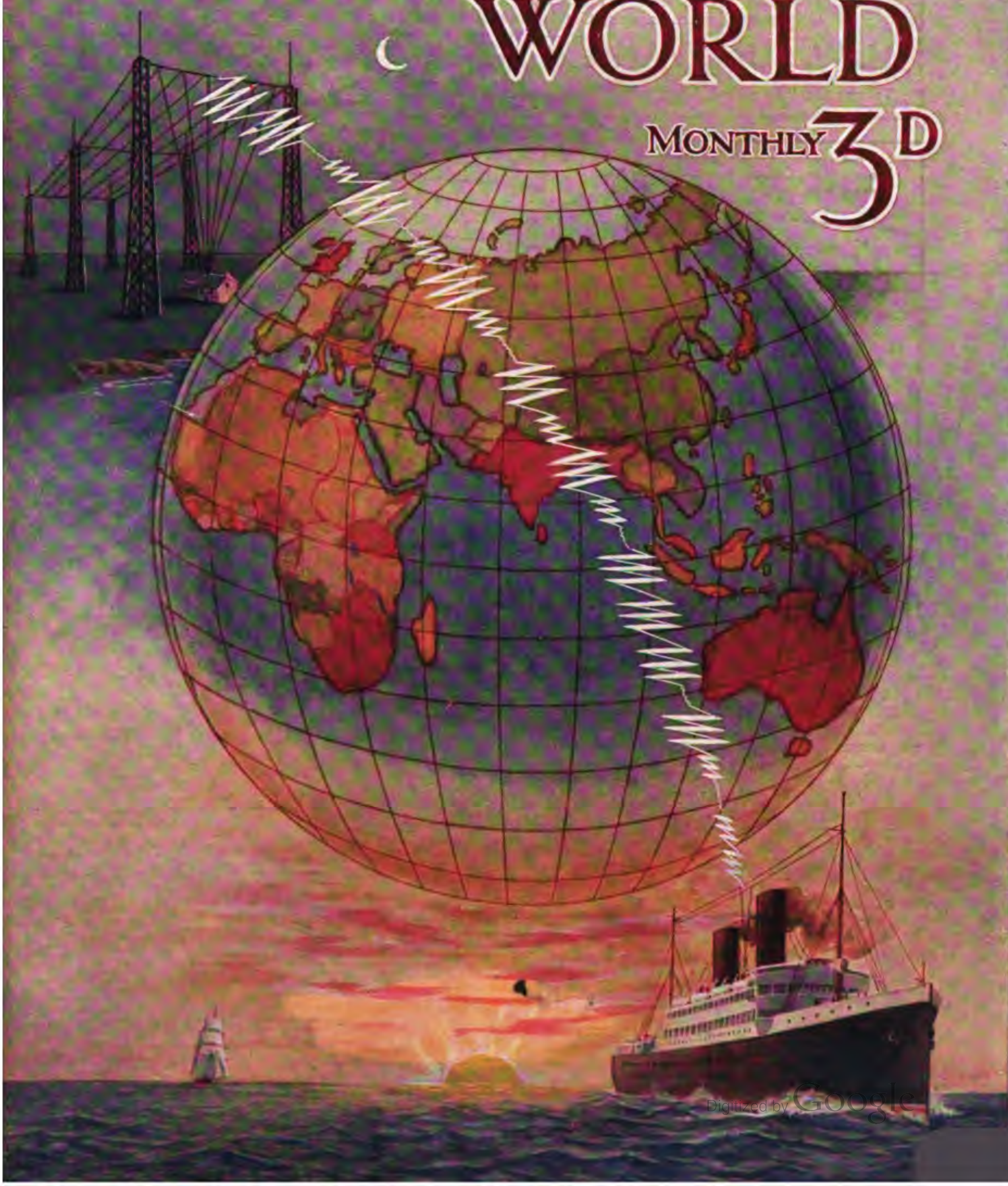
WIRELESS WORLD

MONTHLY 3D



THE WIRELESS WORLD

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WIRELESS IN THE BALKAN PENINSULA

A Note on the Trend of Events in the Near East

IN the earlier days of the war, when, as far as the general public was concerned, the development and utility of wireless were comparatively little known, the attention of newspaper readers was continually directed by their journals upon the constantly recurring evidence of its importance. Now the public has become so familiarised with its manifold branches of activity that the ordinary daily press places radiotelegraphy in the limelight much less than it did.

This, however, does not by any means imply that radio-telegraphy is retreating into the background. Far from it! We find that, whenever it becomes necessary to direct energetic measures against any fresh objective, a central feature of that objective consists of an important wireless station. Thus, when General Botha was skilfully conducting his operations against the Germans in South West Africa, his main objective, the capture of which enabled him to bring his conquest to a victorious issue, was the German centre of Windhoek, with its powerful wireless station. In the same way to-day, when the Allies are taking measures to chastise the insolent ambition of Bulgaria's petty Cæsar, one of the first operations of which we hear is a Russian naval attack upon Varna, the main Bulgarian port in the Black Sea, and the only town in Bulgaria, as far as we know, provided with a wireless installation.

The Balkan Peninsula forms in one way a historic landmark in the progress of wireless from the point of view of military operations; it was, we believe, the first scene of its employment to any great extent in general field warfare. It is true that some preliminary wireless experiments were conducted at the time of the British South African war and during the course of the Russo-Japanese struggle, but in those days the combination of portability and reliability which are essential for successful and rapid field work had not been attained. By the time, however, that the Balkan imbroglio of 1913 occurred, military wireless had reached such an advanced stage that it became indispensable to the operations of all the armies concerned. Our readers will remember how a portable set at Adrianople demonstrated itself to be of the greatest use in communicating with Constantinople from the beleaguered city, and indicated strikingly to the world at large that, thanks to radiotelegraphy, it was no longer possible for a besieged town to be cut off from outside communication in the way that was possible before the advent of marconigrams. Such isolation, for example, as was effected by the Russians in their famous 1877 siege of Plevna, and which had been the general rule when a town blockade was made really effective, has become, thanks to wireless, no longer possible.

The present writer, in the course of an extremely interesting interview at the Serbian Legation, was given to understand that the wireless sets in the possession of the Serbian army proved of the greatest utility to that hardly tried force in the course of their exhausting retreat across the Albanian mountains; in fact, it formed the only means available for keeping the Serbian units in touch with one another.

RT. HON. SIR JOSEPH WARD, BART., P.C., K.C.M.G., D.C.L., LL.D.

Personalities in the Wireless World

THE RT. HON. SIR JOSEPH WARD, BART., P.C., K.C.M.G., D.C.L., LL.D.

OUR Australasian cousins have for some time appreciated the benefits which may accrue from the adoption of wireless telegraphy to supplement or supersede the other means of telegraphic communication already in use in that part of the world. And this is due in no small measure to the interest and initiative of the subject of our illustration. The Right Honourable Sir Joseph Ward, Baronet, is an Australian by birth, having first seen the light at Emerald Hill, Melbourne, in 1856. He is thus just sixty years of age, and his career has been as varied as his life has been long.

He commenced at the bottom of the ladder as a telegraph messenger boy in the department over which in later years he presided as Minister. In 1887, when thirty-one years old, he entered the New Zealand Parliament, and after three years accepted the portfolio of Postmaster-General (February 4th, 1891) in the Ballance Ministry, and held that position, with the exception of the period 1896 to 1899, continuously until 1912, when he resigned it. He was three times Acting-Prime Minister during the absence of the late Rt. Hon. R. J. Seddon from New Zealand, and after the death of the latter gentleman in 1906 he assumed the position of Prime Minister, which he resigned in 1912.

Sir Joseph Ward was one of the first advocates of the All-Red Cable Service, which he had the satisfaction of seeing inaugurated on the Pacific side. His introduction, on January 1st, 1901, of penny postage into the relations of New Zealand with countries overseas formed the crowning result of many years of sustained effort in pursuit of that beneficent measure. The reduction of postal rates, the extension of telegraph facilities, the pushing of mail services into the wilderness, are among the many postal and telegraphic conveniences which mark the activity of his mind and his generous foresight in the public interest.

He quickly saw the advantages of wireless telegraphy, and as a result of his efforts contracts were let in 1910 for the installation of two high-power wireless stations at Awanui and Awarua respectively and three low-power stations at Auckland, Wellington, and Chatham Islands respectively. In this connection it is interesting to note that the first radio station opened in New Zealand was situated in the tower of the General Post Office at Wellington, and was opened on July 26th, 1911. Sir Joseph Ward has been one of the most prominent figures in the politics of the Dominion for the last quarter of a century, and his powerful influence has been felt in practically every legislative field during that time.

The Special Problems of Aircraft Wireless—III

By H. M. DOWSETT, M.I.E.E.

Aircraft Balancing Capacities. Airships.

THE airship radiating system comprises a fixed balancing capacity, and a trailing aerial let out to such a length that it has the same natural period as the balancing capacity. This is the simplest arrangement. Considerably longer wave-lengths than what would be thus obtained are often used for transmitting, in which case the radiating system is tuned by inserting an inductance coil in series with the fixed balancing capacity and by letting out more wire of the trailing aerial. Should the airship be travelling low or at high speed, it may be found convenient to insert inductance also in series with the aerial instead of increasing its length. When the capacity and inductance in the radiating system are thus no longer distributed but are concentrated and separated, it becomes of use to know what the electrostatic value of the balancing capacity actually is.

Airships are divided into three classes: (1) "rigid," (2) "semi-rigid," and (3) "non-rigid," according to the degree of support given to their gas-bags.

The "rigid" class, of which the Zeppelin, the Schütte-Lanz, and the Speiss are examples, has several gas-bags enclosed in a skeleton frame of metal or wood.

The "semi-rigid" class, to which belong the Lebaudy and the Gross, has a metal or wood frame keel built on the gas-bag.

The "non-rigid" class, which includes the Clement-Bayard, the Parseval, and the Astra-Torres, has a perfectly flexible gas-bag, but sometimes, as in the case of the Clement-Bayard, a stiffening girder is supported by triangulated steel ropes some distance below the gas-bag.

The form of radio balancing capacity used will naturally vary with the type of airship and the degree the airship's structure lends itself to form a suitable capacity surface.

In Class 1, the Zeppelin stands in a grade by itself. Its aluminium skeleton, to which two boat cars or gondolas are rigidly fixed, forms an excellent balancing capacity of comparatively high value and also of low ohmic resistance. To this last quality it owes a well-established reputation for better wireless reception than can be obtained on any other type of airship.

Fig. 1.—Zeppelin Airship under construction in dock on Lake Constance.

Fig. 1 shows the frame of a Zeppelin under construction. The mass of light girder work and cross-bracing forms a lattice cylinder having an electrostatic capacity in free space not very much less than that of a cylinder

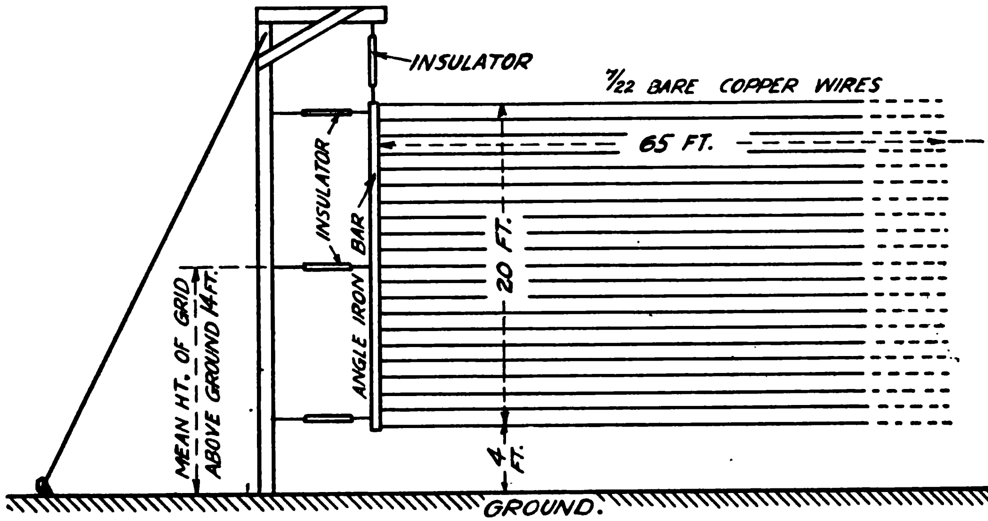


Fig. 2.

of equal size but having an unbroken surface of sheet metal.

The following test carried out at the Marconi Works some three and a half years ago illustrates this point. Two insulated angle iron bars 20 ft. long were suspended and stayed vertically 65 ft. apart, from scaffold supports, the bottom of the bars being 4 ft. above the ground. They were connected by horizontal wires of 7/22 S.W.G. bare tinned copper, carefully adjusted to equal length, the number of wires being varied from 2–20 ft. apart to 101 2·4 in. apart, *see* Fig. 2. The capacity of the wire grid so formed was measured, and the results obtained are indicated in the curve, Fig. 3. Sufficient values are given to determine the general shape of the curve, which shows that the increase of capacity with increase of number of wires ceased to be measurable at about 70 wires, and that therefore the capacity given by 101 wires separated 2·4 in. was practically the same as that of a plate of sheet metal of the same area. In fact, two or more wires which share the same charge have their individual free space capacity reduced by being brought near one another, and, as is well known, this reduction is proportional to, "log (length/distance apart)." The following table shows that for a ratio of "length/distance apart" of 130 : 1 there was a reduction of 1·25 per cent. from the maximum capacity, for a ratio of 65 : 1 a reduction of 10·9 per cent., and so on.

Number of 65 ft. 7/22 wires.	Distance between centres.	Capacity mfds.	Difference from max. capacity.	Length / Distance apart.
			% less	
101	2·4 in.	·00412	—	325
41	6 ,,	·00407	1·25	130
21	1 ft.	·00367	10·9	65
11	2 ,,	·00300	27·2	32·5
2	20 ,,	·0015	63·6	3·25

Now the Zeppelin, as is shown very clearly in Fig. 4, is a sixteen-sided vessel, and the *L I*, 525 ft. in length and 50 ft. in diameter, will have had its main longitudinal members separated a distance of 9·8 ft. But the effect of its wire cross-bracing must also be allowed for, and, as shown in Fig. 5*b*, this was equivalent to introducing two parallel wires between each pair of longitudinal members, so that for the purpose of calculating the capacity of the *L I* skeleton it may be considered as a cylinder of 48 longitudinal members instead of 16, without cross-bracing, spaced a mean distance apart of 3·3 ft. Then its ratio "length/distance apart" was 160 : 1, and from the table given above its capacity in free space could not have differed from that of a cylinder of sheet metal of equal size, by much more than 1 per cent. If no allowance were made for the cross-bracing the difference from maximum capacity would be 17·5 per cent. The formula for the capacity of a prolate ellipsoid which would be used to calculate the capacity of a Zeppelin skeleton is as follows:

$$C_{cms.} = \frac{2\sqrt{l^2 - r^2}}{\log_e \frac{l + \sqrt{l^2 - r^2}}{l - \sqrt{l^2 - r^2}}}$$

where l=*half* the length in cms., and r= radius in cms. of the framework.

Fig. 4 is a view of the *L II*, a vessel 487 ft. long, 55 ft. diameter, and a ratio "length/distance apart" of its effective longitudinal members as calculated above of 135, from which it follows that its capacity in free space must have been about 1·25 per cent. less than that of a sheet-metal cylinder of the same overall dimensions. The *L II*, it may be remembered, exploded in mid-air, and her crew of twenty-eight were burnt in the wreckage.

It may be of interest here to give the capacity values in one or two practical cases.

The *L I*, 525 ft. long, 50 ft. diameter, probably had a capacity in free space of 2,620 cms. A single 7/18 S.W.G. wire of the same length, by calculation—*see* formula (1) below—should have a capacity in free space of 723 c/ms. Although less than 1/4000th of the Zeppelin diameter, it would have more than a quarter of its capacity.

The capacity of long straight wires is useful to know, as the balancing capacity used on the Schütte-Lanz type of airship—which is rigid like the Zeppelin, but has a framework of ash and poplar instead of aluminium—is made up of one or more parallel wires stretched between the gondolas (Fig. 6). The position of the gondolas is about half-way between the centre of the airship and each end. The largest German airship in commission before the present war was a Schütte-Lanz, the *L IV*. It sank in the North Sea.

A flat grid, 50 ft. wide, of equally spaced wires, each wire 525 ft. long, the grid being, therefore, equivalent in area to the longitudinal section through the *L I*, would have by calculation—using formula (2) see page 714—a free space capacity of

1,988	c/ms. with	21 wires.
2,000	,,	24 ,,
2,041	,,	42 ,,

the last value being practically the same as for sheet metal of the same area, as the ratio "*l/d*" in this case is 430 : 1. This same value is only 22 per cent. less than the capacity of the complete Zeppelin skeleton.

Suitable formulæ for calculating the capacity of a parallel grid of wires, and also as will be seen later, of grids of wires which are not parallel, should prove of considerable use to the aircraft wireless engineer.

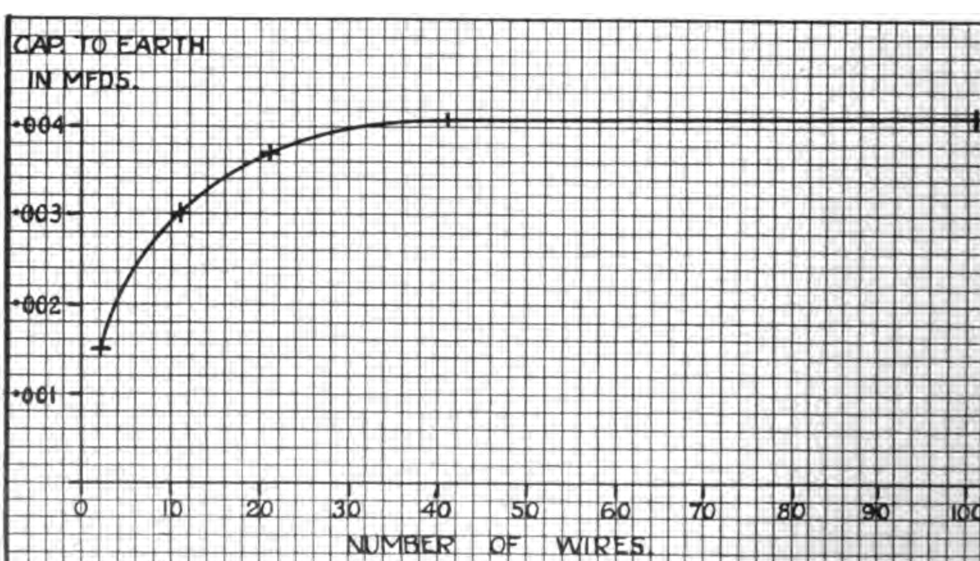


Fig. 3.

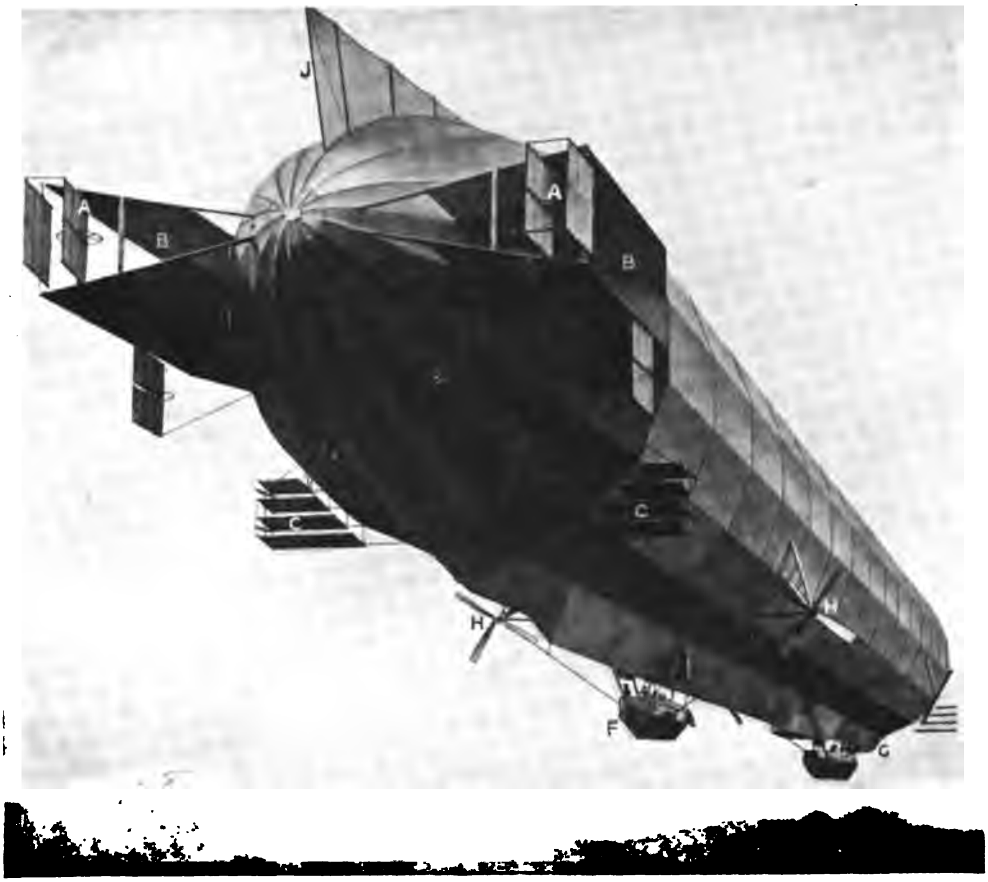


Fig. 4.—Zeppelin L II.

AA Rudder planes. BB Air passages. CC Dipping planes. F Stern gondola.
G Forward gondola. HH Propellers. J Rudder.

Of the several attempts which have been made to construct such formulæ the work of Prof. G. W. O. Howe has been particularly thorough. His formulæ are practical in shape, and by the aid of curves they have been made simple to handle.

Within certain limits they appear to give reasonably accurate results.

According to Howe * the capacity in centimetres of a single wire far removed from earth is

$$C = \frac{l}{2 \log_e (l/r) - 0{\cdot}618} \quad . \quad . \quad . \quad (1)$$

The approximate capacity of a parallel grid of such wires is:

* WIRELESS WORLD, December 1914.

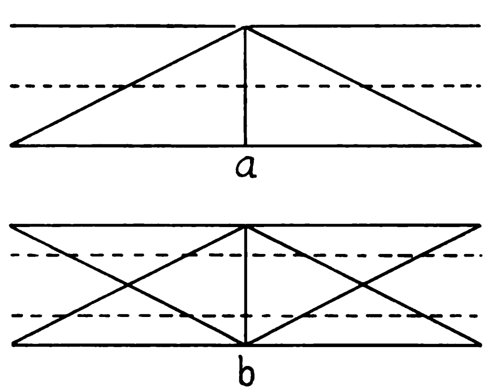


Fig. 5.—Extra Capacity due to Cross Bracing

(*a*) Equivalent to single wire shown dotted, parallel to and midway between longitudinal members.

(*b*) Equivalent to two wires shown dotted, parallel to and spaced $\frac{1}{4}$ and $\frac{3}{4}$ the distance between the longitudinal members.

$$C=\frac{nl}{2\{n\log_e(l/d)+\log(l/r)-B\}} \quad (2)$$

A closer approximation to the capacity of such a grid is obtained by the following formula provided " l " is a large multiple of " nl."

$$C=\frac{nl}{2\{n(\log_e l/d-0{\cdot}309)+\log_e d/r-B\}} \quad (3)$$

and the following expression is said to be rigidly accurate:

$$C=\frac{nl}{2[n\{\log_e(l/d+\sqrt{l^2/d^2+1})-\sqrt{1+d^2/l^2}+d/l\}+\log_e d/r-B]} \quad . \quad (4)$$

where l=length of each wire.

r=radius of each wire.

d=distance between wires.

n=number of wires.

B=the mean of the values $(\log_e \underline{/n-m/m-1})$ for the whole grid of wires, each wire in turn being the mth.

Values of B up to 12 wires in the following table have been calculated by Prof. Howe. The values for n=21, 24, and 42 were calculated by the writer in order to test the above formulæ. When the number of wires is large, the calculation of B is a tedious operation, but it has only to be done once, and then can be used for all future calculations involving a like number of wires.

n	B	n	B
2	0	9	8·06
3	0·46	10	9·80
4	1·24	11	11·65
5	2·26	12	13·58
6	3·48	21	34·2
7	4·85	24	42·03
8	6·40	42	95·7

Using formula (4) the calculated capacity in free space of 42—7/22 wires forming a grid 65 ft. by 20 ft., as shown in Fig. 2—is 289·7 cms.

Correcting for the effect of the earth,* the capacity becomes 397·5 c/ms.

Now the measured value for 42 wires from curve, Fig. 3, is ·0041 mfds. or 369 c/ms.

The calculated value is, therefore, 7·6 per cent. high. As the calculated value assumes a perfect earth, whereas under the conditions of test the earth was far from perfect, being simply grass-covered soil containing no earth-plates or wires in the close neighbourhood, this difference is quite reasonable, and the test results may be said to support the formula.

(To be continued.)

* WIRELESS WORLD, January 1915. Formula not needed for calculating aircraft capacities.

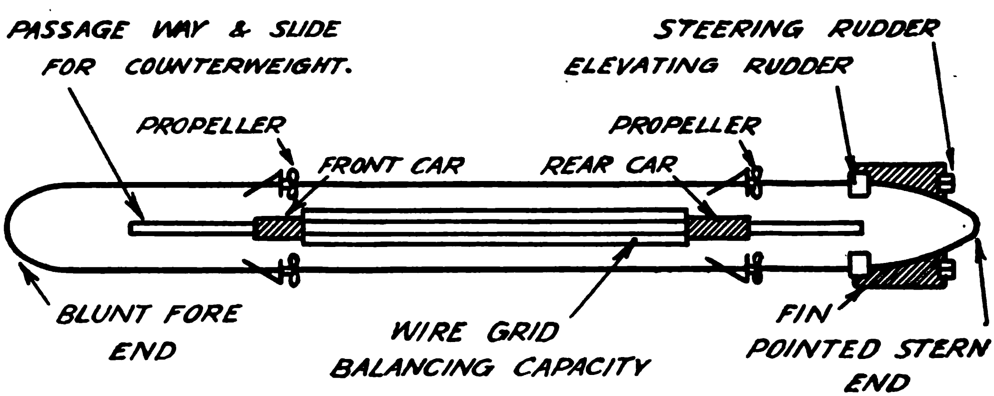


Fig. 6.—Schutte-Lanz Airship. View from below.

Wireless apparatus generally in front car. Wire grid balancing capacity may sometimes be extended beyond rear car.

Digest of Wireless Literature

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

PREVENTION OF COLLISIONS IN FOG.

In a paper presented at the Royal Society by Professor J. Joly, a method of estimating distances at sea in fog or thick weather was outlined. The method depends on the different velocities with which disturbances travel in different media.

If aerial and submarine signals are simultaneously emitted at a lighthouse or lightship the lag of the aerial as compared with the submarine sound is about 4·3 seconds per nautical mile. If therefore an approaching ship can pick up the signals and measure the lag even to a quarter of a second, she becomes aware of her distance to less than a quarter of a mile. If the faster moving signals are sent out in groups, the individual signals being spaced to regular intervals, say of one second, and the slower moving signal is always emitted simultaneously with the first signal of a group, the navigator has only to count the faster signals till the slower signal reaches him in order to estimate his distance from the signal station. In this case the signals themselves tell him his distance, and no actual time measurements are required on board the ship. Similarly wireless and submarine signals or wireless and aerial signals may be used.

The system may be extended to the problem of avoiding collision in fog. If vessels possess the means of emitting a loud and crisp sound signal which can be sent out simultaneously with a wireless or submarine signal, the determination of distance thereby rendered possible, together with the wireless information as to course and speed, will enable the navigator on each ship to determine with certainty (1) whether or not there is a risk of collision, and (2) the point on his own course and the moment at which collision is threatened. The solution of the problem is based on the fact that at each instant the rate of approach is the maximum if the ships are advancing so as to collide. A simple geometrical construction, which by its character is unlikely to involve error, enables the navigator to solve the problem immediately the signals are received.

* * *

THE EFFECTIVENESS OF GROUND ANTENNÆ.

Mr. R. B. Woolverton recently read a paper before the Institute of Radio Engineers, New York, on the Effectiveness of the Ground Antenna in Long Distance Reception. The subject of the paper was suggested in October, 1914, when resonance curves were being taken by the writer at Eccles, Cal., on waves emitted by the various high powered commercial stations situated in the vicinity of San Francisco, at a distance of approximately 100 miles. The antenna used in taking these resonance curves consisted of the top wire of a five-foot fence extending in a north-westerly direction for a distance of approximately 4,000 feet. Although the antenna used was quite aperiodic, as might be expected, the received energy in the secondary circuit was remarkably large, signals being heard from stations in the Hawaiian Islands and Alaska. By using the ordinary crystal detector full scale deflection was obtained on a portable galvanometer when taking resonance curve data on the wave emitted by the high powered Marconi station at Bolinas, Cal.

In view of the results obtained at Eccles, the writer conducted on October 9th and 10th, 1915, experiments of a somewhat more quantitative character at the Palmer B. Hewlett ranch, situated ninety miles south by east of San Francisco. The receiving apparatus was of the oscillating vacuum valve type, using a second step amplifying bulb, and the audibilities were read on an audibility meter.

Before beginning the experiments it was thought that a comparatively long single wire antenna would be so directional in effect that it was decided to confine the readings to one particular station; and Sayville, Long Island, was chosen, the antenna being made as nearly directional toward that station as possible. Buildings slightly interfered with this plan, however, and the antenna's true direction from the receiving apparatus was west-south-west, instead of more nearly west. As soon as readings were begun it became apparent that this directional effect did not exist, as is shown by a table accompanying the paper. The two antennas consisted of 500 foot and 1,000 foot lengths respectively of a single Number 28 B. and S., cotton covered magnet wire laid on dry earth without support at any point. The audibilities for the four transmitting stations are shown below.

Antenna.	Sayville.	Honolulu.	Arlington Arc.	Arlington Spark.
500 feet ...	50	100	60	100
1,000 feet ...	80	160	80	160

The audibility of atmospherics was unity in each case. Atmospheric audibilities taken during the period of the tests on a five-wire antenna, 45 feet high and 100 feet long, averaged 100. The results are, therefore, of great interest to all who are concerned with the problem of eliminating atmospheric trouble.

The paper closes with a foreshadowing of further experiments by the writer, showing that he intends to go much further into the matter.

* * *

THE EXPANDING HOT-WIRE AMMETER.

The measurement of antenna current in a wireless transmitter is usually carried out by means of a hot-wire instrument, the high frequency of the current to be measured making it impossible to utilise many of the forms of ammeter suitable for currents of lower frequency. Mr. William H. Dettman, in a recent number of the *Wireless Age*, writes an interesting article on the Physics of the Expanding Hot-Wire Ammeter, from which we extract the following notes.

In forcing a current against the resistance of a wire, a certain amount of electrical energy must be expended which manifests itself as heat. Let (R) be the resistance of the wire in ohms and (I) the current in ampères, made to flow through it under the potential difference of (E) volts applied to its ends. Then the power expended in the wire is given by the equation:

$$P=EI \text{ or } I^2R. \text{ since } E=IR,$$

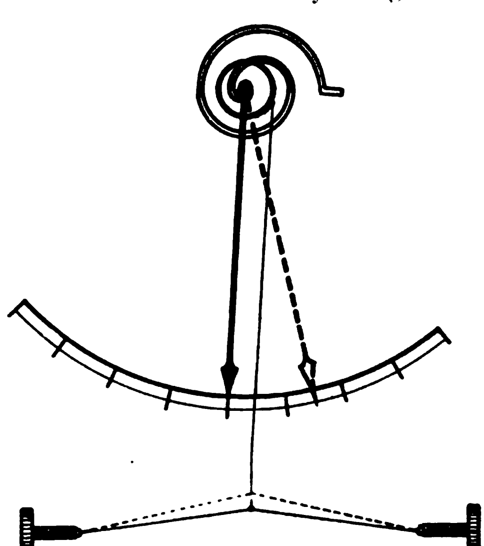
which appears as heat. The total energy (W) transformed into heat in (t_1) seconds.

$$W=I^2Rt_1 \text{ or } EIt_1 \text{ Joules.}$$

The unit of heat in the C.G.S. of units is the gram calorie, which is the amount of heat required to raise one gram of water through 1 degree centigrade. One Joule equals ·24 calorie.

$$W^1=\cdot 24\ I^2\ Rt_1 \text{ calorie.}$$

This heat raises the temperature of the wire above the temperature of its surroundings, with the consequent increased rate of heat loss by radiation, convection and conduction. A body is said to give off heat by radiation when the heat is conveyed away from the body by ether waves, these waves being similar to light waves but much longer. A body loses heat by convection when it is immersed in a fluid such as air or water as a result of the molecules of the fluid coming into contact with the hot body and robbing it of some of its heat, thereby raising their own temperature. These molecules are then carried away from the heated object by the motion of the fluid. A body loses heat by conduction when it is in contact with solid objects, the molecules in contact with the heated body taking some of



the heat from it and handing it on to other molecules further away from the body.

If the wire lost no heat by any of the methods referred to, all the heat would go to raise the temperature of the wire. If (W) is the weight of the wire and (S) the specific heat of the material of the wire, which may be defined as the ratio of the quantity of heat required to raise the temperature of the material through 1 degree centigrade, to that required to raise the same mass of water through 1 degree centigrade, then the temperature (T) acquired by the body after (t_1) seconds, assuming (R) and (S) remain constant, is given by the equation

$$T = \frac{\cdot 24\ EIt_1}{WS}$$

The temperature of the conductor would continue to rise until it would melt, and thereby break the circuit. But the above state of affairs is never realised, since every body, when at a temperature above its surroundings, always loses heat by radiation, convection and conduction, except when placed in a vacuum, as the filament in an incandescent lamp, when it loses heat by radiation mostly, and a small amount by conduction along the lead-in wires which may be neglected.

After giving further explanations regarding temperature, amount of heat radiated, etc., the author says that it can be seen from an equation given that if other things are constant, the increase in length of the wire is proportional to the square of the current, and therefore this property of the wire may be used to indicate the root mean square value of the oscillatory currents used in radio communication, if this wire be so mounted as to show by means of a pointer its elongation when the currents flow through it. Since the coefficient of linear expansion for most wires is very small, the elongation will also be small for moderate currents, and therefore moderate rises in temperature of the wire.

By using a very fine wire we not only increase the resistance, but also at the same time decrease its surface. The resistance can furthermore be increased by employing a wire having a high specific resistance. This specific resistance should not only be large, but it must be practically constant for such changes in temperature as are encountered in the use of the wire as a current indicator, otherwise the accuracy of the instrument will be impaired.

Even after taking all the measures mentioned to make the increase in length for a given current as large as possible, it is still so small as to necessitate some arrangement for magnifying this elongation. The method generally adopted for effecting this magnification in the hot-wire ammeter used for measurement of high frequency currents is indicated in the figure.

The extremities of the wire through which the currents to be measured pass are fastened to the screws shown. To the centre of the wire one end of a silk thread is fastened whilst the other passes round the drum behind the spiral spring. The drum and the pointer are fixed to a spindle which turns in jewelled bearings to diminish friction, and the spiral spring serves to keep the thread and wire taut. It will easily be seen that if a current passes through the wire and causes it to sag the pointer will move over the scale.

* * *

THE SIGNALLING RANGE IN RADIO-TELEGRAPHY.

The several series of long-distance transmission tests, carried on jointly by Dr. L. W. Austin and the National Electric Signalling Company, are referred to by Mr. John L. Hogan, junr., in an interesting paper bearing the above title in the *Electrical World*. These tests, says Mr. Hogan, included measurements of the effects on signalling range of antenna height, antenna current and wave-length. Heights from 37 feet to 130 feet, sending currents from 7 amp. to 30 amp., and wave-lengths from 300 metres to 3,750 metres, were observed at distances up to 1,000 nautical miles. Correlation of the data thus secured led to the expression

$$I_r = \frac{4{\cdot}25\ I_s h_1 h_2}{\lambda d}\ \epsilon^{-0{\cdot}0015d/\sqrt{\lambda}}$$

where I_s and I_r are sending and receiving antenna currents in ampères, h_1 and h_2 effective heights at sending and receiving antennas in kilometres, λ and d the wave-length and signalling distance in kilometres. As is easily seen, the expression can be used to compute the antenna currents or heights necessary to produce a required signal strength at any given distance under normal daylight conditions. With average

500 cycle spark senders and good crystal receivers, about 10 microamp. receiving antenna current are necessary for barely audible signals.

Later tests over greater distances extended the observations to antenna heights of 450 feet, sending currents of 110 amp. and distances of 2,300 nautical miles. None of the data then obtained indicated need of altering the functional relations of the several quantities given in the equation (1), though it was found that with the rectifying heterodyne receiver on 5 microamp. receiving antenna current gave signals of unit audibility, even with spark transmitters.

The expression (1) above has therefore been fairly well verified by applications to many instances of radio transmission. It is probably the most nearly accurate equation for computations of the sort necessary if signalling distances and intensities are to be predetermined rather than estimated For rapid numerical work it is desirable to state the various quantities in the units which are most convenient for their measurement; for instance, if sending current is in ampères, receiving current in microampères, antenna heights in feet, wave-lengths in metres and distances in kilometres, the equation becomes

$$I_r = \frac{392\, I_s h_1 h_2}{\lambda d} \epsilon - 0{\cdot}0474 d/\sqrt{\lambda}$$

Or if, the other units remaining as just stated, distance is expressed in nautical miles, the coefficient of I_s should be 212 and the exponential coefficient 0·0877.

After pointing out that the simple algebraic solution is possible for all quantities except λ and *d*, Mr. Hogan says that these latter cannot be determined explicitly by the common methods, since they occur both linearly and exponentially. He then explains an ingenious logarithmic method of solving *d* which is the basis of a series of curves used at the United States Navy Yard, Puget Sound, Wash. A chart is also given for computing signalling ranges for various antenna heights and wave-lengths.

* * *

WIRELESS AND AIRSHIPS.

In view of the series of articles on Wireless Telegraphy as applied to Aircraft which have been appearing in our pages, we think that the following extracts from a paper read at the Royal United Service Institution by Lieut. (now Commander) F. L. M. Boothby, R.N., will not prove uninteresting. The paper was read so long ago as April, 1912, and our contemporary, *The Aeroplane*, publishes a number of extracts by permission of the Council of the R.U.S.I. We reproduce below one of the parts dealing with wireless telegraphy.

When we come to consider the behaviour of airships at sea in relation to the weather, says the writer, we shall find that wireless telegraphy is of the greatest assistance. A point in favour of the airship is that, unlike the aeroplane, it can receive as well as send a wireless message. Such importance is wireless likely to assume that I imagine in the near future the Meteorological Office will have to be fitted with its own wireless station and work on its own special tune to transmit warning and advice to aircraft.

In searching for hostile submarines the airship has an advantage over the aeroplane, in that she can hunt slowly and carefully with four times the number of lookouts. To keep aircraft off, submarines would have to remain on the surface, where they are liable to be attacked by ordinary ships, so, when once they are located, their position will not be very enviable. Once the battle fleet knows the whereabouts of the submarines they can easily avoid them, and the long range wireless telegraphy of the airship is a very great advantage here, as she can pass information without losing sight of the enemy; in fact, wireless is at present the most important part of the equipment of aircraft, practically doubling their range and utility, and once they have got important information through, it does not very much matter what ultimately becomes of them.

The Editor of the *Aeroplane* adds, in parenthesis, that this last is a very noteworthy piece of prophecy. Few people, even in the services to-day, realise that wireless is at present the most important part of the equipment of aircraft.

"S.O.S"

From "*The Star.*"

A morning paper describes "Wireless telegraphy as a calling for women." To the tune, we suggest, of "Who's dat a-calling so sweet?"

In Revolutionary Mexico

A Trip South to fit s.s. "Cetriana"

By L. MAYNE.

THE trip south to Mazatlan, Mexico, *via* San Francisco, was very ordinary and uneventful except for a visit to the Exposition at San Francisco, which was a veritable wonderland.

The southern trip was made on the s.s. *British Empire*, a very old freighter of the well-deck type (correctly named, for it never was dry).

On Sunday, April 11th, we arrived at Mazatlan; beautiful clear skies and hot weather seemed to be the rule here at this time of the year. The city, as will be seen from the accompanying photo, is somewhat quaint, and possesses a street-car system comprising two cars and five mules, all very much the worse for wear.

From April 11th to the 16th the time was spent looking over the sights, owing to the Customs delaying the transfer of the wireless apparatus from the s.s. *British Empire* to the s.s. *Cetriana*, for which vessel the set had been shipped from Vancouver, B.C.

On April 16th the apparatus was on board the *Cetriana*, and the vessel left for San Francisco. The operator who was to remain on board the vessel, and myself, trying to make up for lost time by working like Trojans, managed to have the installations completed and the aerial aloft by the afternoon of the 18th. On the evening of the 18th we sent out our first message from the extreme southerly point of Lower California to the Marconi station at East San Pedro (KPJ). Considering that the installation was the Marconi ½ kw. Standard Ship Set, and the distance covered about one thousand miles, the result was gratifying.

April 20th saw us running short of fuel, but nothing to cause any real worry. We passed the Japanese warship stranded in Turtle Bay during a heavy fog; several Japanese vessels were standing by salving her.

On the 22nd, at 8 a.m., we arrived at Ensenada, Mexico, and from now on things

Panorama of Mazatlan.

Mazatlan Cathedral.

began to take great strides in making our trip eventful.

Our captain went ashore to clear Customs and land our 150 passengers. The passengers consisted of Hindu, Japanese and Chinese. We had no food or water left and only six tons of coal on board. It was hoped, therefore, that we should have been able to replenish supplies and proceed that same afternoon to San Diego, Cal.

About 9.30 a.m. it was seen that something was amiss, as the captain's gig was taken from the wharf and anchored in the bay, and later the owner of the vessel (who was on board the *Cetriana*) asked me to try and get the U.S. Naval Service and see if it would be possible to procure some fuel from them.

Nothing matured during the day, and, without being relieved in any way, we retired for the night.

Next morning (23rd) found us still anxious for our shore party, which consisted of the captain and purser (the latter being a native of Ensenada), until about 12.45 p.m., when a note was sent aboard from the captain asking me to send out the SOS and get in touch if possible with a British warship—there were some in that locality—and explain our plight. Lying at anchor, abeam our vessel, was the s.s. *Mazatlan*, an American vessel that had been taken charge of by the port authorities, and immediately I had completed the call for help the operator on the *Mazatlan* began making dashes, and continued at this for some time, until an armed party came aboard and took operator Periard and myself prisoners. At first we resented, but there was no other course open. Landed on the wharf, we were escorted to the military court, and for the first time learned something of the charge laid against our ship.

It appeared our vessel had no clearance papers from Mazatlan (Caranza district, and we were now in Villa territory), also that the vessel was supposed to have acted as a troopship for the Caranza forces, and that wireless had been installed on the vessel to enable us to carry on our "filibustering" (as they termed it) with greater success.

No charges were laid against the operator or myself, but we were not allowed back or near the *Cetriana*, and we were allowed freedom of the two main streets from sunrise until 8 p.m.

We were quartered at the hotel, paying for our meals, although we were prisoners.

Accidentally we remained out one night in company with the captain, who was allowed the same privileges as ourselves, until 9.20 p.m., so our guard was increased, and we were rounded up to the hotel at 8 p.m. each evening.

The *Cetriana* had on board a very valuable cargo—gold, silver, hides, hemp, and other foods, and many thousand pesos gold.

Villa's people being very short of funds, the cargo of our vessel would have proved a veritable godsend.

The shippers were Germans, and the consignees were also Germans; so the British Consul would not act to save the cargo, and we were detained until the Court had *authority* to seize what we had.

The American Consul made every effort to save the cargo, and left for San Diego to get in touch with Washington, as he was refused the use of the telegraph lines, and the British Consul busied himself in trying to find out who was responsible for my being brought ashore by force of arms, as I was shown on the ship's papers as a passenger —a Britisher on board a British ship.

The outcome of these various actions on our behalf was the arrival of the U.S.S. *Denver*.

On Wednesday, the 28th, things looked a little worse, and the British Consul, fearing for the safety of our captain, took him home with him to his ranch, but when this was discovered it made our position rather awkward, as there was an impression that some movement was on foot to get us back to the *Cetriana*.

The following morning we met the captain of the American gunboat, and in company with him went in search of our captain. We all visited the Courts, and at 9 p.m. we were free once more. In the excitement we had eaten nothing all day, so on arrival on board the *Cetriana*, after all the handshaking had been gone through, we looked around for food; it was only then that we learned the awful plight of those on board since the ship's arrival practically without food or water.

The gunboat *Denver* sent over some canned beef and fresh water; the water was pumped into a lifeboat and towed over to us by a launch, but as there was a very heavy sea running at the time and our boat riding very low a number of seas were

Types of Mexicans.

Wireless Tower, Mazatlan.

shipped before our vessel was reached, almost destroying our supply of fresh water.

It was arranged that the *Denver* should take us in tow at 4 a.m. on Friday, but a gale sprang up and they advised by semaphore of their inability to take us out till later on. I was on the bridge at the time, and my experience in semaphoring came in handy at the time, as I was able to take their messages and forward our captain's replies.

Owing to the huge breakers rolling into the harbour it was necessary for us to move our position to the port quarter of the *Denver* in order to obtain some shelter. The wind did not die down until Saturday morning, and, although there was a heavy sea running, a tow-line was passed aboard at 7 a.m. and our journey started. At 8.10 a.m. the line broke, but without very much delay another line was made fast by the tars of the *Denver*, and we continued on our way, arriving at San Diego about 6.30 p.m. the same day.

On our arrival at San Diego fresh water and provisions were the first things brought on board, and the memory of that, our first square meal for one week, still lingers.

Almost an entire week was spent at San Diego trying to straighten out the tangle caused by the passengers who could not land in the States and were not allowed to land at Ensenada. They resented being taken to San Francisco.

We left San Diego on Saturday, May 8th, and tried to land the passengers on the beach, north of Ensenada, but this attempt was blocked by Mexican coastguards and a squad of soldiers, and as the few other likely places where such a landing could be effected were closely watched there remained no other course open but to steam north to San Francisco.

We arrived at San Francisco, Tuesday, May 11th, and I left at noon the same day for Seattle, Wash., thence to Vancouver and home.

A CORRECTION.

With reference to our first paragraph under the heading "Maritime Wireless Telegraphy" in our Christmas Double Number, Mr. Josef Eide points out that the vessel which picked up the *Iris* was the *Irma*, and not the *Iona* as stated by us. We give below a photograph of the *Irma* lying alongside the quay at Bergen, preparatory to leaving for England.

S.S. "*Irma*" alongside Quay.

[Under this heading we propose to publish each month communications from our readers dealing with general 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.]

Moulded Insulators.

IT is obviously the duty of every electrical engineer to investigate the properties of all substances used by him in the course of his work, and particularly of those materials which serve as insulators. The wireless engineer above all needs to pay very special attention to insulation problems. In the early days of wireless telegraphy the number of substances used for insulation was small, ebonite taking a prominent place in both indoor and outdoor work. Of late years many other materials have been adopted, and porcelain specially manufactured for high-tension work now takes a large share of the duty. Many of the most important and interesting points in the manufacture of this substance have been touched upon in these columns, as our regular readers will remember. (See WIRELESS WORLD, September and November, 1915.) Apart from ebonite and porcelain, there is a large class of substances which may be termed "built-up insulators" passing under various fancy trade names, and growing in use both in this country and America.

A few years ago the choice of insulating materials which could be readily moulded lay practically between porcelain, ebonite and similar rubber compounds, and the so-called shellac compounds. Each of these materials has its disadvantages, and inventors were not lacking who endeavoured to produce other substances with the advantages of those materials just mentioned, and none of their drawbacks. Mr. Hemming in his book on Moulded Insulation* classifies the moulded insulators of to-day under nine headings. These are as follows:

1. Organic Hot Moulded Materials.
2. Organic Cold Moulded Materials.
3. Inorganic Cold Moulded Materials.
4. Ceramics.
5. Rubber Compounds.
6. Organic Plastics.
7. Synthetic Resinous Products.
8. Hardened Fibre Materials.
9. Moulded Mica.

Some manufacturers claim that their products are suited for all purposes, but this is decidedly not so. For instance, whilst materials of Class 4 are fireproof, waterproof, and inert under all climatic influences, their use is limited to such purposes as do not require accuracy of dimensions and great mechanical strength. While materials made under Classes 1, 2, 3, 5, 6, and 7, on the other hand, can be moulded more or less to true sizes and are mechanically strong, they are not as proof against climatic conditions as materials in Class 4.

* "*Moulded Electrical Insulation and Plastics.*" By Emile Hemming. (New York: Ward Clausen Co. $2. London: S. Rentell & Co., Ltd. 8s. 6d. net.)

Of the raw materials used in the manufacture of moulded insulators the following are the most important: Asbestos, Clay, Mica, Silica and its compounds, Hydraulic Cement, Alkaline Earths, Vegetable Fibres, Camphor, Wood Pulp, Cotton, Hemp, Flax, Asphalts, Shellac, the Resins, Paraffin Wax, Linseed Oil, various other drying oils, Alcohols, Crude Rubber, Formaldehyde, and Phenol.

The first requirement of a moulded insulating part is that it be stable. It must retain its shape and physical and electrical characteristics under service, and must not deform or disintegrate. It must also retain its dielectric strength. Neither heat, cold, nor sudden temperature changes, the action of the electric current, nor chemical actions induced by this current, must exert any deleterious effect upon it. No material in use to-day perfectly fulfils all of these conditions. The materials which most nearly meet these requirements are the ceramics, but the inorganic compounds in Class 3 are also very stable. These last possess the peculiar characteristic of improving with age and exposure to the air and weather, in which particular they differ from porcelain and all other forms of moulded insulating material which deteriorate more or less with age. With regard to the rubber compounds in Class 5, rubber when properly compounded is very stable, but unfortunately the increasingly high cost of the better grades of this valuable substance offers great temptations to the manufacturer, and practically all commercial rubber is adulterated with low grade resinous gums and other substitutes which greatly reduce its life and consequently its usefulness as a material for moulded insulating parts.

The synthetic resinous compounds form a new class of peculiar products which have been in use for a comparatively short period, and definite judgment must be withheld until time has demonstrated their value. Very broad claims are made for these products, and it would appear that such claims are not extravagant.

The ability to resist the effects of moisture is a very essential requirement of moulded insulating material. No matter how good it is in other respects, if it is affected by moisture to such a degree that it either deforms, disintegrates, or loses its dielectric properties to such an extent as to cause short-circuit, it is useless.

Moisture has no effect on the ceramics. In their unglazed state they absorb water to a certain extent, but this is entirely overcome by the glazing process. Fibre has fallen into direpute because of its very hygroscopic nature, but the newer class of this material is expected to gain favour because it does not exhibit this disadvantage. The other classes resist the weather well, provided they are properly made. Heat proof qualities need also to be carefully considered, and here again we find the ceramics at the top of the list. Porcelain is, however, liable to crack under sudden temperature changes. When for mechanical or other reasons porcelain is not suitable, the choice lies between the organic cold moulded materials, the inorganic cold moulded materials and the synthetic resinous products. All these materials may be considered heat proof in that they do not soften or otherwise become disadvantageously affected when continuously subjected to a temperature of 100 deg. C., which is the usual maximum working temperature of electrical machinery. Classes 1, 5, and 6 are all seriously affected by the continuous application of such a temperature. Of the three classes 2, 3 and 7, the last is the strongest, and because of their excellent moulding qualities and their neat appearance they are to be preferred where cost is a secondary consideration. These materials will withstand continuously a temperature of from 150 deg. C. to 250 deg. C., depending on the nature and percentage of the filling medium employed. In general, it is advisable to manufacture arc deflectors and all parts which are subjected to constant arcing and similar conditions of the inorganic cold moulded materials, as their inorganic nature precludes all possibility of softening or charring.

Materials intended to withstand the continued action of acids or alkalies must be carefully chosen. Whilst most insulating compounds will resist these actions to a greater or lesser extent, few of them are proof against acids or alkalies for any great period of time. The only materials which can safely be employed for this purpose are the ceramics and to a certain extent the products of Class 5.

Wireless Telegraphy for Women

An Innovation by the Women Signallers' Territorial Corps.

THROUGH the kindness of the principal of the East London Wireless College, the members of the Women Signallers' Territorial Corps are now being instructed in wireless, and by the courtesy of the Marconi Company an instrument is available for regular practice. This woman's movement (described by a writer in the *Standard* as "undoubtedly the most useful and effective of all the semi-military organisations of women") was originated in the early days of the war. The aim of the corps is to link up every town and village throughout the kingdom, and to release the men for the firing line, and also to act as instructors to men in the services. Commanding officers needing instructors for their commands are invited to apply to the organisers. It was believed that by organising a corps of women signallers in their own districts many men might be released to join the army. It rests with women to prove their capacity for sustained public service by taking up this movement with enthusiasm and perseverance. Efficiency with the least possible delay, that they may be ready in emergencies, is the immediate ambition of members. The Government has made it clear that it is incumbent upon women to fill every possible post that may be vacated by men fit for service in the forces. The habits of discipline and co-operation inculcated by the training should prove invaluable in fitting them to take their share of responsibility in the present crisis. Our photographs

Buzzer Practice.

At the Instruments.

show a class of women practising the Morse code by means of a buzzer, and a member of the corps actually at the instrument.

ANSWER TO SECOND LITTLE PROBLEM.

The second problem as set forth in our January issue, was as follows:

Given two steel rods exactly alike in appearance, you are told that one is a magnet. How would you tell which piece is the magnet if you have nothing with which to suspend the rod, no point to poise the rods upon, no other pieces of iron or steel to attract, and no instrument of any kind? Solution: Offer each end, in turn, of each piece of metal to the centre of the other piece. There being neutral magnetism in the centre of a magnet, no attraction will take place when you offer the non-magnet to the centre of the magnet.

Next month Dr. Fleming on the Cube Resistance Problem.

SPECIAL NOTICE TO AMATEUR SOCIETIES.

The secretaries of all amateur societies which have not been suspended owing to the present war are requested to forward full particulars of their societies to the editor, in order that suitable notices may be inserted in the 1916 edition of the "Year Book of Wireless Telegraphy and Telephony."

THE NEW VOLUME.

Do not fail to order the first number *early* from your bookseller or direct from us.

Wireless Telegraphy in the War

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

THIS month we publish three illustrations which will give our readers a fair idea of the latest scene of Entente activity in the Mediterranean district. After the failure of the German submarines to blockade our British shores and the increase of naval and military activities in the Southern Seas, these underwater "Rovers," whose nefarious practices are necessarily directed by *wireless telegraphy*, found a more fruitful field of operations in the historic waters of the "Great Sea."

Corfu, situated at the junction of the Adriatic and Mediterranean, proved an admirable headquarters from which the messages directing the operations could be issued and petrol supplies provided. The fact that the historical palace of the Achilleion is the leasehold property of the German Emperor rendered the opportunity all the more easy. Here, undeterred by the decencies of diplomatic etiquette or regard for neutrality, our Teutonic foes established arrangements for supplying their pirate craft with petrol—and instructions, most of which were probably sent by wireless.

* * *

On page 742 of this issue will be found an excellent description of the radiotelegraphic apparatus with which these enemy craft are furnished, an ingeniously contrived method of installation which enables them to keep in close touch with their base. At actually what spot the Germans placed any secret wireless installation which may have been necessary, we do not as yet know, but it is inconceivable from the needs of the craft and the requirements for their operations that a supply base should have been without the means for communicating with the vessels for whose needs it had to cater.

* * *

The landing by the Allies at Corfu has been effected with the greatest regard for Greek susceptibilities. Indeed Mr. Donohoe, one of the British correspondents in this part of the world, characterises their *régime* not only as "benign but ultra-tolerant," and the only arrests reported up to the present are those of two of the most active member of the local German espionage organisation.

Our illustration on page 728 shows the town of Corfu as seen from the old fortress; on page 729 appears the fortress itself, *Fortezza Vecchia*, which was occupied by the British from the fall of Napoleon until the election of a constitutional King of Greece in 1863; whilst on page 730 we show a picture of the Isle of Ulysses, *Ponticonnissi*, which lies off the coast. This latter view will indicate at once the charming nature of the scenery in these Ionian Islands and the facilities afforded by their bays and creeks as lurking grounds for enemy submarines.

* * *

In the days when telegrams were a novelty the advent of the special messages, with their buff envelopes, was in many domestic households looked upon as a harbinger of woe. The reason appears to have been that the new method of speedy communication was only resorted to in cases of emergency, and emergency in a large number of instances means trouble. A similar disagreeable experience is occasionally the lot of recipients of *wireless messages*. A German correspondent in one of the newspapers of the Fatherland, the *Berliner Lokal-Anzeiger*, recently narrated the pathetic wireless story of a German sentinel whom he found one evening guarding a bridge on the Western Front.

Herr Karl Rosner observed a man with his head bowed as it were in deep thought. Answering an inquiry concerning the cause of his abstraction, the German soldier remarked, "I am constantly thinking of England, where I have left my wife and my seven dear children." This German's name was Raymond Wollner, a worker of Middlesbrough,

Corfu, from the old Fortress.

who after two years of seafaring life married an Englishwoman and settled down. On the morning of August 1st, 1914, Wollner saw the declaration of war on Russia by Germany, and was torn between domestic affection and patriotic duty. He communicated with the German Consul, and, in company with about forty comrades, was shipped to the Hook of Holland. In mid-Channel a *wireless message* arrived announcing war between England and Germany and summoning German reservists to the colours. That message finally sundered the man from his home and family, and there the Berlin correspondent found him, guarding his bridge, anathematising the strife which caused him so much anguish and the wireless message which had summoned him to duty.

* * *

In a recent issue we referred to the fact that at the Christmas and New Year Seasons much interchange of good wishes had in the past taken place through the medium of wireless telegraphy. Every year adds to an increased use of this medium for the conveyance of good-will, and in this connection an interesting item recently appeared in the daily press. After narrating how General Sarrail, Commanding Officer of the Allied Forces in the Orient, exchanged messages with General Moschopoulos, commanding the Third Corps of the Great Army, the Special Correspondent of the *Daily Chronicle*, Mr. George Renwick, narrates that the distinguished French officer received, by *wireless* from London, greetings from the British Imperial Staff for himself and the army under his command.

* * *

Sixteen months after the daring exploit for which the decoration is awarded, came the announcement that H.M. the King had been graciously pleased to bestow the Distinguished Service Order on Lieut. T. A. Bond, of the Royal Australian Naval Reserve. It is nearly a year and a half ago since the British-Australian Navy made its successful attack upon the wireless station at Bita Paka, German New Guinea, which formed the occasion when Lieut. Bond displayed the gallantry which had called forth this honour from the hands of his King.

* * *

So long ago did this expedition take place that a book has been written by Mr. F. S. Burnell, an Australian journalist, who accompanied the expedition. He entitles his work "Australia *versus* Germany," and published it last June. Herein we read the story of how Captain Travers and Lieutenant Bond took successive possession of the first and second line of German trenches. As soon as they had received the surrender of the enemy they pushed on to the wireless station, capturing *en route* a mounted noncommissioned officer and a cyclist dispatch bearer. They arrived at the wireless station about dusk, and—we cannot do better than extract the account of this portion of their activity from Mr. Burnell's book:

"The trenches were unoccupied, and, "going boldly forward, the three proceeded "to seize the station and its astonished "occupants. Besides about 26 natives, "seven German wireless officials were "found, quietly seated at dinner, in com- "plete ignorance of the turn events had "taken. With a philosophic shrug they all "surrendered without resistance. In re- "lating his experiences afterwards, Travers "could not sufficiently express his admira- "tion of the coolness with which Lieutenant "Bond behaved throughout. 'He strolled "along the road,' said Travers, 'as though "'we were out for a picnic, talking about "'the various plants we were passing at "'the side of the road. He's an enthusiastic "'botanist. There he was, discoursing on "'lepidoptera and such-like, with the immin- "'ent risk at every moment of being picked "'off by some nigger up a tree. "Splendid" "'is the only word I can imagine for his "'coolness.'"

Besides the incident narrated above, the official *procès-verbal* attached to the record of the distinction conferred upon Lieutenant Bond emphasises his "conspicuous ability and coolness under fire in leading his men through most difficult country and enforcing the terms of surrender whilst drawing off an attack by another body of the enemy." A number of other officers and men received commendation for services rendered during the course of the same operations.

* * *

Amongst the affidavits which were produced by Germany in support of their allegations against the action of H.M.S. *Baralong* in sinking a German submarine when the latter was attacking the *Nicosian* will be found that of an American youth pamed Garratt. Whilst all these various precious affidavits differ materially amongst themselves, that of Garratt varies considerably from any of them. He states that on August 19th the *Nicosian was informed by wireless* that German submarines were seeking for the *Arabic* to destroy her. He was on board the *Nicosian* when the captain "ran up a flag which I suppose meant surrender," and states that he saw the *Baralong* come up flying the American flag, which was lowered in favour of the British before the disguise was thrown off, and the British vessel started firing.

* * *

We have often alluded in general terms to the utility of wireless telegraphy from the point of view of calls for assistance in wartime, and here is an excellent case in point. The offer made by Sir Edward Grey in response to the impudent German official claim has, of course, been refused. Full and

Old Fortress, Corfu.

Isle of Ulysses, off Corfu.

impartial enquiry is the very last thing that the Germans desire. A gunner on the British auxiliary cruiser narrates the whole incident in an account published by a Yorkshire paper. He tells how they received the *wireless message* from the *Nicosian*, how they sighted the vessel, and how under the white ensign they started firing. He claims that the *Baralong* was less heavily armed than the submarine, whose crew appear to have lost their heads as soon as an armed enemy engaged them. Two Americans on the *Nicosian* confirm the British version of the story, and one of them not only states that he could see no American flag displayed on the British cruiser, but definitely asserts that he saw her fly her own colours.

* * *

The consequence of Germany's almost entire dependence upon wireless telegraphy for speedy long-distance communications is sometimes responsible for quite a "comic effect." The American Press all through Christmas and the New Year was to its intense amusement flooded with *wireless despatches*, narrating in detail how Germany was no longer dependent upon American cotton either for naval or military purposes. Cellulose made from wood, said the boastful Teuton, was more valuable than cotton for ammunition purposes, whilst as for textiles all that they needed to do was to resort to the common thistle. Reports from the battlefield, however, tend to show that the boasted wood cellulose results in shells that do not explode, and the unimpressed American points to the fact that thistles have been found useful by other asinines than those of the Germanic species.

* * *

Every means of long-distance communication has been used in this war, and although the carrier pigeons' loft in the South of England, long utilised by the British Admiralty, was dismantled a few years ago on account of the introduction of wireless telegraphy, we know that pigeons are still being used by the British for war purposes. Only quite recently the War Office authorities issued instructions to the effect that it was hoped that British sportsmen who were not able to distinguish between ordinary wood pigeons and carrier pigeons would abstain from pigeon shooting altogether. The reason for this appears to have been that some of our own sportsmen were destroying British flying dispatch bearers. The fact of the matter with regard to all these things is that the latest method may for all ordinary purposes supersede its predecessors; but in times of strain and stress it is wise to have as many strings to one's bow as possible.

* * *

One of the points referred to in the last American Note deals with the detention of neutral ships at sea by British men-of-war, acting on evidence, not found on the ship itself, but *obtained by wireless telegraphy.* The Yankee lawyers who are responsible for the compilation of this document apparently considered that the commanders of British men-of-war should shut their ears to wireless messages tending to show that vessels under the protection of a neutral flag are really trading with the enemy. This application of the procedure of courts of law to conditions of actual warfare will assuredly hardly commend itself either to our own citizens or to those of the United States. Our American cousins claim, not unjustly, to be a practical people, and as such must have little sympathy with the technical formalities which shut out evidence that is not "before the court," however relevant it may be to the issue at stake.

* * *

It is significant that the American authorities have recently been obliged to increase the stringency of their own regulations with regard to *wireless apparatus.* One of the latest official announcements from New York states that after prolonged conference it has been officially decided that all belligerent ships entering New York Harbour must dismantle their radio-telegraphic installations. This equipment must remain sealed until the vessels have passed beyond the limit of territorial water. Notices to this effect are being served on all incoming captains by an United States "destroyer" stationed to guard the bay.

* * *

The United States of Brazil have been in this war confronted with much the same difficulties as have affected the authorities of the U.S.A. Whilst the South American route is served by steamers of practically all European countries, by far the most important lines are British and German. Thanks to the *wireless warning* to German commerce vessels referred to by Mr. Isaacs in his speech, reported on page 416 of our September issue, the greater number of the German merchant steamers are able to take refuge in neutral ports, and those of Brazil contain a very large number of such refugees. The Brazilian Government have loyally endeavoured to fulfil all the conditions of neutrality, and, in common with other Governments, have forbidden, from the start of the war, the use of wireless telegraphy by vessels sheltering in Brazilian harbours. Like other countries they have had many difficulties to contend with in controlling the activities of their German guests, but the Brazilian Navy has, on the whole, been successful in enforcing respect for their wireless regulations. During the activity of the German Cruising Squadron in the waters of the South Atlantic a few vessels are believed to have escaped their vigilance, got into *wireless connection* with the ships of war, and supplied them. But the number of these is very small in comparison with the aggregation of German and Austrian vessels still crowding Brazilian ports, whose total burden has been calculated to approximate to 200,000 tons.

* * *

The *Times* special correspondent at Bucharest recently published an interesting account of the situation in Bulgaria. This includes a description of the exultation produced by the acquisition of territory by Bulgarians at the expense of the Serbians, but also indicates an almost universal fear throughout the country of an invasion from Russia. The Bulgarian General Staff, which, according to this writer, is mainly composed of German officers, has directed the construction of a series of fortifications on the heights commanding the Danube and in the neighbourhood of the Roumanian frontier. Germany contributes the artillery and German soldiers are designing and superintending the fortifications. German officers have also established, and control, a series of observation stations, furnished with searchlights and *wireless telegraphic* apparatus. These vedettes and wireless stations extend all along the river and the line of frontier as far as the Black Sea. The Bulgarian portion of the river is patrolled nightly by Austrian monitors and German torpedo boats. Not only the Military, but the Civil Administration, at Rustchuk is subordinated to the

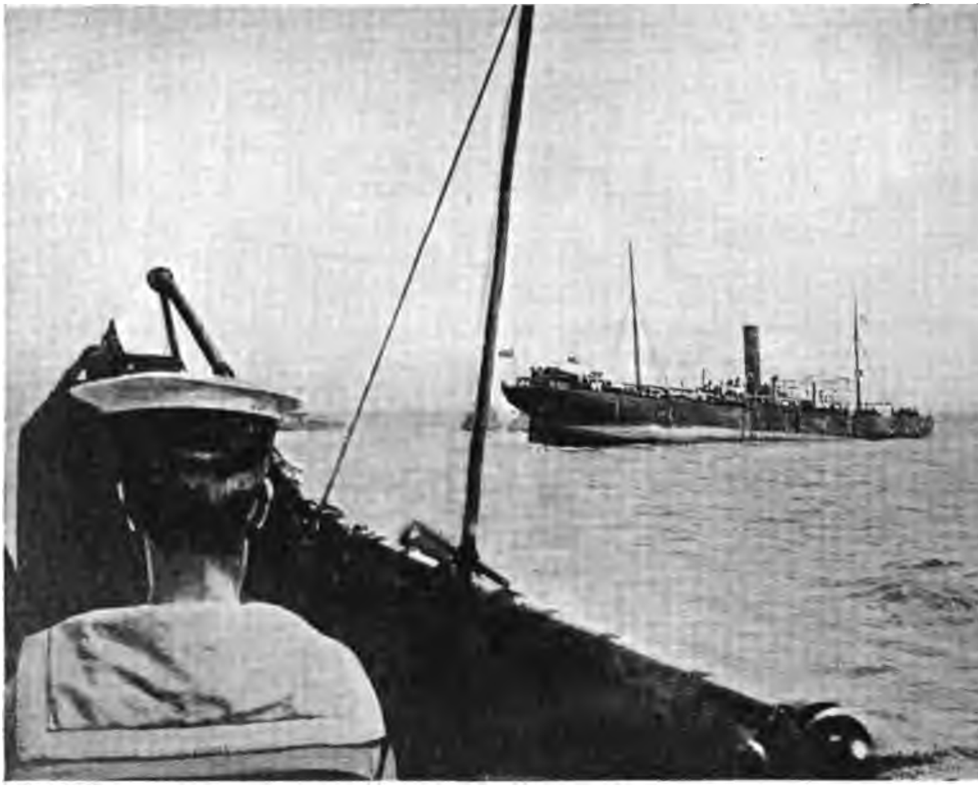
German Commandant, so that the inhabitants feel like a conquered people. The way in which the Germans organise their *chains of wireless stations* as an essential part of their fortified positions is characterised by the same thoroughness and system as most of the other military operations conducted by these efficient foes.

* * *

The illustration on this page depicts a French field radio set in active operation. This particular photograph was taken at Salonica at a time when the apparatus was being used for communication with one of the Entente aeroplanes on duty there. Pictures bring home, in a graphic way unattainable by written description, the extent to which wireless has revolutionised military scouting. The airman whose messages are being received by these operators may be noting from his aerial point of vantage the activities of the Germano-Bulgarian enemy, whose boasts about striking at the Salonica position of the Allies have been many, but who up to the present have judged discretion the better part of valour.

We have referred in former issues to the great utility of wireless telegraphy to the British forces operating in Mesopotamia, and given extracts from correspondents describing the nature of the equipment. Since the series of unbroken successes which marked the earlier stages, the enemy were found to be in much greater force than was anticipated. Hence the British Expedition has found itself obliged to retire and entrench at Kut-el-Amara, and for communication with the relieving forces under General Aylmer, General Townshend has had to rely mainly on the same agency. Wireless, therefore, will form the means employed by the two generals for co-ordinating their efforts to secure an eventual junction, which recent news appears to show is unlikely to be long delayed. The German Wireless News boasts that General Townshend's force is expected by the enemy to be compelled to surrender before help can reach it; but that boast was evidently made before the recent successes won by General Lake's advancing columns, and is quite unlikely to be justified by events.

French Field Radio Set.



A Destroyer Rushing to Sinking Merchantman.

We have many times published in these columns notes relating to the assistance given by British torpedo boats, destroyers, and cruisers, to merchant vessels mined or torpedoed by the enemy, in answer to S.O.S. signals. The illustration on this page depicts the actual occurrence of one of these rescues. Readers will see the forepart of a British destroyer which has received the wireless message of distress and is rushing to save the helpless non-combatants on board the doomed vessel. There has never been a war at sea conducted on these inhu-human lines since the days of early savagery. There is only one thing that " Jack " enjoys more than rescuing these helpless victims of Kultur, and that is—avenging them on their pirate foes.

* * *

Perhaps the most graphic description of any operation in the war is that given in the message from Captain Bean, the official representative of the Australian forces in the Dardanelles, when he gives a glimpse of the naval operations during the Anzac and Suvla Bay withdrawal. He puts it into diary form, under times instead of dates, for, of course, a single night witnessed the whole of each operation. The messages of which he describes the receipt in graphic style were sent by *wireless telegraphy*, and he records the final Marconigram, received at 4.15 a.m., in the following terms :

" A wireless message has just been re-
" ceived stating that the whole embarkation
" has been completed. The naval officer
" next me turns round and holds out his
" hand, ' Thank God.' . . . The Suvla wire-
" less station is now closed also. The navy must
" have timed the embarkations perfectly."

Although perhaps it would be going too far to say that these operations would have been impossible without the use of radio-telegraphy (for " Jack " is used to doing without all sorts of necessary things), there cannot be the slightest doubt that wireless telegraphy discharged a prominent and price-less service on those two eventful nights.

NOTES OF THE MONTH

A recent Order in Council makes further alterations in previous Orders governing the export of certain commodities. It is interesting to note that amongst those prohibited to all destinations appears material for wireless telegraphs.

* * *

A number of permanent sub-committees to work in conjunction with the Central Committee of the Admiralty Board of Invention and Research have been appointed. Submarines, mines, searchlights, torpedo-nets (not on ships), wireless telegraphy, and general electrical and electro-magnetic subjects are covered by a single sub-committee.

* * *

In connection with the Marconi Athletic Club at Chelmsford, a smoking concert was held recently at the club rooms, Mr. A. E. Eddington presiding. There was a very good attendance, which included several members of the Marconi Company's Chelmsford staff, and a splendid programme had been organised by Mr. G. Barlow. The singing of Staff-Sergt.-Major Stainton and Staff-Sergt. Watson, from the Chapel Royal, Windsor, was a feature, whilst Mr. Davis was very dramatic in his recitation, "The Highwayman." Mr. Cousens well displayed his sleight-of-hand in the manipulation of a pack of cards. The whole evening proved an unqualified success.

* * *

The annual report of the Department of Technology of the City and Guilds of London Institute has just come to hand. According to this report, the results of the examinations have been most gratifying. The Institute unfortunately is not really very well known, but it does excellent work amongst those who are compelled by force of circumstances or otherwise to increase their technical knowledge by means of evening classes, often after a hard day's work in the shop or office. It is interesting to note that the number of candidates in telephony was double the number of those in the chemical and allied trades combined. We draw the following extract dealing with telegraphy from the report referred to :—

"The results are still disappointing in "the Final Grade. The standard reached "generally is far below what it should be, "seeing that the questions set are all within "the syllabus and are not of a very difficult "character. . . . The fact that few candidates attempted the question on oscillating "circuits, and that most of the answers were "not of a high order, indicates that the now "important subject of wireless telegraphy "receives scant attention from teachers and "students."

* * *

The *Montgomery County Times* recently contained the following paragraph :

"The men of the Marconi Guard at "Towyn had a very pleasant Christmas. "The barrack dining room was seasonably "decorated, and the Christmas dinner of "goose, beef, and plum pudding was excellent. Several gifts arrived by the mail. "A nice box of briar pipes came for Welshpool men from Mr. Robert Owen, and the "children of the National School sent "Christmas cards of their own painting, "which were very much appreciated. Newton, Dolgelly, and Machynlleth men all "received Christmas gifts. Towyn and the "outside districts seemed to have forgotten "their men, and a few men had to be content with the Welshpool children's Christmas card. The Y.M.C.A. hut with its "billiard table was a great attraction, and "most of the men spent the hours off duty "there."

Maritime Wireless Telegraphy

JAPANESE STEAMER SUNK.

INFORMATION has been received from Malta to the effect that the Japanese steamer *Sado Maru* was sunk recently by a German or Austrian submarine in the eastern waters of the Mediterranean. Assistance was requisitioned by wireless, and this was immediately organised and forthcoming from Alexandria.

* * *

LOST IN THE ICE.

The Russian wireless station at Archangel recently received a message from the French packet boat *Bretagne* to the effect that she had struck an iceberg in the White Sea and was in the gravest danger. Two icebreakers and some tugs were immediately sent to the scene of the disaster, but all that could be found there was some wreckage buried in the ice. It is surmised that it belonged to the packet boat.

* * *

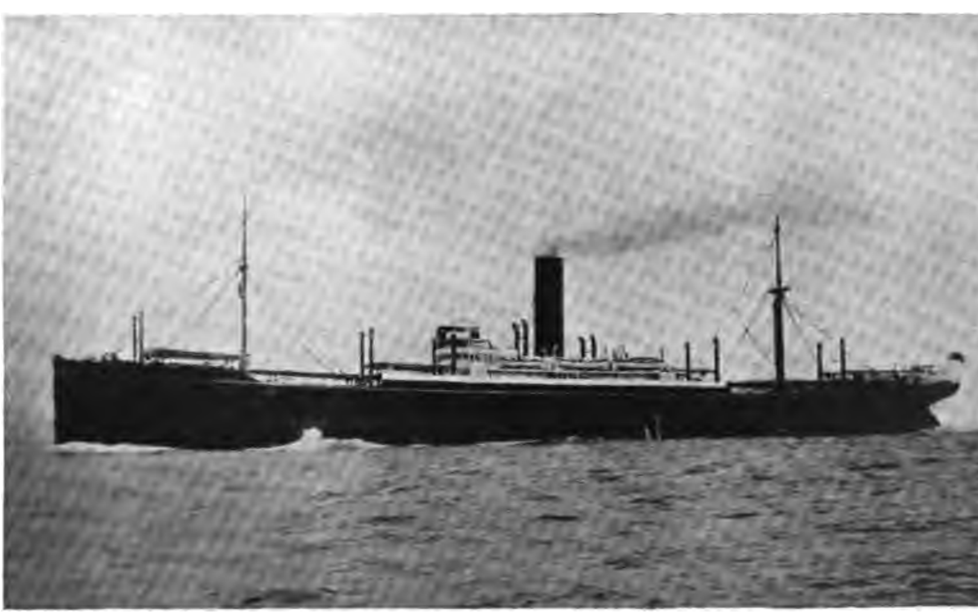
"SANTA CLARA" STRANDED.

Early in the morning of November 2nd last the steamer *Santa Clara* ran aground on the bar of Coos Bay, Oregon, and details of the accident have just come to hand. It appears that the wireless operator immediately called up the station at Marshfield, Oregon, saying that the vessel was aground, and asking the aid of the life-saving corps. By this time there were indications that the ship was in danger of breaking in two, and a further distress call was made. The *Adeline Smith* answered that she was only a short distance away, and the *Santa Clara* therefore asked her to stand by. Another ship also responded, but she was twenty miles away, and therefore could not give immediate help. Boats were launched, and all on board the *Santa Clara* were transported safely to the shore.

* * *

NEW "GLEN" LINER SUNK.

It was announced recently from the office of the Glen Line that their passenger steamer *Glengyle*, of which we are enabled to reproduce a photograph, was sunk in the Mediterranean on January 2nd last. Her comple-



S.S. "Glengyle."

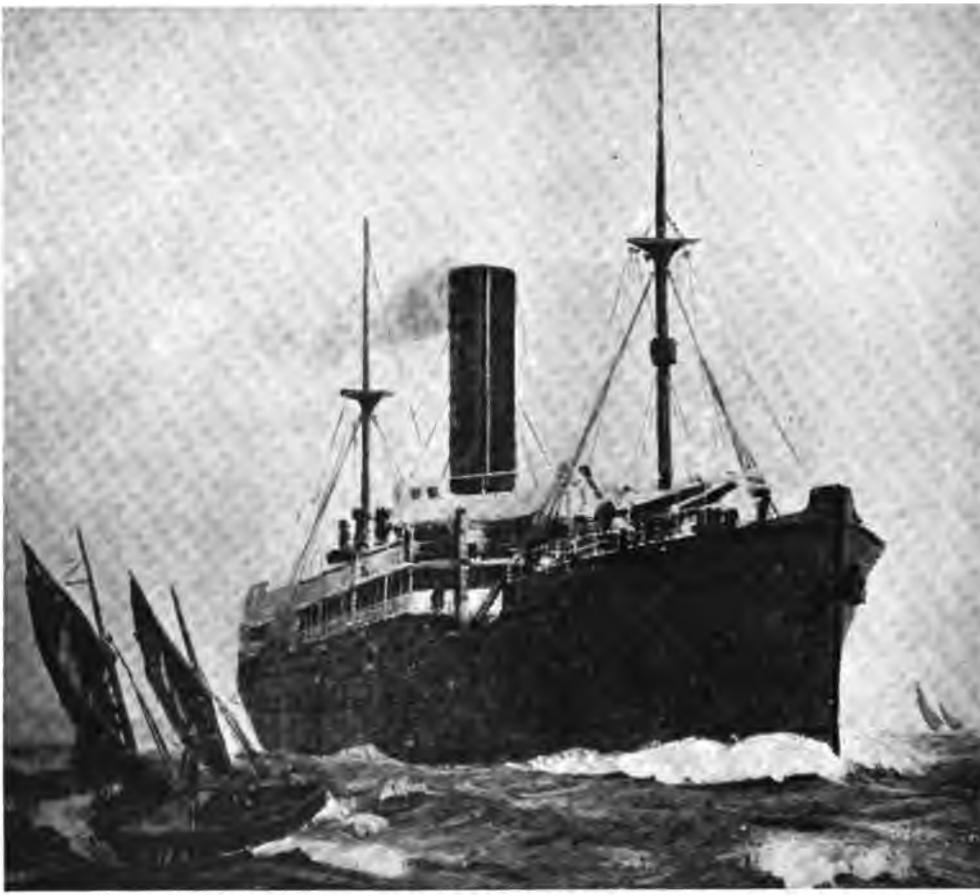
ment of passengers and crew amounted to 120, of whom all but ten have been accounted for. The majority of the passengers were British subjects, and the missing are seven Chinese and three Europeans. The *Glengyle* was homeward bound from Vladivostok for London, and had taken on board a large quantity of cargo at Shanghai and also a quantity at Singapore for Genoa. She was a vessel of 9,395 tons, built by Hawthorn, Leslie & Co. only last year, and was the largest ship of the Glen Line. She was specially built for Eastern trade, and it is interesting to note the comparison of her speed of 13 knots with the 18 knots of the *Persia*, which latter was sunk very near the scene of the *Glengyle* disaster. She was fitted with wireless telegraphic apparatus.

* * *

S.S. "PERSIA" TORPEDOED.

With their usual brutal disregard for human life the Teutons have now excelled themselves. This time, without any previous warning, they have callously sunk the Peninsular and Oriental Co.'s fine vessel *Persia* off the coast of Crete in the Mediterranean. The vessel made no attempt whatsoever to escape, and this hostile action is entirely unwarranted. She carried no troops or war material of any kind. The *Persia* was of 7,974 tons gross, and was built by Caird & Co., of Greenock, in 1900. Her engines developed 11,000 I.H.P., which gave her a speed of 18 knots. Her length was 499 ft., and her breadth 54 ft., and she was fitted with all the latest improvements, including wireless telegraphy. A reference to our "Doings of Operators" pages will give some information concerning the wireless operators. We are enabled to publish a very artistic illustration reproduced from a painting of the ship. A poignant interest attaches to the fact that the captain's wife, who was aboard the *Medina* on her way to Malta to spend the winter, was advised by wireless of her husband's death.

S.S. "Persia."



S.S. "Geelong."

ANOTHER P. & O. LINER SUNK.

Within a day or so of the sinking of the *Persia* the world was astounded to hear of the loss of another of that company's steamers. This time our enemies do not appear to be to blame. She was sunk after a collision with the steamer *Bonvilston*, and fortunately all the passengers and crew were saved. She was fitted with wireless telegraphy, possessed a tonnage of 7,951 tons, was built by Barclay, Curle & Co. in 1904, and originally belonged to the Lund Line. When that firm's interests were acquired by the P. & O. she, with other vessels of the fleet, was taken over and placed in the P. & O. Co.'s service to Australia *via* the Cape of Good Hope. By a strange coincidence the *Geelong* was a sister ship to the *Waratah*, which was lost in mysterious circumstances off the African coast in July, 1909, while homeward bound from Australia with a large number of passengers and a valuable cargo.

* * *

DUTCH STEAMER MINED.

According to a correspondent of a news agency at The Hague, a wireless message reports that the Dutch steamer *Ellewoutsdijk*, of Rotterdam, struck a mine in the North Sea. It transpires that the crew were rescued by the steamship *Batavier III*. The *Ellewoutsdijk* was a steamer of 1,412 tons net.

* * *

MEDICAL AID BY WIRELESS.

A wireless call was sent out from the steamship *Radiant* recently for the treatment of an engineer who had for three days remained unresponsive to the medicines administered by the captain. The wireless operator communicated with the station at Tampa, Florida, and also with the steamer *Comus*, belonging to the Southern Pacific Steamship Company. From this latter vessel doctor's advice was obtained, and the sick man greatly relieved.

* * *

CLAN LINER ASHORE.

The Fort Patrick wireless station recently received the following wireless message from the British steamer *Clan Davidson* with a request that it be transmitted to Seaforth :

"Ashore in the Gun Island, about "Ballyquinton, on the fourth rock."

She was eventually got off, and proceeded to her destination. The *Clan Davidson* was on her way from London to the Clyde.

* * *

RUDDER LOST BY NORWEGIAN SHIP.

The Dutch steamer *Noordwyk* recently reported by wireless telegraphy to Land's End that the Norwegian steamer *Gæa* was anchored, with rudder lost, in lat. 49.45 N., long. 6.23 W., after having been twice taken in tow by the Dutch steamer. It appears that this latter took part of the *Gæa's* crew on board and stood by her. The position was 30 miles south of Falmouth. The *Gæa* is a steamer of 1,002 tons, was built in 1900, and owned by Pedersen and Co , of Christiania.

* * *

A NEW MOTOR SHIP.

We are enabled by the courtesy of Messrs. Page's *Engineering Weekly* to place before our readers a photograph of the new motor ship *Kangaroo* which has been acquired by the Government of Western Australia to carry produce from that Colony to the United Kingdom. The vessel is very up-to-date and possesses all the latest improvements, including Diesel engines and electrically operated steering gear and deck machinery. The vessel has been built to the highest class at Lloyd's, and is fitted with wireless telegraphy. Her length over all is 381 ft. and her gross tonnage 4,348.

* * *

GREEK STEAMER IN DISTRESS.

According to a Central News Agency report from New York wireless calls for immediate help have been received from the Greek steamer *Thessaloniki*, which was three days out from New York. A search by coastguard cutters, however, failed to find her, as she did not give her position. Subsequent advices state that she was taken in tow by her sister ship *Patris*, but the line broke and the *Patris* no longer stood by. Meanwhile the Danish steamer, *United States*, received the distress call, and at once altered her course and went to the assistance of the *Thessaloniki*. It is understood that all the passengers have been taken off by the British steamer *Perugia*, and that the *Thessaloniki* has sunk. The *Thessaloniki* is a vessel belonging to the National Steam Navigation Co., of Greece, and possessed a tonnage of 4,682.

* * *

LOSS OF THE "YASAKA MARU."

The *Yasaka Maru* forms the second Japanese steamer to fall a victim of Teuton savagery. It transpires that either a German or Austrian submarine was the cause of the disaster, which took place in the Mediter-

Motor Ship "Kangaroo."

S.S. "Yasaka Maru."

ranean, whilst only fifty minutes elapsed between the impact of the torpedo and the total disappearance of the liner. Great relief was occasioned amongst the relatives of those on board when it became known that the whole of the crew and passengers had been saved, owing to the timely advent of a French gunboat, which was summoned by wireless from Alexandria, and which landed the occupants of the doomed vessel at Port Said. The steamer was one of the finest of the fleet belonging to the Nippon Yusen Kaisha, and was built in 1914. She possessed a tonnage of 11,000. We are enabled by the courtesy of the *Syren and Shipping* to publish a photograph of the sunken ship.

* * *

UTILITY OF WIRELESS DEMONSTRATED.

In September, 1914, it was decided by the Pacific Cable Board to fit their cable ship *Iris* with wireless telegraphy, principally on account of the fact that at that time enemy warships were at large in the Pacific, and, to a lesser extent, for future purposes. The vessel made her voyage from Bamfield to Norfolk Island and Auckland to repair the cables damaged in the vicinity of that station. The installation was made in the month prior to the departure of the vessel for Fanning Island, and its utility has already been demonstrated in connection with the search for the schooner *Strathcona* (*vide* p. 378 of the September issue).

* * *

THE "EMDEN" A TOTAL WRECK.

According to the Sydney correspondent of the *Syren and Shipping*, a wireless message has been received from the gunboat *Protector* to the effect that the *Emden* is now a total wreck, the fore part of the vessel only remaining on the beach. Salvage operations will therefore be abandoned.

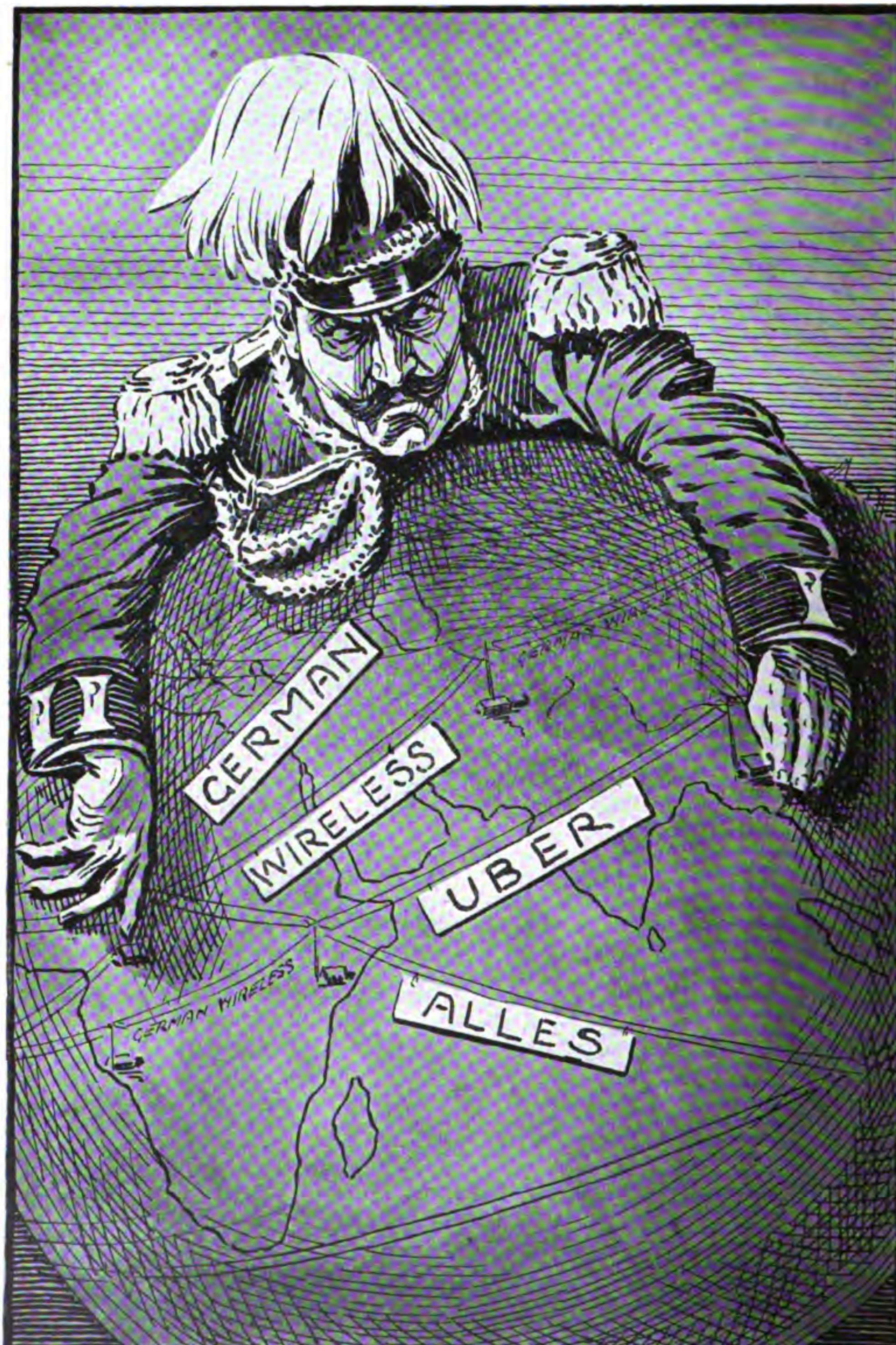
* * *

EXCEPTIONAL DISTANCES.

According to the *Wireless Age* the senior operator on the s.s. *Vauban* has reported that on the night of September 1st last at ten minutes past ten he copied time signals and the weather report from Arlington, the vessel being 3,320 miles distant from that land station. On the following night he also copied time signals and the weather report from Arlington. The vessel then was 3,597 miles away. The operator stated that the signals were quite distinct.

CARTOON I(i)

"PRIDE GOETH . . . ."



"I'll put a girdle round about the Earth."

CARTOON (ii.)

". . . . BEFORE DESTRUCTION."

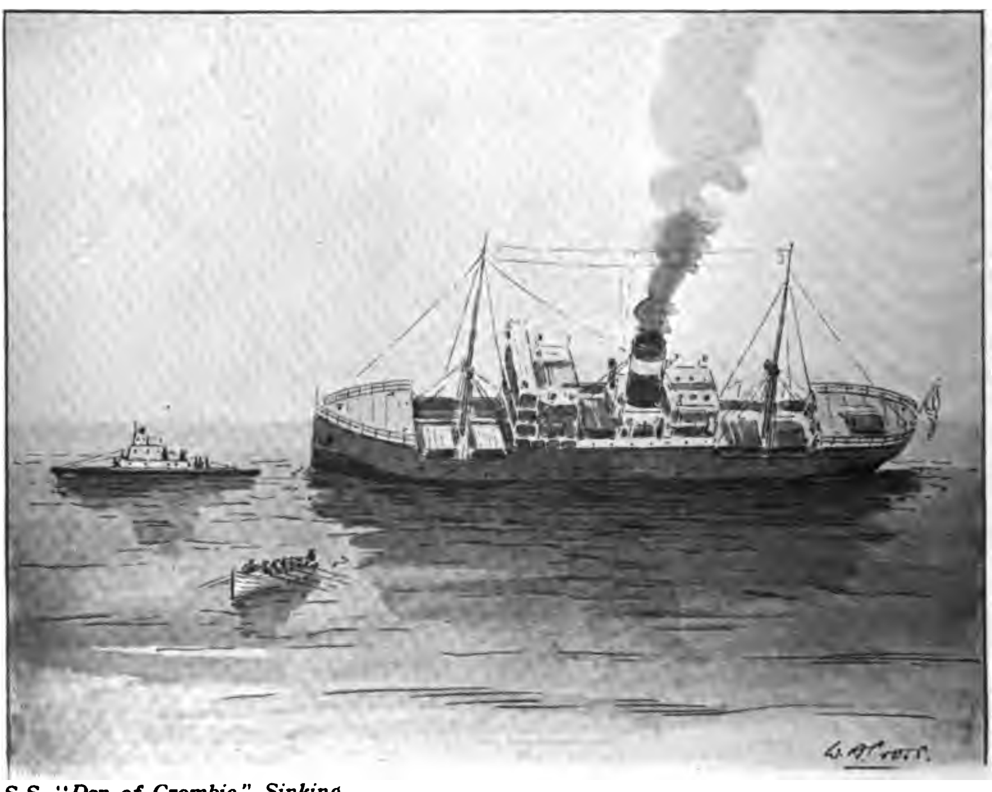
! ! ! ! ! !

The Wireless Equipment of German Submarines.

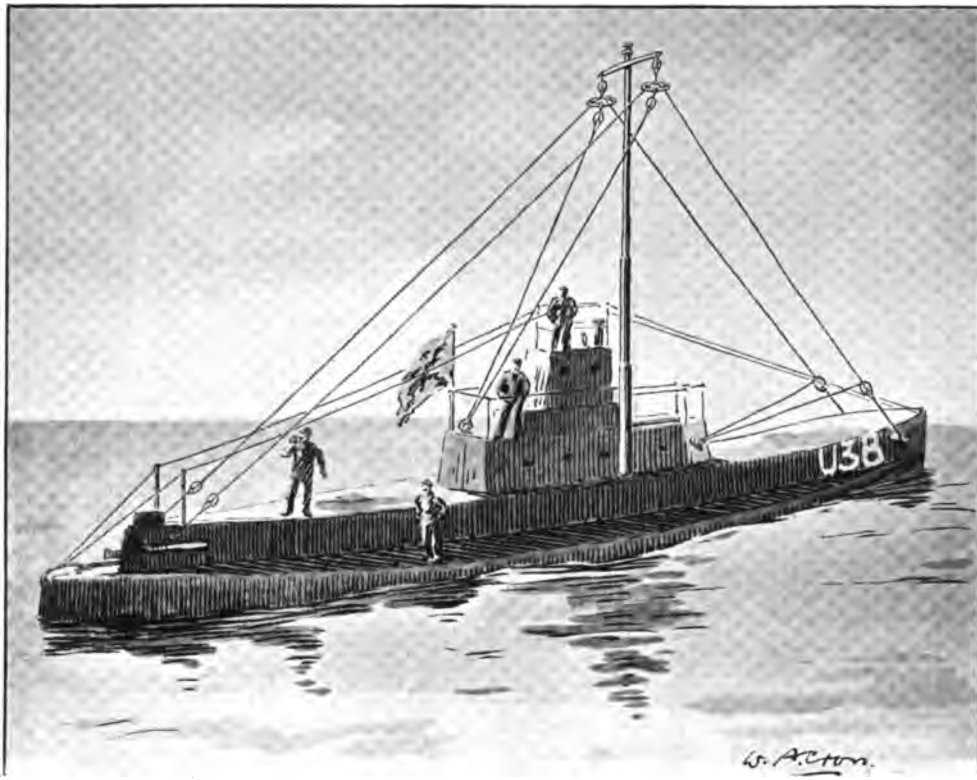
ONE of the outstanding features in the rapid development of wireless telegraphy during the Great War has been the equipment of practically all submarines and small craft with this means of communication. Most elaborate systems of intercommunication have had to be evolved for the use of these vessels, and doubtless many fascinating stories will be written on this subject when the veil of secrecy is finally lifted.

Many questions have been asked regarding the exact form of aerial adopted on submarines, for it is recognised by all who take more than a superficial interest in radiotelegraphy that limitation of space and height create difficulties which require much ingenuity to be overcome. It is unnecessary to state that no particulars can be given of the equipment of British or Allied submarines, but no purpose can be served in withholding from our readers some interesting information which has come before us regarding the exact form of aerial on a German craft quite recently seen in the Mediterranean.

If anything at all can cause intense annoyance to von Tirpitz (we can scarcely call him Admiral), it must be the comparative calmness and indifference with which the British sailor, true to all the traditions associated with our Naval and Mercantile



S.S. "Den of Crombie" Sinking.



German Submarine, U 38.

Marine, regards the abortive submarine blockade which was to bring Great Britain suddenly to her knees.

In our Christmas number we referred to the sinking of the s.s. *Den of Crombie* by an enemy submarine, and spoke of the interesting experiences through which it was the lot of the operator, Mr. Percival Denison, to pass. Mr. Denison, as we mentioned in that issue, was a keen amateur wireless enthusiast before joining the Marconi Company, and his interest in the subject has not abated since he has been at sea. As soon as the *Den of Crombie* was held up by the enemy submarine he noticed that the latter had a wireless equipment, and with a coolness worthy of the *Marconi traditions* he forthwith made a rough sketch of the equipment. When making away from the sinking vessel he also sketched the scene behind him. These two rough sketches have been handed to our artist, who, following them as accurately as possible, has produced the illustrations which accompany this article. In the second illustration particular care has been taken to show the aerial equipment exactly as drawn by Mr. Denison.

A single telescopic steel mast is erected amidships and carries at the top a permanently fixed spreader. The aerial, which is of the two-wire type, is attached at one end to two porcelain compression insulators secured by short wires to one end of the deck, and then passes up to similar insulators suspended from the spreader, thence to insulators at the other end of the deck, and from them to the lead-in insulator, which can be seen protruding from one side of the superstructure. The aerial is thus a modified form of the " L " type.

The most ingenious feature of the installation appears to be the method for rapidly erecting and dismantling the aerial structure. If our readers will observe the illustration carefully, they will see that on the way from each end of the deck to the spreader the aerial passes through a ring on each side. These rings, which are apparently made of brass or bronze, are connected through insulators to two ropes secured to a ring bolt in the deck. When the commander wishes to lower the aerial the mast is rapidly telescoped, whilst at the same time a member of the crèw hauls in the ropes attached to the rings. The spreader at the top of the mast then descends to a height equal to that of the conning tower, and is attached to the front of this structure by hooks. The rings by this time have slid over the aerial wire, doubling it up and taking in the slack caused by the reduction in height. The ropes are then secured and the aerial wires found to be taut and trim along the sides of the deck and out of harm's way. By this arrangement the need for unshipping the mast and wires is obviated, and, as can be imagined, much time and trouble are saved. The whole of the operation can be carried out after the order has been given to submerge, and before the upper portions of the deck and conning tower are awash.

The first sketch, which, as we have previously mentioned, was made by Mr. Denison from a lifeboat in which he found a place, shows the ill-fated merchantman heeling over to port a few minutes before she disappeared beneath the water, the submarine shown close by watching the result of her work. How quickly punishment descended upon her we cannot say, but we hope that her fate was as swift and sure as that which came upon the pirate found by H.M.S. *Baralong*. We think all our readers will join with us in congratulating Mr. Denison on his coolness in time of peril, his powers of observation, and his lucky escape.

WIRELESS IN THE TROPICS.

THE following extract from a letter received from Duala, Cameroons, may prove of interest to our readers:

"A discovery has been made here which may be or may not be news, but which is certainly very interesting.

"Field wireless sets came out to be used for this campaign in charge of Lieut. R——, R.E. It was of the greatest importance to establish communication between the columns working from different directions towards Jaunde, but over the forests of the Southern Cameroons every attempt to send wireless messages failed utterly. Two posts mutually visible 25 miles apart could not communicate. A reason for this had to be found, and, perhaps for the first time, electric conditions in tropical forests came to be studied by an expert. Lieut. R——, by watching thunderstorms, has come to the conclusion that for 100 ft. to 200 ft. above the trees the atmosphere is intensely charged with electricity.

"This electric strata apparently breaks up the lightning flashes, and accounts for the well-known fact that trees or ground are rarely struck in forests.

"In view of the more or less well-known influence of electricity on weather, quite a new light seems to be thrown on the effect of forests on rainfall. Trees are usually regarded as tending to connive ground water and atmospheric humidity, but this theory credits vegetation with a comutative general effect.

"A connection between woodlands and rain exists as an observed fact, but in the absence of any apparent reason, it has always seemed doubtful whether a small forest belt could actually precipitate rain locally. These electrical observations by R. seem to supply a plausible reason for such effects, if it is established that small forest areas do increase precipitation."

LIVERPOOL UNDERWRITERS' ANNUAL REPORT.

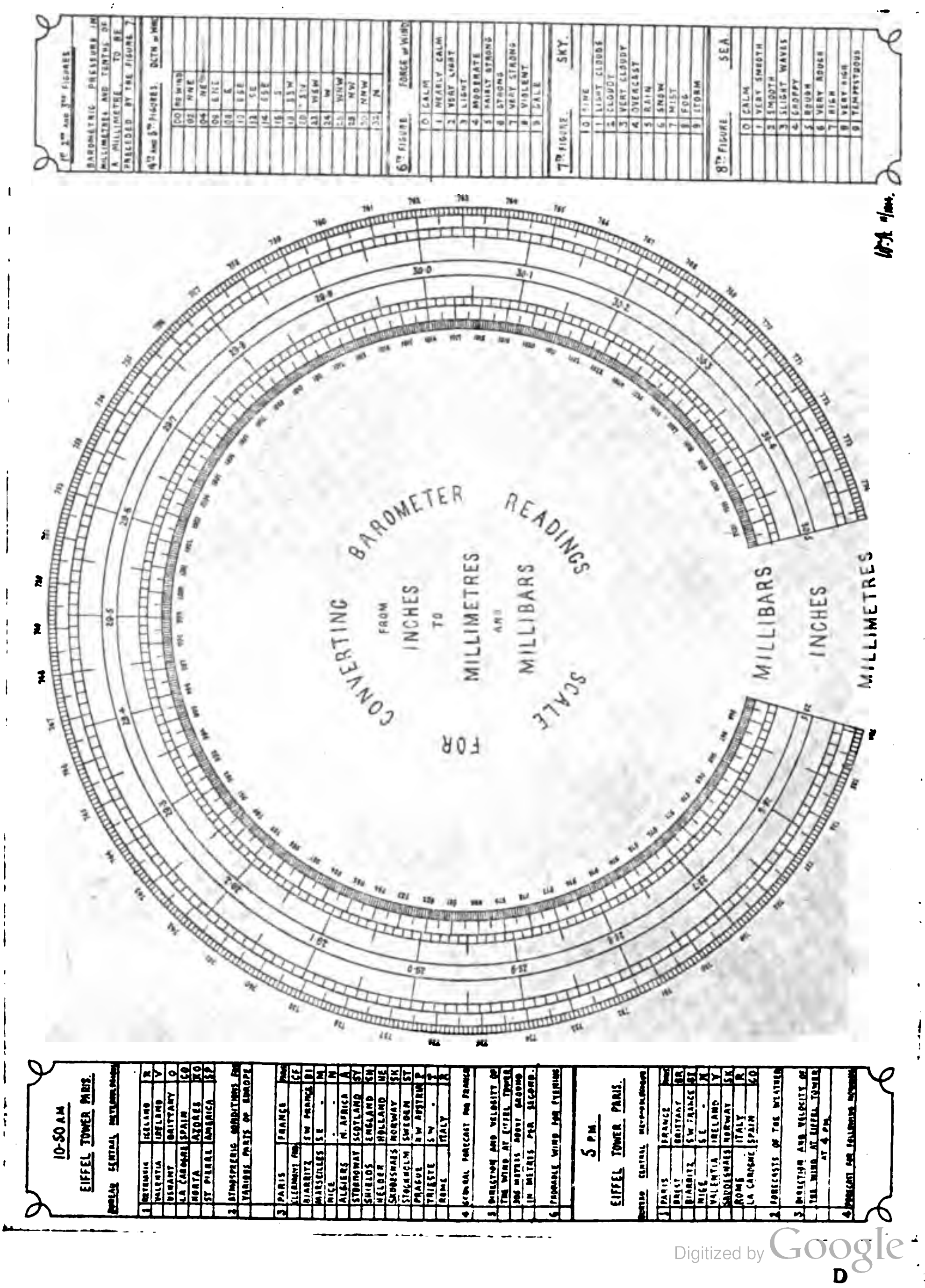
The Committee of the Liverpool Underwriters remark in their report that they have more than once called attention to signalling on ships, which has become more important than ever at the present time. They feel pleasure in recording that tests of proficiency in signalling now form a regular feature of Board of Trade Examinations. Regarding Wireless Telephony the report states that striking developments have been effected during the year, the new apparatus devised by Mr. Marconi giving a range at sea of upwards of 70 miles.

TRAGEDY AT ST. JOHN'S WOOD.

An inquest was recently held at Marylebone on Helen Marie Curtiss, aged 32, who was found dead. It appears that she had been very worried and she was obsessed with the notion that the Germans had set up a Wireless Installation on the roof of a country bungalow where she had spent some time.

A New Chart

(*See next page*)



D

A NEW CHART.

THE chart on previous page, but for the fact that all private wireless stations in belligerent countries are at present closed down, would be of great value and interest to all amateurs. However, devotees of this most fascinating hobby can scarcely have too large an accumulation of such information, and we all look forward to the time when its utility can be made use of to the full.

In the left-hand column is given a list of meteorological stations with their code letters for both the Paris morning and evening weather reports.

The method of decoding these reports is given in the right-hand column.

It is an advantage in keeping tables of the various barometer readings at different times to have all in the same scale of measurement, and the scale in the centre is useful for conversion from millimetres to inches in the Paris reports, and from inches to millimetres in the British Admiralty reports.

THE RESTORATION OF AN ANCIENT CUSTOM.

The Pope to Bless Wireless Telegraphy.

IT has been announced in Vatican circles that the Pope is preparing officially to bless wireless telegraphy. By adopting this course His Holiness thus restores an ancient custom of the Church. From time immemorial it has been usual to bless inventions which confer great benefits on humanity. This forms a very important step on the part of the Pope, exemplifying the recognition of the importance of wireless telegraphy by the religious world. We have been enabled to obtain a very good photograph of the Pope standing in one of the corridors at the Vatican. It may be interesting to some of our readers to note that the present Pope in 1887 joined the household of Cardinal Rampolla and in 1907 was consecrated Archbishop of Bologna. His admission to the Sacred College of Cardinals dates only from the year 1914, and his elevation to his present important office took place at the end of the same year.

His Holiness Pope Benedict XV.

A SOLDIER'S PRAYER.

O God of Hosts, if on the battlefield
The Death which cowards shun should
come to me,
In heat of close encounter, suddenly,—
Or, oozing slowly through a crimson wound,
The Life Thou gavest me should pass away,
As from a lamp whose oil being spent
The light grows dim, and flickering expires,—
Grant, Lord, I may not meet Thee unprepared;
That, ushered swift before Thee, I may
stand
In meek humility and with the calm
Of one who feels his little best is done;
That on the Frontier of Life and Death
I may not fear the crossing, but in Faith
And Courage may go forward with a smile.

DOUGLAS R. P. COATS.

A Model Alternator.

By L. F. ISAAC.

[*The restrictions at present placed upon all amateur working in the field of radiotelegraphy do not, of course, touch the construction of electrical apparatus which is not directly connected with "wireless." The following article on a model alternator will, perhaps, enable readers to pass a few hours in very interesting constructional work—work which will give them a deeper insight into many alternating current problems than would many hours of theoretical study.*—ED.]

READERS may be interested in the following description of a small generator constructed for the purpose of experimenting with small alternating currents. The general design and dimensions can be seen from the photograph, the base being about 9 in. by 6 in. It is a sixteen pole multicoil machine made from odd material I had on hand, and I chose a design that entailed a minimum of mechanical work, only two drills and one tap being used throughout.

The field magnet yoke was made from soft iron strip 1 in. by 1/16 in., hammered into two semi-circles, which were bolted together to form a circle about 8 in. in diameter. The sixteen pole pieces were made of ¼-in. soft iron rod, each ¾ in. long; these were drilled and tapped, and fastened by small iron screws at equal distances round the inside of the yoke. As the latter had not been bent into a perfect circle, I made all the pole pieces slightly too long, and filed them down when in position, so as to make the air gap as regular as possible. Small circles of wood were glued on the ends of the pole pieces, and they were then wound with about 1 oz. of No. 26 double cotton-covered wire. These coils were all wound in the same direction, but joined up in series so as to produce alternatively north and south poles. The two free ends of these windings were connected to the small terminals seen on the left of the photograph.

The armature core was made of a few 32-slot armature stampings, 6 in. in diameter, with alternate projections removed so as to leave a soft iron plate with sixteen poles on the circumference. Sixteen cardboard bobbins were made, about ½ in. by ½ in., each wound with No. 36 enamelled wire, and soaked in shellac varnish. These were slipped on to the projections of the core, being protected from centrifugal force by radial bindings of thin wire, which can be clearly seen in the photograph. The windings are connected up in series in the same manner as the field magnets, so as to make all the alternate coils of the same polarity. The armature was bolted on to a Meccano wheel, a piece of rod 4 in. long from the same source being used for the shaft. On the latter in front of the armature are fixed two slip rings, made of brass tube mounted on discs of hard wood, and these are connected to two opposite points of the armature winding, so as to put the two halves of the latter in parallel.

The brass pillar seen to the left of the front bearing supports a small block of fibre, upon which are mounted the brushes, made of fine wire gauze; these are connected to the terminals on the right. The bearings, 1½ in. high, were filed out of brass sheet, ¼ in.

thick, mounted on wooden blocks 2 in. high, and the method by which the field magnet yoke is fastened to the base can be clearly seen.

Owing to the fact that the machine is wound with such thin wire, it produces a high voltage and small current; when the field magnets are excited with a current of about 2 ampères it will give a powerful shock at a speed of less than 500 revs. per minute, partly in consequence of the large diameter of the armature.

I think that if the machine were wound with thicker wire, more attention given to the regularity of the winding and the reduction of the size of the air-gap, the output would be considerably greater, but at present it is giving excellent results through the medium of an old induction coil converted into a step-down transformer.

On Mathematics.

By W. PERREN MAYCOCK, M.I.E.E.

1. A man taking up mathematics is like a man entering for the first time a vast museum, where everything is of some moment, but most beyond his comprehension.

2. The average man is stunned at the extent of things, and recognises that time (or life) is too short to do them justice.

3. The exceptional man under very able guidance will acquire just that kind and amount of knowledge which is useful to him in his particular work.

4. Another kind of exceptional man under the same guidance will follow up matters on his own account. He will then mature into either a great man or a monomaniac.

5. The average man under the same guidance may or may not be able to grasp the work.

6. Men under ordinary guidance soon sift themselves out into exceptional men and smatterers, generally the latter.

7. Mathematics is like astronomy. A man can devote his whole life to it, and be of little real use on earth.

8. Mathematical engineers in the highest sense are like one type of high army officer. Other types of such officer are needed; and the whole army cannot consist of officers.

9. The very exceptional man can pick up by himself just as much of the right sort of mathematics as he needs. The average man trying to do the same thing is like a ship without a rudder.

10. The average man should absorb just as much of the right kinds of mathematics as he can manage without detriment to his other work.

11. If some good mathematical men were to collaborate in a series of really good books of technical mathematics suitable for different callings they would accomplish great work.

12. Really good books of this description must contain matter most carefully sifted and selected, and must be models of concise, clear, simple and good English and arrangement.

13. It is as impossible for everyone to be mathematical as it is for everyone to make money, or be musical.

14. Money makers—by the way—are seldom mathematical.

15. Some mathematical men act as very superior beings. If they excel in other ways they certainly are so.

16. Some inventions or developments are arrived at mathematically, some are not.

17. The carrying-out of an invention or development through the numerous stages which culminate in monetary return or public weal, or both, depends mostly upon an army of non-mathematical men.

18. The moral is that we want both mathematical men and men talented in numerous other ways.

19. If these "other ways" were stated the mathematical man would be lost in the crowd.

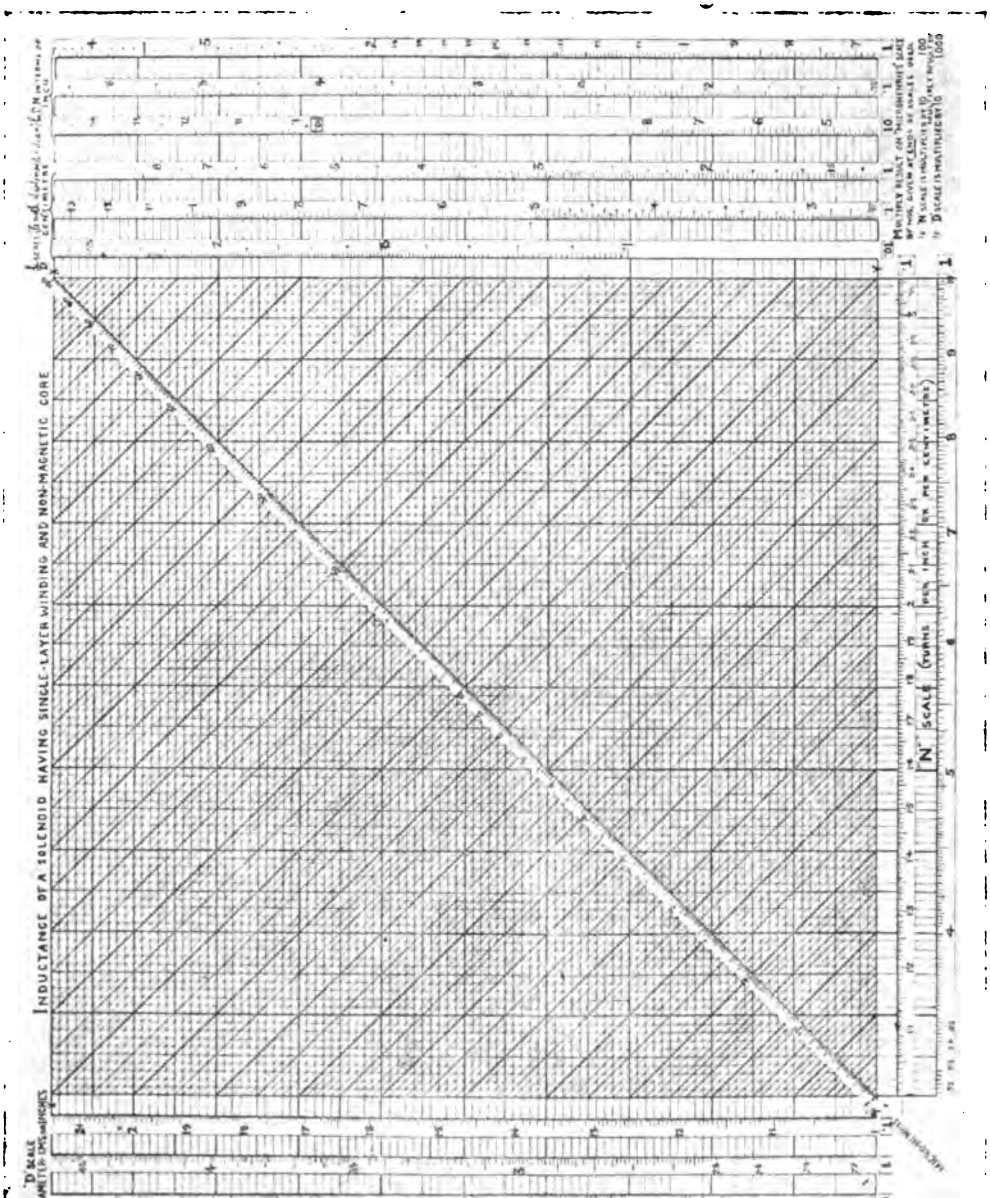
20. Many mathematical men will think this nonsense; non-mathematical men will not.

Inductance Calculations Simplified

By SAMUEL LOWEY.

THE formula for the calculation of self-inductance of a solenoid—viz., $L=(\pi^2 DN) lK$ may be split up into three main factors:—

$$D^3;\ N^2;\ \text{and}\ \frac{l}{D}\pi^2 K.$$



In the diagram the "D" scale is marked, so that the scale length to a given number is equal to the mantissa of the logarithm of that number cubed.

Similarly the "N" scale, to the logarithm of the number squared; the left hand "$\frac{l}{D}$" scale to the logarithm of the product $\frac{l}{D}\pi^2K$ corresponding to the value of $\frac{l}{D}$ indicated, while the right-hand "$\frac{l}{D}$" scale is marked to the log. ($2{\cdot}54\frac{l}{D}\pi^2K$) to correct for the measurements being in terms of the inch instead of the centimetre.

By suitable manipulation, three scale lengths on "D" "N" and "$\frac{l}{D}$" scales may be added together, referred to a scale of antilogarithms, and the result for any particular case obtained directly.

The *modus operandi* can be most conveniently described by indicating the necessary movements geographically, as one would if dealing with a map.

From diameter of solenoid on "D" scale proceed *East*, and from turns per centimetre (or inch) on "N" scale *North*, and from junction either N.W. to line X.—.—.X (multiply result by 10), or S.E. to line Y.—.—.Y

Thence South or North respectively, *and* from $\frac{\text{length}}{\text{dia.}}$ of solenoid on "$\frac{l}{D}$" scale, West to junction; thence either N.W. or S.E., and note reading where "microhenries" scale is cut.

The reading on "microhenries" scale gives the significant figures of the answer; the decimal point is fixed by following the instructions given on diagram.

With care, a result correct to the formula within about 1 per cent. may be obtained, which is usually sufficient, and, in the case of more accurate work, the diagram would be useful in obtaining a first approximation.

Similar scales could be constructed for a large variety of purposes, such *e.g.*, as for showing what capacity is required with any given value of inductance to tune to any wave-length, etc.

WIRELESS EXPEDITION ATTACKED.

That prospectors on behalf of wireless telegraphy in sparsely populated districts have an easy, enjoyable time is given the lie by an incident which has just been recounted. It appears that an expedition of six men were endeavouring to locate a site for a wireless station at the entrance to Hudson Bay, when they found themselves adrift on a huge ice-floe in a blinding snowstorm. The following day they were without food, and on the approach of night discovered that they were being surrounded by two dozen polar bears. The men took refuge on the top of a giant berg, while the bears gathered and laid siege. During the night the bears made an effort to reach the men, when one of them was killed by a well-directed shot.

In the morning the unwelcome visitors beat a retreat, and the men, half starved and badly frost-bitten, succeeded in reaching camp.

WAR PREPAREDNESS.

The December number of the *Wireless Age* contains an interesting page article on war preparedness among American Marconi operators. Captain W. H. G. Bullard (a biography of whom appeared in our issue for September, 1915) has made the suggestion to the American Marconi Company that the latter should lay before their operators a letter from him, asking these young men to enrol themselves for Government services in the event of war. The American Marconi Company has accepted this excellent suggestion, and is taking a keen interest in it. Thus another link has been forged in the chain of American National defence, the importance of which has been demonstrated by the unhappy European cataclysm.

WIRELESS AIDS IN FIGHTING FLAMES.

A disastrous fire recently occurred at Avalon, California, when a large section of the town was destroyed. Aid was summoned by wireless telegraphy, asking that the fire boat *Warrior* be rushed across the channel. A passenger steamer was already on her way when she received notification of the fire and proceeded at top speed to the relief of the distressed town.

Doings of Operators

THE latest name to inscribe upon the rolls of honour of those who, magnificently upholding the "Marconi Tradition," have given their lives for the great cause of humanity is operator George Henry Dewey, who perished in the wreck of the P. and O. liner *Persia*. So sudden was the transition from safety to disaster, from a speedy and comfortable liner bearing its living freight, all unconscious of the proximity of the slinking foe beneath the waves, to the heeling wreck plunging deep into the blue waters of the Mediterranean, with all who were able making away in the lifeboats, that very little is known of the last moments of any who met their death to make a German holiday. Mr. Dewey was still young, having attained his majority as recently as August last. His home was at Grantham, and he was educated at Croxton Kerrial and at Sedgebrook Grammar School.

Operator Dewey.

Operator Salmon.

After completing his education he entered the Post Office as a learner, afterwards becoming sorting clerk and telegraphist. Conceiving the desire to take up the more modern form of communication, he studied wireless telegraphy at the British School of Telegraphy, London, and afterwards entered the Marconi Company's London school, from which he was soon transferred to the operating staff. His first voyage was made upon the s.s. *Lancastrian*, and subsequently he served upon the steamships *Vitruvia*, *Count of Seville*, *Briton*, and *Morvada*. In the middle of December last he was appointed to the hapless liner *Persia*.

One of the passengers on board the *Persia* was operator Herbert Charles Salmon, who was proceeding by this vessel to a port abroad for the purpose of joining another ship. He was fortunately among those saved, and is apparently none the worse for his adventure. Mr. Salmon, whose home is in Cricklewood, has been eighteen months with the Marconi Company, one of the ships upon which he has served being the famous *Falaba*.

Operato: Wellington.

THE LOSS OF THE S.S. "GLENGYLE."

Most of our readers will be acquainted with the sinking of the liner *Glengyle* by an enemy submarine. We are pleased to be able to report that operator Cecil Wellington, who was in charge, has been saved. Mr. Wellington is a native of Oakham, Rutland, and is 20 years of age. He was educated at the Oakham School, Rutland, and afterwards at St. Cuthbert's College, Worksop, Notts., and on leaving studied wireless at the British School of Telegraphy, Clapham. He entered the Marconi Company's school in November, 1913, and was appointed to the staff about a month later, proceeding to sea on the s.s. *Antillian*. He then served on the s.s. *Ortega*, *Den of Ogil*, and *Remuera*, taking up his appointment on the s.s. *Glengyle* in August, 1915.

* * *

THE WRECK OF THE S.S. "GEELONG."

Within a few days of the loss of the *Persia* the P. & O. Company had the misfortune to lose a second large liner, the s.s. *Geelong*. Operator Christopher Rapsey was in charge of the wireless installation, and at the time of writing we have no information as to whether he is among the survivors. Mr. Rapsey, who was born in December, 1891, at Fulham, was a teacher of handicraft before taking up wireless telegraphy as a profession, and upon the Marconi Company opening a course of evening classes entered the London school for training. He was appointed to the staff in October, 1913, serving first on the s.s. *Minnehaha* and subsequently upon the s.s. *Patia*, *Englishman*, *Montfort* and *Middlesex*. He was appointed to the s.s. *Geelong* in August of last year. We sincerely trust that he has come safely through the perils of shipwreck, and is none the worse for his experience.

* * *

S.S. "LANGTON HALL."

Mr. Charles Thomas Seaton, operator of the lost steamer *Langton Hall*, is 24 years of age, and hails from Lancashire. Born and educated at Leicester, he was for some little time in the service of the Post Office, and afterwards entered business in Uppingham, whence he proceeded to positions in Nuneaton, Liverpool and Earlston. Taking interest in wireless telegraphy, he entered the Liverpool Wireless Training College, and was accepted in the Marconi Company's London school in June, 1914. After a finishing course he was appointed to the operating staff at the end of July of that year, and served successively on the s.s. *Potaro*, *Minneapolis*, *West Point*, *Start Point* and *Langton Hall*. We are glad to say that he is safe and sound, and has, in

Operator Seaton.

Operator Baker.

fact, already taken duty upon another steamer, the s.s. *Nore*. He is to be congratulated upon his lucky escape.

* * *

LOSS OF THE S.S. "ORTERIC."

Still another victim of Hunnish piracy is the s.s. *Orteric*, upon which Mr. Frederick Horsey Baker served as operator. Mr. Baker, who has been in the service of the Marconi Company some four years, is 27 years of age, and was born at Corsham, Wiltshire. On leaving school he took to telegraphy as a profession, and served a number of years on the telegraphic staff of the Great Western Railway. He was accepted in the Marconi Company's London school in September, 1911, and after a course of training in wireless made his first voyage to sea upon the s.s. *Virginian*. Upon his return he was appointed to the s.s. *Huayna*, and afterwards to the s.s. *Oronsa*, *El Argentina*, *Gloucester Castle*, *Urubamba*, and finally to the *Orteric* about a month before the outbreak of war. Mr. Baker had had a very long voyage with this steamer when she was torpedoed, but fortunately he escaped unscathed, and has again taken up his duties, now serving on the s.s. *Mississippi*. The pluck and determination shown by these young men is emphasised by their willingness to repeatedly tread the path of danger when duty calls.

FEATURES OF THE NEW VOLUME.

IMPORTANT IMPROVEMENTS IN THE "WIRELESS WORLD."

OUR next number will bring to a close the third volume of the "Wireless World." Starting with the April number, we shall present our readers with a magazine much larger in size, with an extended and very comprehensive scope, and many additions and improvements. A number of appreciative letters from all parts of the world, some of which have appeared in our pages, have indicated to us the direction in which progress could most suitably be made. Next month we shall return to the subject and give full details.

In order to find space for these improvements the size of the journal has had to be increased, with the consequence that it is no longer possible for us, especially in view of the enormous increase in cost ot materials and production, to issue the magazine at the price of 3d. Will readers kindly note, therefore, that the subscription rate with the new volume will be 8s. per annum, post free, and the price of a single copy 6d., or 9d. post free.

A new and artistic cover is in course of preparation, and will, we are sure, find many admirers when the day of publication arrives.

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: and it must be clearly understood that owing to the Defence of the Realm Act we are totally unable to answer any questions on the construction of apparatus during the present emergency.

We again wish to draw the attention of readers to the note at the head of this page. Both the construction and use of wireless apparatus by amateurs is at present prohibited, and we cannot answer any questions as to how aerials and other parts of a wireless installation can be constructed, neither can we criticise diagrams of connections sent to us. A number of correspondents have also addressed letters to us asking what their position would be in the event of conscription. Not being blessed with the gift of prophecy we can only reply in the words of Mr. Asquith: "Wait and see."

Many thanks to the many correspondents—too numerous to reply to individually—who have sent in interesting letters on the subject of the "Little Problem." Next month we shall publish an article on the Cube Problem from the pen of Dr. Fleming, who is an authority on all such calculations.

P. R. (Co. Wexford).—The educational qualifications which you state that you possess should be sufficient to have your case considered, but your suggestion that the Marconi Company should find you another situation in your present trade after the war is over almost takes our breath away. Seriously, P. R., where do you think the Marconi or any other company would be in a little while if it devoted its energies to finding situations in other trades for its present or would-be employees?

C. C. B. (Crouch End) writes: (1) "Where can I find a fuller explanation of the phenomenon of the production of electric waves in the æther by the interaction of electromagnetic and electro-static lines of force emanating from an aerial, mentioned on p. 259, column 1, of THE WIRELESS WORLD, Vol. I.?" (2) "On p. 333, col. 1, *ibid*, the three things which determine the power in an oscillating circuit are mentioned. What is the formula for this?" (3) "On p. 523, col. 2, *ibid*, it is stated that 'the most efficient coil . . . for the secondary circuit of the crystal receiver is one whose wave-length by itself will be the required value without the addition of any extra capacity.' If this be so, why not make the inductance variable and dispense with the condenser altogether? Lower down it says, again, that 'the maximum efficiency is obtained when the capacity across the secondary condenser is reduced to zero.' When this state of affairs is reached, however, surely the crystal, potentiometer and 'phone becomes part of the oscillating circuit (the condenser being, for the nonce, a mere break in the circuit), all of which have great resistance, which, as pointed out earlier in the article, is very bad in an oscillating current?"

Answers.—(1) The subject of electro-magnetic waves is dealt with very fully in Dr. Fleming's book, ***The Principles of Electric Wave Telegraphy and Telephony***, and also to some extent in the *Handbook of Technical Instruction for Wireless Telegraphists*. To go at all deeply into the subject requires considerable mathematical knowledge. (2) The formula for the power in the circuit you mention is:

$$P = \tfrac{1}{2}NCV^2$$

where N is the number of times per second the condenser is discharged, C the capacity in microfarads, V the voltage, and P the power in watts. (3) There are several objections to making the inductance variable. Without a lot of trouble it can only be made variable in steps, whereas the capacity can easily be made continuously variable; then, again, if the inductance is made variable by the usual methods, the end turns not connected to the detector are still connected to the rest of the inductance and the whole coil is free to resonate at its natural wave-length, thus hindering sharp tuning. There are other objections which may occur to you when you think matters over. High efficiency modern receivers in which the secondary inductance needs to be variable have arrangements for cutting the inductance not needed right out of circuit. With regard to the second part of the query, the telephone, crystal and potentiometer are not in an *oscillating* circuit. You must remember that the inductance with its self-capacity forms an oscillating circuit, and the crystal, etc., is tapped off this. If it were not for this self capacity the circuit would not be tuned.

H. J. G. (Walthamstow).—Many thanks for your appreciative remarks. It is unusual to build a condenser as shown by you. The two outer plates should be of the same polarity, thus giving one side of the condenser one more plate than the other. The capacity can then be calculated from the formula given in paragraph 601 of Vol. II. of THE WIRELESS WORLD, December, 1914.

G. B. (Millom, Cumb.) writes: "" On page 528 of THE WIRELESS WORLD, Vol. II., there is an article 'A Morse Practice Set,' by C. Barnard. In the diagram of connections shown I do not quite follow the direction of the current. Also, is the key shown a single contact key or a double contact one?"

Answer.—Both keys have contacts at the front and the back, also connections to the bridge. If you will look at the diagram you will see that the keys are drawn open at both contacts. Now imagine the left-hand key depressed (front contacts together) and the right-hand key in its normal position—namely, with the two back contacts together, then the current will pass from the right-hand battery up through the back contacts of the right-hand key, through the primary "*f*" along the top wire, through the second primary, down the front contacts of the left-hand key, round the bottom wire up through the buzzer and down again to the battery "*d*." When the left-hand key is in normal position and the right-hand key is depressed you will be able to trace the current from battery "*D*" in the same way.

F. M. (Ballinacurra).—Certificates in other systems are granted only when the applicant has had *practical training* on the apparatus of those systems. We would advise you to master the Marconi system before taking up the study of other apparatus, as it is far better to be thoroughly proficient in one system than to have a smattering of several. Why are you anxious to take a certificate in a German system?

Coupon for Problem Competition.

This coupon must accompany each entry for the above. A separate coupon must be submitted with each problem.

Full particulars as to prizes and latest date for entries are given on another page.

Address all communications to

The Editor,
"THE WIRELESS WORLD,"
Marconi House,
Strand, London, W.C.

And mark envelopes "Competition."

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Instructional Article

NEW SERIES (No. 6)

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

Trigonometry.

35. In commencing a study of trigonometry, our first need is of some method of measuring angles. There are two methods in common use, and we will first consider that known as

Sexagesimal Measure.

Imagine the line A B (Fig. 13) to be hinged at A, so that the end B can be moved round A along the circumference of a circle—shown dotted. If we move A B anti-clockwise to a position A B_1, then the line A B will have *swept out the angle* B A B_1.

Suppose now we continue to turn A B until it reaches a position A B_2, perpendicular to A B, then A B will have turned through *one right angle.* Continuing round the circle, we reach a position A B_3, such that B_3 A B is a straight line, and then A B will have swept out *two right angles.* Proceeding, when A B reaches the position A B_4, such that A B_4 is perpendicular to B_3 A B (or where B_4 A B_2 is a straight line), then A B will have passed through *three right angles.* Finally, when A B reaches its original position it will have passed through *four right angles.*

In *sexagesimal measure* these four right angles, corresponding to one complete revolution of the line, are divided into 360 equal parts, called *degrees.*

As four right angles equal 360 degrees (written 360°), one right angle equals $\frac{360°}{4} = 90°$.

For more accurate work each degree is sub-divided into 60 equal parts called *minutes*, and each minute is in turn divided into 60 *seconds.*

Example.

Find the value of one-seventh of a right angle to the nearest second.

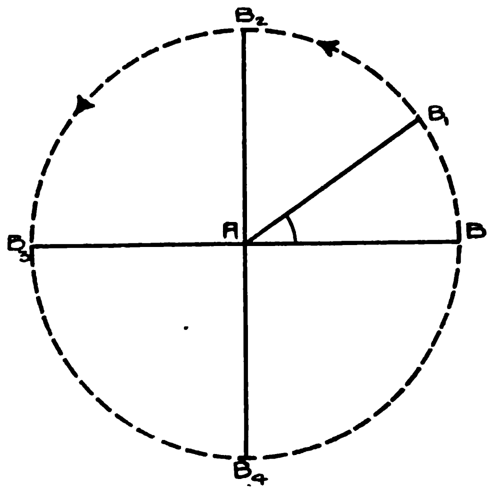

Fig. 13.

One-seventh of a right angle

$= \frac{1}{7}$ of $90° = \frac{90}{7}° = (12\frac{6}{7})°$.

$\frac{6}{7}$ of a degree $= \frac{6}{7}$ of 60 minutes.

$= (\frac{6}{7} \times 60)$.

$= \frac{360}{7} = (51\frac{3}{7})$ minutes.

$\frac{3}{7}$ of a minute $= \frac{3}{7}$ of 60 seconds.

$= (\frac{3}{7} \times 60)$.

$= \frac{180}{7} = 26$ seconds (approx.).

Ans.—12 degrees 51 minutes 26 seconds, written as $12° \ 51' \ 26''$.

36. It must not be supposed that 360° is the greatest possible angle, for the line A B could be made to rotate indefinitely, sweeping through an additional angle of 360° in each complete revolution. Thus an angle of 800° would consist of two complete revolutions, making up $(2 \times 360)° = 720°$, *plus* an additional angle of 80°.

37. The second method of measuring angles is called

CIRCULAR MEASURE.

This is the method used in all higher mathematics. The unit by which angles are measured in this system is obtained as follows:

Draw a circle B C D (Fig. 14) with any radius A B. From B measure off a length B C, *along the circumference*, equal to the radius A B (r). Then, on joining C A, the angle B A C is a unit angle of one *radian*. It is most important to note that it is *not a straight line* B C, which is equal to A B, but the *length of that portion of the circumference* which lies between B and C.

It can be easily proved, mathematically and by trial, that an angle of one radian marked off in this way is an absolutely constant quantity, quite independent of the size of the circle used. Thus the radian can be used as a fundamental unit by which to measure angles, and it is so used in circular measure.

In Article V. we saw that the whole length of the circumference of a circle is equal to 2π times the radius, and so we can mark off 2π successive lengths, each equal to the radius, round the circle. Now obviously (see Fig. 14) each of these 2π lengths will face an angle of one radian at the centre of the circle, and so the whole four right angles or 360° at the centre will be equal to 2π radians.

Thus 2π radians = 360° = 4 right angles.

π ,, = 180° = 2 ,,

$\frac{\pi}{2}$,, = 90° = 1 ,,

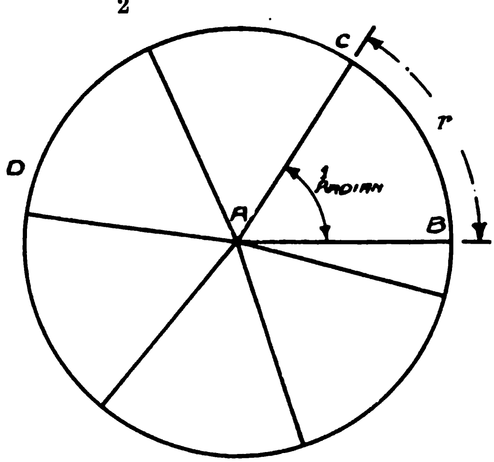

Fig. 14.

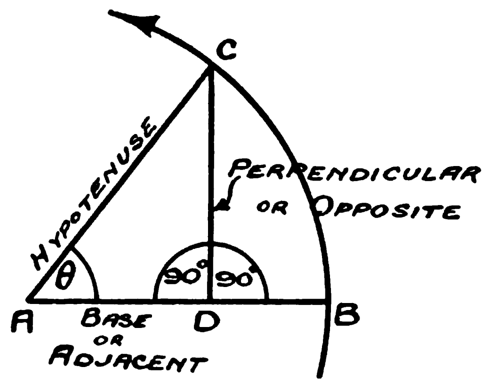

Fig. 15.

Example.

Find the value, in sexagesimal measure, of 1 radian.

π radians = 180°.

Therefore 1 radian $= \left(\frac{180}{\pi}\right)^{\circ}$

$= 57.3^{\circ}$

$0.3^{\circ} = \frac{3}{10}$ of $60' = 18'$

Thus 1 radian = 57° 18′ (approx.).—*Ans.*

Example.

Find the value of 140° in circular measure.

180° = π radians.

Therefore 140° = $\frac{140}{180}$ of π

$= \frac{7}{9}\pi$ radians
or 2·445 radians. } *Ans.*

TRIGONOMETRICAL RATIOS OF ANGLES.

38. For the present we shall only deal with angles which are smaller than one right angle.

Reverting for a moment to our revolving line, we will assume it has reached a position AC (Fig. 15), and we will call the angle BAC by the Greek letter θ (Theta). CD is a line drawn from C perpendicular to AB; thus angle BDC and angle ADC are each equal to one right-angle or 90°.

Dealing with the angle DAC and the triangle ACD, we will call AD the *base* or *adjacent* side,

AC the *hypotenuse*,

And DC the *perpendicular* or *opposite*.

As the line AB revolves about the centre A, the values of the perpendicular and of the base will continually vary, the perpendicular *in*creasing and the base *de*creasing: the hypotenuse remains constant. This will be easily seen by considering Fig. 16, which shows various positions of the rotating arm AB from 0° to 90°.

From this figure you will see that as AB moves round, the *ratios* existing between the various sides of the triangle ACD, taken in pairs, are continually changing in value according to the size of the angle BAC. It can be shown, moreover, that for any given size of angle the *ratio* $\frac{\text{opposite}}{\text{hypotenuse}}$, say, is a constant, quite independent of the *actual* lengths of these two sides. Obviously we could specify any given angle by saying that its ratio $\frac{\text{opposite}}{\text{hypotenuse}}$, obtained from a right-angled triangle such as the triangle ACD, is equal to some stated numerical value. Thus it is that the question of these ratios between the three sides of the triangle is of very great importance.

39. The three sides we have called adjacent, hypotenuse and opposite can be arranged in the following six ways, each of which is given a name :—

(i) $\frac{\text{opposite}}{\text{hypotenuse}}$ = sine of angle θ.

(ii) $\frac{\text{adjacent}}{\text{hypotenuse}}$ = cosine of angle θ.

(iii) $\frac{\text{opposite}}{\text{adjacent}}$ = tangent of angle θ.

(iv) $\frac{\text{hypotenuse}}{\text{opposite}}$ = cosecant of angle θ.

(v) $\frac{\text{hypotenuse}}{\text{adjacent}}$ = secant of angle θ.

(vi) $\frac{\text{adjacent}}{\text{opposite}}$ = cotangent of angle θ.

Note that cosecant is the reciprocal of sine, or cosecant = $\frac{1}{\text{sine}}$.

Similarly secant = $\frac{1}{\text{cosine}}$.

And cotangent = $\frac{1}{\text{tangent}}$.

These ratios look somewhat forbidding at first sight, but they are of the utmost importance, and must be learnt. The reciprocal ratios are quite easy once the first three (sine, cosine and tangent) have been learnt, but it must be remembered that :—

(*a*) sine and *co*secant ;
(*b*) *co*sine and secant are reciprocals,
NOT *co*sine and *co*secant.

40. For convenience in writing and printing the following notation is adopted :—

"The sine of the angle θ" is written as sin θ.

"The cosine of the angle θ" is written as cos θ.

"The tangent of the angle θ" is written as tan θ.

"The cosecant of the angle θ" is written as cosec θ.

"The secant of the angle θ" is written as sec θ.

"The cotangent of the angle θ" is written as cot θ.

Instead of writing "The angle whose sine is 0·7," we write $\sin^{-1} 0{\cdot}7$, and similarly for "The angle whose tangent is 0·3"—$\tan^{-1} 0{\cdot}3$. "The angle whose secant is 3·7"—$\sec^{-1} 3{\cdot}7$, and so on.

41. Let us take a triangle ABC (Fig. 17) in which angle B=90°.

Angle A=angle C=45°.

Then AB=BC=1 (say) because the triangle is isosceles.

As angle B=90°, $AC^2=AB^2+BC^2$
$=1+1=2.$

Thus AC= $\sqrt{2}$.

From this sin 45°=sin BAC

$$=\frac{CB}{CA}=\frac{1}{\sqrt{2}}$$

$$\cos 45° = \frac{AB}{AC} = \frac{1}{\sqrt{2}}$$

$$\text{and } \tan 45° = \frac{BC}{BA} = \frac{1}{1} = 1$$

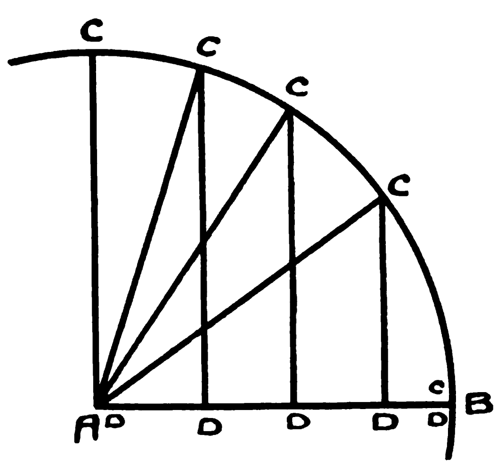

Fig. 16.

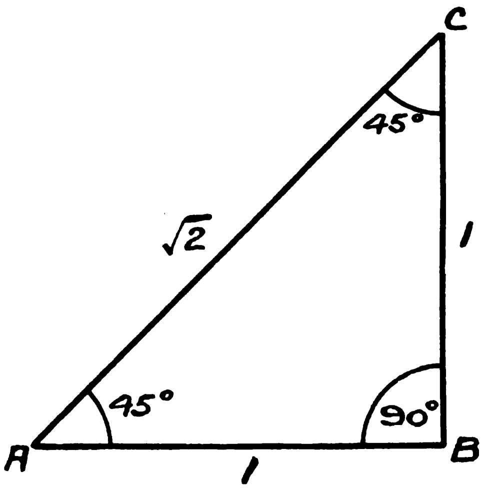

Fig. 17.

$$\text{Also cosec } 45° = \frac{1}{\sin 45°} = \sqrt{2}$$

$$\sec 45° = \frac{1}{\cos 45°} = \sqrt{2}$$

$$\cot 45° = \frac{1}{\tan 45°} = 1$$

42. Triangle ABC (Fig. 18) is equilateral, and so each angle is equal to 60°; also let each side equal 2 units. If AD be drawn perpendicular to BC, then angle DAB=angle DAC=30°; angle ADB=angle ADC=90°; and BD=DC=1.

From the right-angled triangle ADB—

$$AB^2 = AD^2 + DB^2$$
$$\text{or } AD^2 = AB^2 - BD^2$$
$$= (2)^2 - (1)^2$$
$$= 4 - 1 = 3.$$

Thus AD = $\sqrt{3}$.

$$\text{From this } \sin 60° = \frac{AD}{AB} = \frac{\sqrt{3}}{2}$$

$$\cos 60° = \frac{BD}{BA} = \frac{1}{2}$$

$$\text{and } \tan 60° = \frac{DA}{DB} = \frac{\sqrt{3}}{1} = \sqrt{3}.$$

From this figure we can also get the values for the various ratios of an angle of 30°, in which case—

BD is "opposite."
DA is "adjacent"
and AB is "hypotenuse."

43. In Fig. 19 the angle BAC (or DAC) has become very nearly 90°. It will be easily seen that now CD has become nearly equal to CA, which we can call unity: AD has nearly vanished altogether. Obviously, when CA has turned a little farther anti-clockwise, so that the angle BAC *is* 90°, then CD will equal CA (which equals 1), and DA will be equal to 0.

$$\text{Thus } \sin 90° = \frac{CD}{CA} = \frac{1}{1} = 1$$

$$\cos 90° = \frac{AD}{AC} = \frac{0}{1} = 0$$

$$\tan 90° = \frac{DC}{DA} = \frac{1}{0} = \text{infinity}$$
(written ∞).

Similarly the values for 0° can be obtained, and we can then construct the following table of ratios for these angles:

	0°	30°	45°	60°	90°
Sine .	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cosine .	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tangent	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

44. In company with log tables will generally be found tables giving the values of these trigonometrical ratios for all angles between 0° and 90°. An extract from such a table is shown below:

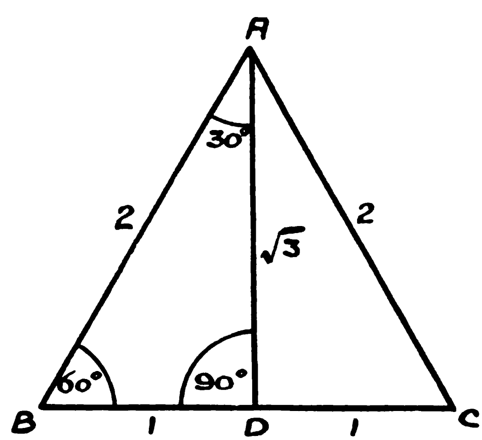

Fig. 18.

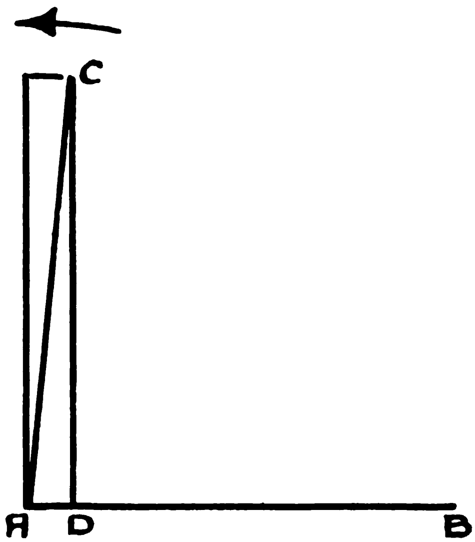

Fig. 19.

Deg.	Sine.	Tangent.	Cotangent.	Cosine.	
14	·2419	·2493	4·0108	·9703	76
15	·2588	·2679	3·7321	·9659	75
16	·2756	·2867	3·4874	·9613	74
17	2924	·3057	3·2709	·9563	73
18	·3090	·3249	3·0777	·9511	72
19	·3256	·3443	2·9042	·9455	71
20	·3420	·3640	2·7475	·9397	70
21	·3584	·3839	2·6051	·9336	69
22	·3746	·4040	2·4751	·9272	68
	Cosine.	Cotangent.	Tangent.	Sine.	Deg.

For angles up to 45° we work *downwards* from the top, and for angles greater than 45° we work *upwards* from the bottom. For example, cos 17° is 0·9563, found *under* " cosine " and opposite 17° in the left-hand column. The value of cos 74° is 0·2756, found *above* " cosine " and opposite 74° in the right-hand column.

Similarly—

$\cot 18° = 3{\cdot}0777$
$\tan 69° = 2{\cdot}6051$
$\cos 73° = {\cdot}2924$
$\sin 19° = {\cdot}3256.$
$\tan^{-1} {\cdot}3839 = 21°$
$\sin^{-1} {\cdot}2419 = 14°$
$\cot^{-1} {\cdot}3443 = 71°$
$\cos^{-1} {\cdot}30 = 72\tfrac{1}{2}°$ (approx.).

WIRELESS AT BOWES PARK.

THE note in the January number entitled " Wireless at Bowes Park " has brought forth the following letter from the person actually concerned :—

" DEAR SIR,—I notice your reference to " me last month, and beg to add a few re- " marks on the subject. The incident dis- " closes a characteristic trait of the average " individual ; the over-powering desire to " participate in something. Everyone seems " to possess it. Thus, some people will sub- " scribe to the ' Fund for Homeless Hippo- " ' potami,' or some other good and deserving " cause, just for the sake of seeing their " names in a subscription list. Others amal- " gamate to wage war on harmless (?) experi- " menters like myself. My instruments were " taken away shortly after war broke out, " but this did not prevent the police from " paying me periodical visits, because some- " one was sure that our clothes-line was an " aerial in disguise. It was not until I had " hoisted a huge Union Jack on the disused " aerial mast that the patriotic neighbours " were satisfied that I had no pro-German " tendencies. With their breasts swelling " with a sense of duty well executed, they " retired temporarily and gave me a few " months' rest. Then I invented an " electric motor horn, with a particu- " larly aggressive and penetrating note, " which, I might add, I hope shortly " to place on the market. That did it ! " I was again presented—metaphorically— " with a high-power wireless station by the " indignant neighbours, and the visits were " renewed in consequence. Between our- " selves, however, it does not say much for " their knowledge of ' wireless ' if they can " confuse the sound emitted by an electric " horn with the crackle of a low-power " amateur transmitter. Perhaps, however, " it possesses certain advantages ; it keeps " these persons from doing worse mischief " elsewhere, it gives me a par. in the local " paper, and—but I see the editorial blue " pencil hovering over this letter on account " of its length, so wishing this magazine— " which I have read with interest and much " advantage from No. 1—every success,

" Yours, etc.,

(*Signed*) " ARTHUR W. HULBERT."

The LIBRARY TABLE

"AN INTRODUCTION TO APPLIED MECHANICS." By Ewart S. Andrews, B.Sc. Cambridge: At the University Press. 1915. 4s. 6d. net.

The subject of applied mechanics is one which presents difficulties to both teacher and student. To steer a clear course between too much applied mathematics on one hand and too much engineering application without sufficient explanation of principles on the other is a task not lightly to be undertaken by an author, and we think the writer of this treatise has acquitted himself excellently. As a class book in the junior classes of engineering colleges and those schools which give attention to engineering, as also for the home student who is not very far advanced, this volume should be of welcome assistance.

* * *

"INTRODUCTION TO MAGNETISM AND ELECTRICITY." By E. W. E. Kempson, B.A. London: Edward Arnold 3s.

One of the most favourable features of this book, and one which might well be copied by other writers, is the treatment of Static Electricity in such a way as to show its relation to Voltaic Electricity. All who are concerned with the teaching of wireless telegraphy know the confusion in the student's mind created by his learning about frictional electricity, the electrophorus, the Wimshurst machine, and other similar matters as something entirely separate from voltaic electricity, and then, after a further period of study during which he learns of batteries and dynamos, his finding that wireless telegraphy utilises condensers similar to Leyden jars in connection with the same batteries and dynamos. Mr. Kempson—who, by the way, is senior physics master at Rugby—is fully alive to the importance of treating the two branches of the science in such a way as to show their inter-relation, and in the book before us elaborates his lecture notes for a year's course of Electricity and Magnetism as given to the science forms in that famous school. The book is well produced, with clear diagrams, and should prove useful to both schools and private students. It is particularly to be recommended to those about to take up the study of wireless telegraphy who desire to obtain a good sound grasp of elementary electricity.

* * *

"THE AVIATION POCKET-BOOK, 1915–16." By R. Borlase Matthews. London: Crosby Lockwood & Son. 3s. 6d. net.

The number of specialised "pocket-books" grows apace. Only a month or two ago we reviewed Dr. Fleming's "Pocket-Book for Wireless Telegraphists," and now we have before us the third edition of "The Aviation Pocket-Book" with a mass of up-to-date information, well digested and tabulated, of great value to all who are interested in the art of flight. Unlike too many so-called pocket-books, the little volume under review can readily be slipped into the pocket without creating a decided "lump." Commencing with a review of aviation developments, the editor points out that "whereas the effect of the war has "in many cases been derogatory to develop- "ment, the science of aeronautics has on "the contrary been stimulated, and every "possible effort has been and continues to "be put forward by Allies and enemy alike "to improve the efficiency and reliability "of their flying equipment." Of particular interest to the wireless student is the statement that, prior to the outbreak of hostilities, the German Admiralty had ordered a British seaplane (a Sopwith), fitted with wireless apparatus driven by a separate engine. Following this review of progress, we find some interesting statistics of German aeroplanes and dirigibles, together with a list of some notable British aeroplane war achievements. Next come a number of chapters on Air Pressure and Resistance, Aeroplane Theory and Design, Structural Materials, etc., etc., and some important information on aeroplane engines, piloting, and aviation generally. Mention must also be made of the useful glossary of terms at the end of the book. Altogether, this is a very useful and well-compiled volume.

* * *

"POLYPHASE CURRENTS." By Alfred Still, A.M.I.C.E. Second Edition. London: Whittaker & Co. 6s. net.

This book aims at providing a non-mathematical treatment of the principles underlying the operation of polyphase currents. The reader is presumed to be acquainted with direct current principles, but not with alternating work, and the first chapters are therefore given up to an elementary study of alternating currents, self-induction, capacity, and the like.

Whether the author is justified in giving up nearly a quarter of the book to such elementary considerations is a point on which opinions will vary. For our part, we think that very few students will purchase a book on polyphase currents before having thoroughly mastered the general principles of alternating current work; and for those who approach the subject without a previous knowledge of alternating current phenomena these chapters are scarcely sufficient preparation. However, the two chapters in question will doubtless serve to refresh the memory of students on points of importance before they proceed to the main subject.

Those parts of the book which deal with polyphase currents are clearly written and well illustrated, chapters being devoted to general principles and synchronous generators, measurement and calculation of power in polyphase circuits, polyphase transformers, motors, and other matters. We have no doubt that the volume will be welcomed by many whose mathematical knowledge is insufficient to enable them to follow the reasoning in the more advanced treatises, and who have not the time to spare for a deeper study of the subject.

* * *

"FOR FLAG AND EMPIRE." By T. Wilkinson Riddle. 1915. London: Marshall Bros., Ltd. 1s. net.

It is with pleasure that we accede to the request of Lord Radstock to review the above book in the pages of our journal. The sub-title is "The Story of the British and Foreign Sailors' Society in Peace and War." The book forms an exposition of the aims and objects of the Society and the great work that is done by them in the alleviation of distress amongst the sailors of the world's navies and mercantile marines. Within the latter category is classed the whole army of wireless operators throughout the world, who, although they are not in the trenches, are not one whit the less "doing their bit." The naval fleets keep the seas open whilst the mercantile fleets bring food and other necessary material to our shores. We hope that all our readers will obtain a copy of the book, and thus help forward the excellent work so unostentatiously done by this Society. It is interesting to note that the poem entitled "The Merchant Service Man" has been reprinted from THE WIRELESS WORLD.

* * *

"THE GREATER POWER." By Guy Thorne. 1915. London: Gale & Polden, Ltd. 1s. net.

In the dedication of this book the author explains the why and wherefore of the story. A friend had asked him "to write "a sensational novel dealing with an aspect "of the world-war *in a fortnight*." The author did it. The book deals with a powerful plot conducted in the heart of the

Vatican itself in which wireless telegraphy plays an important part. One of the priests of the Papal Court was suspected of sending wireless messages from the golden ball above the dome of St. Peter's, Rome, to the Austrian forces. The hero and his brother determined to stop this, and their ways and means to accomplish this end should be sought in the book. Altogether it forms very thrilling reading.

* * *

"DAILY MAIL YEAR BOOK, 1916." Edited by David Williamson. London: Associated Newspapers, Ltd. 6d. net.

The sixteenth annual edition of this useful compendium of information has come into our hands. It is fuller than ever of things one wants to know. Naturally in the present edition a very large amount of space has been given to the war and matters concerning the war. To our readers the article which will make a special appeal is entitled "Wireless and the War," which records some of the achievements of Senatore Marconi's invention. No reference bookshelf is complete without this amount of information.

* * *

"FIGHTING SHIPS." By Fred T. Jane. 1915. London: Sampson Low, Marston & Co., Ltd. 21s. net.

In spite of the difficulties consequent upon issuing such a book during the present state of affairs, a work altogether worthy of the author and publishers has been placed upon the market. It is true that no designs or silhouettes are allowed to be published in the section dealing with the British ships, but with that exception the book practically contains all its well-known and much-appreciated features. In his preface the author tells us that a great deal of money has been expended in an effort to secure odd items of information not generally known, especial care being devoted to the German section. Mr. L. Cecil Jane, M.A., the well-known historian of Oxford, has written an article entitled "Historical Analogies and the Naval War," and this replaces that usually contributed on the progress of Naval Engineering, which has been temporarily suspended from the book. All our readers should possess a copy and especially in view of the large and important part played by wireless telegraphy in naval matters. It is understood that after the war a complete issue, including the full British particulars, will be placed on the market.

* * *

"AN UNTAMED TERRITORY" (The Northern Territory of Australia). By Elsie R. Masson. London, 1915: Macmillan & Co., Ltd. 6s.

The material for this book, says the author, was collected in the northern territory of Australia during the years 1913 and 1914. Miss Masson, in the course of her stay, studied life in Darwin, and also saw something of the more outlying parts of the territory. The whole social life of the territory is fully dealt with, and a very interesting insight into the manners and customs of the aboriginal blacks is given. Some excellent illustrations adorn the book. Miss Masson made a trip out through the bush by motor-car to Undidu. She recounts how during the last two years the experiment has been made of using an automobile instead of a horse. "It was a bold experiment in a country roadless, sometimes for long stretches waterless, and sparsely populated, and there have been difficulties with tyres, petrol or water." Australia within the last two or three years has seriously taken up the question of radio-telegraphic communication between various points within the Commonwealth and outside it. There is a vast field for further scope in this connection to which the Australian Government is fully alive.

* * *

"PORTUGAL AND THE PORTUGUESE" ("Countries and Peoples" Series). By Aubrey F. G. Bell. London, 1915: Sir Isaac Pitman & Sons, Ltd. 6s. net.

The excellent "Countries and Peoples" series placed upon the market by the publishers have now become standard works. From time to time we have had the pleasure (it is a pleasure) of commenting on books in this series, and it has now fallen to our lot of reviewing yet another. Mr. Bell is a well-known writer on all matters pertaining to the Iberian peninsula, and his contributions to literature have received well merited distinction. The present book is quite up to his usual standard and its perusal afforded us great pleasure.

Foreign and Colonial Notes

Japan.

The Funabashi wireless station, which has just been completed, has for some time since been receiving and despatching wireless messages to and from Honolulu. There has been received from the *Hawaii Shimpo*, a Japanese paper, the following message, addressed to the *Tokyo Asahi*:

"As the result of the great success of the "Marconi wireless system Japan and Hawaii "have been linked with each other, the two "countries being aerial neighbours. We "beg to utilise this felicitous occasion to "render our warmest compliments to our "contemporary, which is working for the "attainment of the high objects, which we "have in common, of advancing the common "interests of mankind and harmonising the "civilisations of East and West."

* * *

Pacific.

According to the *Electrician* the contracts for the erection of the 600 ft. steel towers for the United States Government wireless stations at Cavite (Philippines), Honolulu, and San Francisco, have been awarded to the Chicago Bridge Company.

* * *

Philippine Islands.

Work on the new wireless station at Margosatubig (Philippines) is nearly completed, says the *Electrician*. Margosatubig will then be in direct communication with Samboanga, Malabag, and the Manilla submarine cable system.

* * *

United States.

On account of numerous complaints made by American exporters and importers against censorship delays of commercial cable messages in London, and the apparent inability of the United States Government to effect relief, the State Department at Washington, according to the *Wireless Age*, is about to advise these firms to use wireless instead of cable. The principal protests have concerned the detention of commercial messages of American firms to and from Norway, Sweden, Denmark and Holland.

* * *

It is recorded that the American Government closed for a fortnight from October 9th last the new radio station at the Great Lakes Naval Training Station. The Government explanation was that during the manœuvres of the fleet off the Atlantic coast it was possible that messages sent to captains of the ships would be interfered with by activity at the Great Lakes Station.

* * *

A wireless operator at Honolulu, Hawaii, on November 29th last, according to the *Telegraph and Telephone Age*, recently picked up messages transmitted from Nauen, Germany, to Tuckerton, N.J., approximately 9,000 miles away. It is stated that the signals as received were very clear.

* * *

At the annual gathering of Alaskans on November 20th last at the Arctic Club, Seattle, to commemorate the close of the summer season in Alaska, the guests were greatly surprised to discover in the banquet room a complete Marconi wireless system, and during the dinner a message was received direct from the Governor of Alaska. Its arrival was marked by prolonged cheering, and the fact that the message was received over the Marconi system direct from Juneau without being handled by land connections was prominently brought home to all present. A wireless reply was sent to the Governor. The set installed in the banquet room consisted of a ½ kw. quenched gap panel set to which was attached a large antenna on the Smith Building, wherein is situated the Seattle station. Messages were relayed from the high-power station at Astoria.

Company Notes

The Marconi Wireless Telegraph Company of Canada, Limited. Annual Report for the Year ending January 31st, 1915.

THE Directors, in submitting the Annual Report of the company's business, together with a Statement of Accounts for the year ending January 31st, 1915, recorded that during the six months which elapsed before the outbreak of the war the business of the company continued to make normal and satisfactory progress.

The range of the Cape Race station has been greatly increased by the equipment of that important station with steel masts 250 ft. high replacing the 160 ft. wooden spars, and on the return to normal conditions there should be a marked improvement in the earnings of the station.

The establishment of a well-equipped factory in Montreal with excellent shipping facilities has been amply justified, and, despite increasing difficulties in obtaining raw materials, the company has been able to meet all demands. During the year permanent stores and offices have been opened at Toronto, Ont., and Vancouver, B.C.

Message traffic to and from ships, which forms an important source of the company's revenue, and which prior to the war was showing a gratifying increase, has naturally been adversely affected by the severe censorship imposed, the general dislocation of passenger traffic, and the placing of important stations at the disposal of the Government.

It was impossible to fully relate the very important services rendered to the Naval authorities. Calls for assistance have been received almost daily, operators required at short notice for special duty, apparatus for urgent requirements installed practically on demand, and especially powerful installations for new stations supplied in record time. It is a tribute to the company's organisation to record that in no single instance has it failed to fully meet the demands made upon it. In addition the company has had to provide for the loss of trained operators and engineers who have enlisted for active service.

The Directors accordingly submitted appropriate claims to the Naval authorities for compensation in respect of the reduced revenue of the various coast stations as compared with the corresponding period anterior to the war. This matter is still in abeyance, but the Directors have reason to believe that an equitable settlement will be duly arranged.

Practically the whole of the mercantile marine of Canadian and Newfoundland registry has now been equipped with Marconi wireless telegraph apparatus. Towards the close of the year the Newfoundland Government enacted legislation providing for the compulsory wireless equipment of all vessels engaged in the Seal Fishery.

The company's transatlantic service has shown important gains in traffic despite the adverse conditions imposed by the war. The publicity campaign inaugurated by the Board two years ago has made "Marconi" a household word among the cabling public and throughout Canada.

The accounts show that the deficit of $15,335.75 at January 31st, 1914, has been converted into a surplus of $5,727.87.

SHARE MARKET REPORT.

A steady demand for the parent company shares since the declaration of the interim dividend, and the issue of the circular showing the favourable position, has resulted in a steady appreciation of the parent and subsidiary companies' shares.

Latest prices :—Marconi (English) Ordinary, £1 18s. 9d., Preference, £1 15s. 0d.; International Marconi, £1 5s. 0d.; American (on purchases from America), 18s.; Canadian, 7s. 6d.; Spanish and General Wireless Trust, 4s. 9d.

PERSONAL PARAGRAPHS.

Great sympathy will be extended to Mr. and Mrs. Davison, of Muswell Hill, in the loss of their only son, Ronald Arthur Pool Davison. The late gentleman, who was treasurer of the North Middlesex Wireless Club, enlisted at the outbreak of war in the 1/7th Batt. London Regiment, and was killed in action during the great advance on September 25th last. He was a member of the Synchronome Company, Clerkenwell Road, and was much respected amongst his friends and acquaintances.

* * *

We notice amongst the list of saved from the ill-fated H.M.S. *Natal* the following men:

Chapman, F. W., Boy Telegraphist, J.29830 (Ch.).
Fox, H. E., Telegraphist, J.15438 (Ch.).
O'Brien, W. A., Ord. Telegraphist, J.20699 (Ch.).
Paxford, E., Ord. Telegraphist, J.23287 (Ch.).
Pinner, W. H., Boy Telegraphist, J.32686 (Ch.).
Shatford, H. S., Ord. Telegraphist, J.23083 (Ch.).
Thomas, J. E., Telegraphist, J.43503.
Whittaker, G. C., Boy Telegraphist, J.33990.

* * *

In our July, 1915, issue, under the heading "Personal Paragraphs," we made mention of the fact that Lieut.-Commander Hubert Dobell had been taken prisoner by the Germans. By the courtesy of the *Cheltenham Chronicle and Graphic*, we are now enabled to publish a photograph of Lieut.-Commander Dobell in his prison room at the Officers' Camp, Bischopswerver, Saxony. He shares a sitting-room with several other officers (of various nationalities), and the Germans treat them very well.

* * *

It is interesting to note that Mr. G. M. Bosworth, who has recently been appointed chairman of the company entitled the Canadian Pacific Ocean Services, Ltd., which was formed to take over and operate the steamers of the Canadian Pacific Railway and the Allan Line, is a director of the Marconi Wireless Telegraph Company of America.

Capt. Newton.

* * *

The following letter recently appeared in the *Daily Graphic*, and will, we are sure, draw a response from those of us who know how "tedious and lonely" the evenings may be in a distant wireless station.

"On behalf of the men of "this lonely station on the "outposts of Empire, I would "earnestly ask any of your "readers who have a gramophone and records they could "spare to send it along.

"It would be greatly appreciated here, where amusements are practically nil, and "the long dark evenings very "tedious and lonely. If you "could, sir, kindly appeal for "us in your valued paper, you "would earn the gratitude and "thanks of all here. Thanking "you in anticipation,

"Yours truly,
"W. J. HILLS, W.O., R.N.R."
"Naval Wireless Station,
"Mombasa, Brit. East Africa."

Lt.-Commander Dobell in German Camp.

Lieut. Balcombe.

We have pleasure in providing this month an excellent portrait of Lieutenant (? now Captain) Balcombe, of whom we recently wrote in these pages. Lieut. Balcombe, our readers will remember, was on the staff of the Traffic Department of Marconi's Wireless Telegraph Company, Ltd., at the outbreak of war, and went to the front immediately hostilities commenced. We also publish a recent photograph of Captain Newton, of whom we wrote in the Christmas number.

* * *

On December 17th last the Lord Mayor of Hull presented the Distinguished Service Medal to Charles Wm. Jeffrey, formerly a wireless operator in the Royal Navy, for meritorious services while mine-sweeping at the Dardanelles. Major-General Ferrier, C.B., officer commanding the Humber defences, was present, and cordially congratulated the recipient.

* * *

Mr. George Maurice Wright has been granted a commission in the Royal Naval Reserve. Sub-Lieut. Wright, who is 25 years of age, held a post in the research department of Marconi's Wireless Telegraph Co., Ltd., at Chelmsford, where he had been for three years.

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We offer our sincere congratulations to Second-Lieut. McEwen, concerning whom a note appeared in these columns in our September issue. We now learn that he is the lucky recipient of the Military Cross.

Allusion was made at a recent meeting of the Metropolitan Asylums Board Committee to the fine progress of William Lawson, who was sent to the training ship *Exmouth* by the Camberwell Guardians, and now at 20 has been advanced to the rating of leading wireless telegraphist.

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Sergeant Holehouse, Royal Engineers, attached to the Wireless Section at Worcester, broke his leg in a motor-cycle accident at Worcester recently. He was about to turn a corner, and swerving to avoid one dray, he collided with another.

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We regret to state that Mr. George N. G. Tucker, of the Electrician Printing and Publishing Co., Ltd., passed peacefully away on January 15th last, at his residence, 109, Lordship Road, Stoke Newington, in his 64th year. He was interred at Abney Park Cemetery on Wednesday, January 19th, last.